

Glorifying Malthus: Current Debate on 'Demographic Dividend' in India

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Demographic factors have reappeared in the economic development debate with the emergence of the concept of the "demographic dividend". With many developing countries experiencing a rapid decline in fertility, there has been overwhelming optimism that a demographic bonus will take these countries to greater economic heights. At the same time, there are pessimists doubting the ability of these countries to take advantage of the demographic dividend. This paper looks at the concept critically in the context of India. It tries to empirically estimate the contribution of the age structure change to economic growth in the country through a two-stage least square method. The empirical analysis clearly exhibits a powerful positive impact of the boom in the working age group population on economic growth. This is despite the fact that the educational achievements and health conditions of the people are far from desirable and employment creation is well below the required level.

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Demographic factors have reappeared in the economic development debate with the emergence of the concept of the "demographic dividend". After the neo-Malthusian onslaught on the detrimental effect of rapid population growth on all aspects of development in the second half of the last century, the beneficial aspect of population growth has perhaps been sidelined in the development discourse. However, the current changes in the age structure bring population parameters back into the growth debates.

The demographic dividend is defined as a rise in the rate of economic growth due to a rising share of working age people in a population. This phenomenon occurs with a falling birth rate and the consequent shift in the age structure of the population towards the adult working ages. It is also commonly known as the demographic gift or bonus or demographic window. With many developing countries particularly in the Asian continent experiencing a rapid decline in fertility, there has been overwhelming optimism that the demographic bonus will take these countries to greater economic heights [Asian Development Bank 1997; Bloom and Williamson 1998; Cyrus Chu and Lee 2000; Mason 1988]. At the same time there are pessimists doubting the ability of these countries to take advantage of the demographic dividend; they refer to several institutional constraints particularly in providing productive employment to the working age population. It is interesting to note that there has been a tendency in India to valorise the great opportunities existing in the country in terms of demographic dividend by all, irrespective of ideology although the concept itself is deep-rooted in the neo-Malthusian framework [Chandrasekhar et al 2006; Mitra and Nagarajan 2005; Narayana 2007].

The purpose of this paper is to look at the concept of the demographic dividend more critically in the context of India. It also tries to empirically estimate the contribution of the age structure change to economic growth in the country through a two-stage least square method to overcome the well known endogeneity issue on the relationship between population change and economic development. Although robust estimates are hard to derive due to want of adequate data on different aspects of the economy particularly at the state level, the estimates provide a useful insight on the demography-economy relationship and place the debate in a proper context.

1 The Concept of Demographic Dividend

There are three phases of the demographic transition process creating three unique age structures for any country. In the first phase, with fertility being very high and mortality declining,

there will be a large number of people in the young age group, particularly below 15 years, creating a high dependency ratio. In the second phase of transition, the fertility starts declining at a fast pace leading to a reduction in the child population. However, as a consequence of higher fertility in the past, there will continue to be higher growth rate in the working age group population during this period. This period is marked by considerable reduction in the dependency ratio. In the third phase, the dependency ratio again will be higher as a result of higher old age population. The demographic bonus or gift is a term used to understand the second phase of the age structure transition. The proportion of the working age population in the total population will be one of the highest during this period with a potential growth inducing impact as well. This is expected to be a short phase in any population depending upon the pace of fertility decline. If the fertility decline is slow and steady as occurred in the western countries, this phase may even pass unnoticed. But for the developing countries of today, which are experiencing a rapid and sudden decline in fertility, the age structure transition is vividly evident and is expected to be present for over 40 years.

However, it should be remembered that the growth of the working age population may be higher even in the first stage of the age structure transition along with a high growth of child population. Hence, the advantage in the second stage of the age structure transition is mainly relative in nature and not in absolute terms. The growth of the working age population will be higher in this period as compared to the growth of child population, leading to a lower dependency ratio. "The young and old tend to consume more output than they generate, unlike working age individuals, whose contribution to output and saving tends to be more than commensurate with their consumption" [Bloom, Canning and Malaney 2000].

It is often argued that the contribution of the second stage of the age structure transition depends on the ability of countries to take full advantage of this stage in providing gainful employment to the workforce. Also the age structure transition due to a drastic decline in fertility provides several economic benefits particularly at the household level. Therefore, it is also necessary to look more closely into other pathways by which a reduction in the dependency rate could affect the economy.

Demographic Rationale of Economic Change

The age structure transition can create a spurt in economic growth in several ways. First and foremost is the increased saving expected during the age structure transition [Mason 1988; Higgins and Williamson 1997; Deaton and Paxson 1997; Lee et al 2000]. The increase in saving rate happens primarily due to the low dependency rate and partly also due to increased life expectancy. The major part of this saving is definitely the contribution by households. In a way, the increased saving is not due to a large number of adult members but due to a fewer number of children because the number of adults would have been the same even in the earlier stages of age structure transition but coupled with a higher number of children.

Secondly, with the decline in fertility, women are more likely to enter into the labour market during this stage. This will result

in increased economic activity and would lead to a spurt in economic growth. One of the major hurdles to women entering the labour market had been the high fertility and the time to be spent on childcare. A decline in fertility gives women the freedom to spend more time on economic activities resulting in higher economic growth during this period [Becker and Lewis 1973].

Thirdly, it is also pointed out that people invest more on their own health when children are fewer in number, leading to better productivity and economic benefits to the household. There is now an increasing recognition of the advantages of better health for increasing productivity and thus better economic outcomes. Lucas (1993) emphasised productivity growth as the source of economic miracles in east Asian countries.

Yet another argument in favour of demographic dividend is that the government also will be in a position to spend and invest in more productive activities with the decline in the number of children as public spending on education and health can be diverted to more productive activities [World Bank 1984].

It is clear from the above that the economic advantages of demographic dividend is primarily achieved at the household level mainly due to fertility change and gets aggregated into a macrolevel advantage. However, the discussion on demographic dividend often does not consider the importance of the fertility transition advantage and limits its discussion to the age structure transition. There seems to be also a tendency to consider the macroeconomic policy environment as the crucial force determining the relevant benefits.

Demographic Change and Economic Growth

Although the evidence on the relationship between demographic change and economic development is drawn only from a limited number of countries, most of the studies show a strong positive association between demographic variables and economic outcomes. The analysis by Bloom and Williamson (1998) of 78 Asian and non-Asian countries showed a powerful positive impact of growth of the working age population on economic growth. The estimates showed that nearly one-third of the economic miracle of east Asian countries can be attributed to the demographic dividend.

Similarly Behrman et al (1999) using panel data for several countries since 1950 looked at the relationship between the average age of the population and several economic outcomes. The study found a strong positive association between the age pattern and economic outcome. Andersson's (2001) study of Scandinavian countries using data since 1980 also found a positive association between the share of economic growth and the share of the working age population. The case of Ireland, which was lagging in fertility transition in Europe, needs special mention. With fertility starting to decline faster in the 1980s, the country also entered into a phase of augmented economic growth indicating a clear association between demographic change and economic growth. Bloom et al (2003) and Bloom et al (2006) using a panel data of countries from 1960 to 2000, established a positive association between the age structure transition and economic growth in India and China. They have also predicted higher growth prospects for India compared to China over the next 30

years, as the effect of the fertility decline and the bulge of population age cohort in the working age group will be sharper in India in the coming decades.

On the other hand, some not-very-optimistic views on the relationship between age structure and economic development are also observed in the case of developing countries. Navaneetham (2002) found a positive impact on economic growth of age structure in south-east Asia but failed to see such a relationship in south Asian countries. Another often reported instance is the Latin American experience where the age structure transition seems to have failed to augment economic growth [Bloom et al 2003]. In the case of India it is argued that the demographic changes are not sufficient to provide an upward push to the rate of economic growth [Mitra and Nagarajan 2005; Chandrasekhar et al 2006].

Interestingly, even the pessimists on the demographic dividend do not rule out the beneficial effects of age structure change but are mainly worried about the existing institutional bottlenecks in some countries that make it difficult to achieve these benefits. There is a near universal agreement that there is nothing automatic about the links between demographic change and economic growth. For instance, Navaneetham (2002) felt that the lack of a clear cut association between demographic change and economic growth in south Asia, compared to south-east Asia, is primarily due to a lack of openness of the former economies to trade. Bloom et al (2006) says that the age distribution changes create supply side potential but whether the potential is realised depends upon the policy environment in each country, particularly the openness to trade. According to Chandrasekhar et al (2006), with India facing a major deficit in the area of education and health, the conversion of a growing labour force into a quality workforce is difficult to achieve; this will ultimately result in a waste of the demographic advantage.

However, it should be remembered that the pathways by which demographic variables impact on the economy operates at the household level and need not necessarily have a direct connection with the macroeconomic environment. Among the factors contributing to economic growth during the demographic dividend stage, the household saving effect and the health-productivity links are automatic and have to be purely attributed to the fertility transition. Perhaps, the female labour force participation depends also upon the policy environment. However, it is well known that many states in India have not made any headway in providing effective employment to women, and even without that the household economy should benefit from the demographic dividend. Therefore, it is necessary to see empirically how far the demographic dividend benefits India.

2 The Theoretical Confusion

There seems to be some confusion in placing the demographic dividend argument within the overall debate on population and development, which has a long and rich history ever since Malthusian pessimism took root. It is interesting to note that even when there is a near unanimity in accepting the advantages of a demographic dividend in India, there is a considerable confusion on the theoretical premises of this argument. For instance,

Chandrasekhar et al (2006) considered that “the notion of ‘demographic dividend’ overturns the older popular perception that the large and excess population is a problem rather than a benefit from an economic point of view”.

The concept of the demographic dividend primarily emerges from the neo-Malthusian analysis of the adverse impact of rapid population growth on economic development. In their classic work Coale and Hoover (1958) brought out in unequivocal terms the detrimental impact of some demographic factors on economic growth. They have particularly mentioned three demographic forces adversely affecting development: the size of the population, growth rate and age structure. These three forces have three different types of impact on the economy. Firstly, there will be a capital shallowing effect as rapid population growth leads to a fall in the ratio of capital to labour. Secondly, the age-dependency effect creates a worsening dependency ratio due to a rise in the young population which will ultimately erode the savings in the household. Finally, the investment diversion effect leads to a large amount of money being spent by the government on the social sector rather than for productive, growth-oriented investment. The Coale and Hoover (1958) argument suggests that declines in fertility promote growth through decreases in the dependency ratios.

However, the neo-Malthusian onslaught on the adverse consequence of population increase has been partly silenced by the revisionists in the 1980s, who argued that population growth is not a major deterrent to economic development [Kelly 1988; National Research Council 1986]. They suggested that population growth has both negative and positive impacts on development. The net impact depends upon the specific conditions in each country and no universal conclusion can be derived on this relationship. The revisionists, thus, downgraded the relative importance of population growth as an important variable determining economic development [Kelly 2001].

Although there had been wide criticism of the Coale and Hoover argument that projects a pessimistic view of the impact of population growth in India, there seems suddenly a unanimity in the possibilities of a favourable impact of the demographic dividend, although both sets of arguments are based upon the same premises. The only point of disagreement seems to relate to whether India will be able to take advantage of the demographic dividend with low literacy levels and several other adverse human development indicators.

3 Empirical Estimation of Demographic Dividend

The Indian states with a wide variation in demographic achievements present interesting data that enable us to understand the implications of the demographic dividend. Empirical estimation of the demographic dividend is methodologically challenging due to the lack of adequate data at the state level. As already pointed out the relationship between age structure transition and economic change is mediated by factors like the saving rate, female labour force participation, etc. Therefore, before specifically getting into the econometric estimation, it is necessary to look at the trends of these intervening factors during the various stages of age structure transition.

Table 1 presents the age distribution of the population by broad age groups for major states in India for the years 1961 and 2001. It can be observed that there has been a drastic change in the age structure of the population in the 0-14 and 15-59 age groups in many Indian states over the last four-decades. The interstate variation in the age structure is in tune with the pace of demographic transition in each state. For instance, states like Gujarat, Karnataka, Kerala, Punjab and Tamil Nadu recorded a decline of more than 10 percentage points among children of 0-14 age groups between 1961 and 2001. On the other hand, states like Bihar, Madhya Pradesh and Rajasthan have registered declines of less than 3 percentage points.

In the working ages of 15-59 years, a phenomenal increase of over 10 percentage points was registered in Kerala during the last four decades. Other states recording significant increases in the proportion of the working age population include Andhra Pradesh, Gujarat, Karnataka, Punjab and Tamil Nadu. Maharashtra and West Bengal closely follow these states with around 5 percentage point change in the proportion of the population in the working age groups. Most of these states also have around 60 per cent or over of the population in the working age groups. Contrary to this, Uttar Pradesh registered a decline in the working age group population between 1961 and 2001. The increase is also marginal for many northern states like Bihar, Haryana, Madhya Pradesh, Orissa and Rajasthan.

In general the proportion of the population in the child and working age groups reflects the current levels of demographic transition in different states of India. While the proportion of the old age population remained nearly the same in most of these states, wide variations are observable in the proportion of the child and working age populations. It clearly reveals that many states are currently experiencing demographic opportunities although it is not clear whether such opportunities are getting translated into an economic advantage.

The dependency ratio for the country over the same period (1961 to 2001) is presented in Figure 1. Dependency is defined as the percentage of the dependent population (0-14 and 60 and above age groups) divided by the working age population (15-59 age groups). The dependency ratio reveals a continuous decline in the proportion of the dependent population since 1971. However, the current dependency ratio of 75 per cent is relatively high in contrast to the dependency ratio of 57 per cent attained by Kerala in 2001. In other words, it confirms that there is significant

variation in the dependency ratio in the country currently in tune with the stages of age structure transition.

The annual growth rate of population by broad age groups for different census decades in India is presented in Figure 2. While there is a substantial reduction in the growth rate of the child population in the 0-14 age group particularly since the 1971-81 period, such an increase is not observed in the case of the adult age group. The growth rate in the adult ages had been higher even in the past; it has shown a marginal decline in the 1990s compared to the 1980s. It means that the advantage of demographic change is derived not because of the enhanced growth of working age population alone but its increase in comparison with the child population in recent decades.

Similar trends are also shown in Table 2 (p 67) where the annual growth of the working age population among Indian states in different census decades along with growth of child and old age population is presented. The child population has recorded a negative growth in two states, Kerala and Tamil Nadu, between 1991 and 2001. Other states like Andhra Pradesh and Karnataka also recorded an annual growth rate of less than 0.5 per cent during 1991-2001. However, the states lagging in fertility transition particularly in northern India have registered higher growth rates of child population even during 1991-2001.

Contrary to this, the growth rate in the working age group has not changed significantly during the last four decades. Although there are slight variations from decade to decade, the growth rate in the working age population remained high even during the decades with no significant fertility transition. It reaffirms our earlier argument that it is not the absolute growth of the working age population but its relative growth that creates a demographic dividend.

We have also presented the age specific annual growth rate of population for the last two census decades, 1981-91 and 1991-2001 in Figure 3 (p 67). A similar picture of steady growth of the working age population is observed during both the decades. The only difference is that due to the fertility transition in many states, even the early age groups in the adult ages record a decline in the growth rate between 1991 and 2001. The growth rate in other age groups is of a nearly similar level between the 1981-91 and 1991-2001 Census periods. Interestingly, the growth rate of the old age population has significantly gone up during the 1991-2001 Census period. However, as already pointed out, the proportion of the aged population remains less than 10 per cent in all the states.

Table 1: Percentage Distribution of Population by Broad Age Groups Major States (1961 and 2001)

State	0-14		15-59		60+	
	1961	2001	1961	2001	1961	2001
Andhra Pradesh	39.54	32.07	54.23	60.32	6.23	7.61
Bihar	42.32	41.54	52.07	52.01	5.62	6.45
Gujarat	42.89	32.84	52.17	60.25	4.94	6.91
Haryana	NA	35.99	NA	56.49	NA	7.52
Karnataka	42.16	31.91	52.11	60.4	5.73	7.69
Kerala	42.64	26.08	51.53	63.44	5.84	10.48
Madhya Pradesh	40.82	38.21	54.02	54.66	5.16	7.14
Maharashtra	40.67	32.14	54.07	59.12	5.27	8.74
Orissa	39.10	33.23	55.23	58.5	5.67	8.27
Punjab	43.57	31.39	49.87	59.57	6.56	9.03
Rajasthan	42.66	40.10	52.19	53.12	5.14	6.78
Tamil Nadu	37.61	26.96	56.79	64.15	5.60	8.89
Uttar Pradesh	40.50	40.83	53.22	52.1	6.29	7.07
West Bengal	40.93	33.28	54.06	59.6	5.01	7.12
India	41.0	35.4	53.3	57.1	5.6	7.5

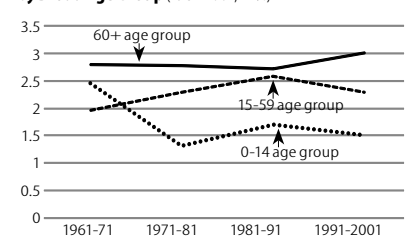
Source: Estimated by authors from various census reports.

Figure 1: Age Dependency Ratio (1961-2001, in %)



Source: Computed from Various Census Reports.

Figure 2: Population Growth Rate (Annual) by Broad Age Group (1961-2001, in %)



Source: Computed from various census reports.

3.1 Savings Rate

One of the important pathways by which the economic advantages of age structure transition are realised is through increased household savings. The low dependency ratio during this stage creates a unique opportunity for higher savings at the household

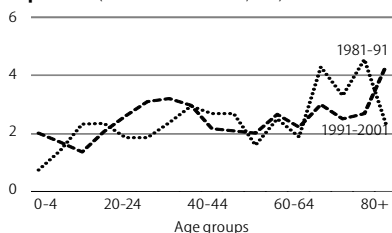
Table 2: Annual Growth Rate of Population by Broad Age Group in Major States
(1961-71 and 1991-2001, in %)

States	0-14		15-59				60+	
	1961-71	1991-2001	1961-71	1971-81	1981-91	1991-2001	1961-71	1991-2001
Andhra Pradesh	2.13	0.21	1.70	2.38	2.57	1.91	2.11	2.49
Bihar	2.00	2.56	1.83	2.15	2.20	2.41	2.44	2.69
Gujarat	2.62	1.22	2.49	3.11	2.31	2.51	3.20	2.83
Haryana		1.60		3.31	2.64	3.10		2.23
Karnataka	2.24	0.39	2.05	2.81	2.41	2.28	2.79	2.57
Kerala	1.76	-0.41	2.71	2.48	1.96	1.25	2.97	2.62
Madhya Pradesh	3.21	1.83	1.85	2.60	2.61	2.23	3.67	2.76
Maharashtra	2.59	1.01	2.22	2.60	2.62	2.40	3.25	4.28
Orissa	3.04	0.76	1.56	2.28	2.30	1.83	2.85	2.87
Punjab		0.80		2.90	2.21	2.24		3.21
Rajasthan	2.81	2.28	2.10	3.08	2.72	2.55	3.16	3.20
Tamil Nadu	2.06	-0.29	1.96	1.98	1.91	1.47	2.26	2.80
Uttar Pradesh	2.14	2.36	1.46	2.29	2.40	2.23	2.54	2.54
West Bengal	2.85	0.67	1.93	2.81	2.42	2.11	2.95	3.26
India	2.46	1.52	1.97	2.30	2.59	2.31	2.80	3.01

Source: Estimated by authors from various census reports.

level. The reduction in dependency ratio is the immediate result of the end of the fertility transition in a country. However, understanding the relationship between household saving and

Figure 3: Age-Specific Growth Rate (Annual) of Population (1981-91 and 1991-2001, in %)



Source: Computed from various census reports.

fertility transition is difficult in the country primarily due to lack of data on household saving rate at the state level. Household saving as a percentage of the gross domestic product (GDP) is presented in Figure 4.

Household savings in India have recorded an increase especially since the 1980s in India, perhaps coinciding with accelerated decline in fertility in the country. Thus, on the face of it, one would be inclined to link fertility transition and household savings. However, it is rather difficult to attribute the increase in the saving rate directly to fertility transition as the saving rate is also determined by several other important factors most notably the high rate of economic growth since the 1980s.

Female Labour Force Participation

The other pathway by which demographic changes influence the economy is the enhanced participation of females in the labour force. This is expected to promote family income and therefore has the potential to improve household savings. The female labour force participation rate for major states in India for different periods is presented in Table 3 (p 68).

It may be noted that the female labour force participation has not recorded any major change

in many Indian states with drastic decline in fertility. For instance, in Kerala and Andhra Pradesh it has declined during 1981-2001. Other states like Gujarat, Karnataka and Tamil Nadu show significant improvement. However, such improvements are also true in the case of states like Bihar, Rajasthan and Uttar Pradesh having no significant age structure transition.

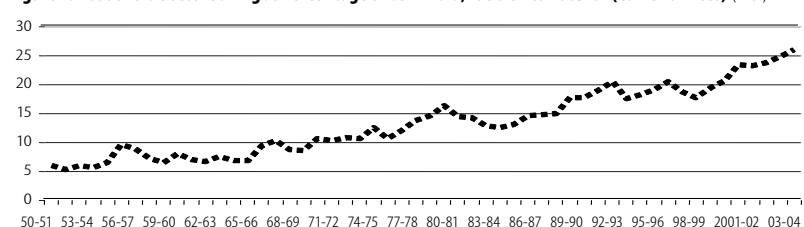
Diversion of Governmental Investment

The other possible way by which the change in the age structure influences economic change is through diversion of governmental investment from education and health to more productive sectors. However, such changes are also unlikely to take place in any state in India including Kerala as the investment in health and education has always been below the required level [Tharakan and Navaneetham 1999]. Hence even with a negative growth of child population in some of the states in India, there is no possibility of diverting funds from the education and health sectors. Rather these sectors require additional funding to improve the quality of services. Thus economic growth occurring through diversion of governmental investment away from social sectors is unlikely in India.

4 Statistical Analysis

For examining the relationship between age structure change and economic growth, we construct a panel data for major 15 states in India for every 10 years since 1971 till 2001 synonymous with the decadal population census. The dependent variable for the analysis is the growth rate of per capita income. The per capita net state domestic product since 1980-81 is obtained from the Central Statistical Organisation (CSO) at 1993-94 constant prices compiled by the EPW Research Foundation. For the period prior to 1980-81, the splicing method is used to arrive at per capita income based on 1993-94 base year. The growth rate of per capita income is computed for the first five-year period of every decade, 1971-75, 1981-85, etc. The independent variables considered in the analysis are the adult literacy rate, percentage of non-agricultural workers, female labour force participation rate, initial per capita income (1971), life expectancy and growth of working age population. Data on adult literacy, non-agricultural sector workers and female labour force participation are drawn from the decadal census data. Female labour force participation of only main workers is considered here to make it comparable with the 1971 Census. The data on life expectancy come from the Sample Registration System. Life expectancy figures are available for five-year periods for 1971-75, 1981-85 and 1991-95. For the last five-year, data available for the period 1999-2003 are used. To

Figure 4: Household Sector Saving as Percentage of GDP India, 1950-51 to 2003-04 (Current Prices) (in %)



Data based on 1999-2000 series.

Source: Computed from CSO data on gross domestic product and Reserve Bank of India data on household saving.

account for the wide differences in the demographic transition, the analysis also included dummy variables for groups of states. The low demographic-indicator states consist of four northern states (Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh) and Assam and the high demographic indicator states consist of all the southern states. All other states are included in the middle group. One of the important variables that mediate

Table 3: Female Labour Force Participation in Major States (15-59 age group, 1981-2001, in %)

State	1981	1991	2001
Andhra Pradesh	52.21	52.56	51.89
Bihar	22.64	25.42	35.04
Gujarat	33.23	41.33	42.56
Haryana	17.78	18.56	43.60
Karnataka	40.66	46.19	47.80
Kerala	26.63	24.04	22.45
Madhya Pradesh	48.87	52.61	46.93
Maharashtra	49.89	53.69	56.93
Orissa	31.73	32.80	37.70
Punjab	9.77	7.01	28.66
Rajasthan	35.57	46.05	54.99
Tamil Nadu	39.78	43.99	44.26
Uttar Pradesh	13.39	20.76	28.28
West Bengal	13.38	18.18	28.13
India	31.85	35.86	40.02

Source: Computed from Different Census Data.

the demography-economic growth relationship is the household saving rate. However, data on saving rate are not available at the state level in India. Hence the estimates are made without considering household saving information. The econometric method used for the estimation is the two-stage least square (2SLS) method. The aim of the econometric analysis, as pointed out earlier, is to see how far the age structure variable affects economic growth in the country. We have modelled the growth rate of per capita income with growth rate of working age population and other important variables, similar to the model adopted for different countries by others [Bloom and Williamson 1998, Bloom et al 2006]. The purpose of using a 2SLS method is to address the endogeneity issue often observed between population growth and economic change. It is argued that the failure to consider the possibility of reverse causality between population growth and economic development often leads to erroneous conclusions from the empirical estimates [Bloom and Williamson 1998]. Many studies conducted in recent years to understand the demographic dividend have found that the ordinary least-square (OLS) regression estimates are inadequate to explain the age structure impact [Bloom and Williamson 1998, Bloom et al 2006].

To find out the appropriateness of using panel data approach for estimating parameters by random-effect model, we have carried out the Breusch and Pagan (1980) Lagrangian multiplier test and found lack of systematic variation between u_i 's (neither with respect to state nor with year) to justify the application of random-effect model. Hence the estimation is carried out using OLS and 2SLS methods for time series-cross section analysis. The full model adopted for the estimation is

$$Y_1 = \alpha_1 + \sum \beta_j x_j + \delta_1 Y_2 + e_1 \tag{1}$$

where Y_2 estimated as

$$Y_2 = \alpha_2 + \sum \lambda_j z_j + \delta_2 Y_1 + e_2 \tag{2}$$

where Y_1 is the growth rate of per capita income, and x_j are the vector independent variables influencing Y_1 except the growth of adult population. The adult

population growth is entered as an instrumental variable in the model ($\delta_2 Y_1$) derived from the second model. Y_2 is the growth rate of working age population and z_j 's are the vector of independent variables such as life expectancy and adult literacy rate. The second model also includes the growth rate of per capita income (Y_1). The e_1 and e_2 are the error term of the respective models.

As a first step, we have carried out an OLS estimate without an instrumental variable and this is presented in column 1 in Table 4. Due to the high correlation of the independent variables such as the adult literacy rate, percentage of non-agricultural workers and life expectancy, we have used a factor of adult literacy and non-agricultural workers in the model. The estimates show that most of the variables entered into the model are not significant. The only variable showing significant expected relationship is the factor of adult literacy-non-agricultural workers and the regional dummy for the states with medium age structure transition. The age structure variable also does not show a significant relationship with per capita income growth. This may be perhaps due to reverse causality and we have adopted a 2SLS method for estimation, which is presented in column 2 of Table 4.

Most variables included in the second model estimated using 2SLS method show a significant relationship with growth of per capita income. The predictability of the model has also substantially improved as compared to the OLS estimates. The adult literacy-non-primary sector workers factor and female labour force participation, as expected, enhance economic growth potential. Contrary to this, life expectancy shows a negative relationship with growth rate of income per capita. Life expectancy has registered a marked improvement in most states in India with drastic reduction in mortality throughout the country. A negative relationship of life expectancy with economic growth, therefore, is not completely unexpected as mortality improvement has taken place irrespective of economic growth in many states. The initial level of per capita income is found to be unimportant deciding the pace of economic progress.

The age structure variable has shown a significant positive relationship with economic growth. It indicates that the age structure changes, as in the case of other countries, have a strong potential to enhance economic growth in India as well. We have

Table 4: Determinants of Growth Rate of Income Per Capita

Sl No	Independent Variables	Beta Coefficient OLS (1)	Beta Coefficient 2SLS (2)
1	Constant	5.56 (18.75)	-2.83 (14.94)
2	Log initial per capita income (1971)	-0.97 (2.08)	-0.81 (1.72)
3	Life expectancy	0.03 (0.09)	-0.76* (0.15)
4	Factor of adult literacy and non-primary sector employment	1.44* (0.66)	5.23* (0.88)
5	Log female labour force participation	1.15 (0.62)	1.62* (0.47)
6	Growth rate of working age population	-0.35 (0.86)	-
7	States with poor age structure transition (northern states and Assam) Ref: southern states	1.01 (1.09)	2.26* (0.90)
8	States with medium age structure transition (other non-southern states) Ref: southern states	2.25* (1.04)	1.99* (0.83)
9	Growth rate of overall population	-	-2.28* (0.96)
10	Instrumental variable for growth rate of working age population	-	24.19* (4.19)
R-Square (per cent)		36	62
Prob > F		0.0009	0.0000
No of cases		60	60

Standard error is provided in parenthesis. * Significant at 5 per cent level.

also tested for the impact of overall population growth on economic growth and found a strong negative impact confirming the neo-Malthusian argument of adverse consequences of population growth on the economy. Overall, the econometric results, on the one hand confirms the important role of demographic factors for economic change, the other substantiates the importance of age structure transition in promoting economic growth in the country.

On the whole, the analysis shows clearly the demographic opportunities existing in the country for economic growth. These estimates are in line with the finding from other countries on the impact of demographic dividend using nearly similar econometric models. However, the estimates need to be interpreted cautiously due to several reasons. First, it has not been able to include variables like household saving which are important determinant of economic growth. Second, as the different states in India are in various stages of age structure transition, a common conclusion about India is also problematic. Thirdly, the economic growth itself is complex and these models although give an indication cannot explain the quantum of contribution of demographic variables. Finally, even other important pathways of growth due to age structure change like female labour force participation did not show marked improvement in the country over the years especially in states with advanced demographic transition.

5 Conclusions

This paper examines the arguably strong positive economic benefits of age structure change in the context of India both theoretically and empirically. The concept of demographic dividend is

deeply rooted in the neo-Malthusian framework and conveys the advantages of a country following fertility reduction strategies. The economic advantage of the demographic dividend is primarily achieved at the household level mainly due to a reduction in the number of children per family.

The empirical analysis vividly exhibits the positive impact of the working age group population boom on economic growth. This is despite the fact that the educational achievements and health conditions of the people are far from adequate and employment creation is below the required level. However, it is not merely the higher growth of the working age population that matters for economic growth. The real opportunity occurs due to a higher growth of working age population coupled with slow or even negative growth of the child population (0-14 years).

India is likely to enjoy the fruits of the demographic dividend for a few more decades due to the wide variation in the achievement of fertility transition in different states. While the southern and western states and West Bengal have achieved a relatively low dependency ratio due to early fertility transition, the northern states are yet to reach the demographic dividend stage. The change in age structure would take place in northern states only after a few more years and the fruits of the demographic dividend, perhaps, a decade later.

In a nutshell, the demographic factors play an important part in economic growth. Although this was known since the time of Malthus, it was never easy to test with rigorous empirical clarity. The current emphasis on the demographic dividend reaffirms the virtues of following a small family norm for economic development.

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