

## Spatial Correlates of Age Structure in Maharashtra – 2001

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### Abstract

*Age is a very important attribute of the quality of population and the literature on this theme focuses on spatial distribution of population belonging to different age groups along with its implications, such as, dependency. The present authors were also requested to prepare one such paper for Maharashtra by the Census Department for their seminar on dissemination of census data. After presentation of that paper, it was felt that convincing explanation of the distribution of population belonging to different age groups requires spatial correlation of the data with other socio-economic variables. The present exercise is an outcome of such an attempt. The analysis reveals that, in space, the age structure differentiates between migrant and native population, on the one hand, and groups within native population, including the tribal, on the other.*

### Introduction

Age composition is an important attribute while discussing the quality of population of any region. It is often summarized in three groups, viz. 0-14, 15-59, and 59+, based on physiological and economic activities. Age composition of a region influences the social and economic conditions under which its people live and is thus an indicator of level of development (Ting Yu, 1990). It is often related to stage of population in demographic transition before labelling a region as 'backward' or 'in transition' or 'advanced' (Haggett, 1972; Kaa, 1987). Natality, mortality and mobility are the three basic determinants of age structure (Coale, 1956). Fertility, together with life expectancy and longevity, determines

proportion of population in different age categories. Mortality operates by way of survival rates and exerts its influence through differential rates in the groups (Murray *et al.*, 1992; Mackenbach, 1995). Migration, being selective with respect to age, influences age composition of regions of both its origin and destination (Bucher, 1996; Coleman, 1994; White, 1993). Study of age composition helps one to determine the extent of dependency in population or dividend that can be derived from it (Chandrasekhar and Ghosh, 2006).

The earlier studies on age composition primarily focused on spatial distribution of population belonging to different age groups. Hong (1982) discussed the age structure of selected countries in ESCAP region. Vertot

(1990) has studied the age structure of regions of socialist republics of Yugoslavia and Slovenia. Of late, researchers also related age to performance and inventions (Jones, 2005; Simonton, 1988) and also to economic development (Praskawetz and Lindh, 2007). One also comes across attempts to assess impact of age on labour costs (Daveri and Maliranta, 2007). Some workers have also focused on environmental impact (Liddle, 2000). Xenox and Kabamalan (2005) have tried to understand the relationship between age and social transition in young population.

The present authors had also conducted the study on the age structure of Maharashtra at the request of the Census Department for their seminar on Dissemination of Census Data (Phadke and Mukherji, 2003). While different facets of age data were worked out and spatial distribution of population in different age groups was presented at the seminar, the authors faced some problems in providing an objective explanation of such patterns. It was, therefore, thought that the usefulness of the regional patterns of age structure would be more apparent if such a structure were cross-classified with other demographic and socio-economic variables; this was also in line with the observations of the other workers in the field (Choudhury, 2006). The present paper, therefore, makes an attempt to relate the age data to various socio-economic variables that could either reflect on the cause or consequence of the dominance of a particular age group in a given region.

## **Data Base and Unit of Analysis**

The focus of the study was to understand the spatial pattern of distribution of population belonging to different age groups in the State. Data related to age groups were, therefore, compiled using census of India, 2001. In order to explain the above distribution, it was thought necessary to add data related to factors that influence dominant age group in a particular area. Data related to some of these, such as, religion or language of the people, were also collected using census sources. The source also provided data related to certain demographic indicators reflecting on the characteristics of the society associated with different age groups which were also recorded. Census did not, however, provide data related to economic variables, such as, Per Capita Income, Per Capita Domestic Product or Contribution of Income from different Economic Sectors. Such data were obtained from the Human Development Report (Govt. of Maharashtra, 2002). The source also provided data related to indicators, such as, availability of electricity to people or access to sanitation facilities to them, reflecting on quality of life, and, also total fertility rate. Secondary data pertaining to 68 variables were thus tabulated.

For a meso level region like the state of Maharashtra, it would have been ideal to analyse the data at tahsil level. But while census data were available at this level, most of the other data could be obtained only at the district level and hence it had been decided to adopt district as the unit of

analysis. If all the data were available for the year 2001, there would have been 35 spatial units. But some data, such as, those related to life supporting facilities, per capita income were available only for the year 1991 and hence the researchers were forced to use district boundaries prevailing in the year 1991; the total number of units was, thus, reduced to 30.

The data have been compiled for 30 districts and an attempt was made to analyse association of age structure with other variables selected, on the one hand, and their regional association in the State, on the other. The first part could have dealt with all the 68 variables, but the second part necessitated the use of factor analytical procedure and this meant that the maximum number of variables that could enter analysis was to be reduced to not more than 30, i.e. the number of areal units of analysis.

### **Nature of Analysis**

The interrelation between age structure and other socio-economic variables could have been studied using varied techniques. The simplest among them would have been linkage analysis. But while this could have grouped the variables, there would have been no means to group the spatial units. It was, therefore, thought it appropriate to use factor analytical procedure for the purpose which enables one to group variables as well as spatial units.

In factor analysis, the number of variables cannot exceed the number of

observation units and hence the first task was to eliminate a minimum of 38 variables from the given list in an objective manner. This has been done by preparing a 68 x 68 correlation matrix and then identifying the typical structures using McQuitty's procedure (Yeates, 1974). From the analysis it was observed that there were 9 different groups among the variables; three of them incorporated three different age groups under study. The variables in the other structures were only poorly correlated with different age groups and were thus dropped. The total number of variables finally selected for analysis was thus only 25 (Table 1).

The data compiled for 30 districts and 25 variables were analysed with Mintab 14 statistical software. Three factors have been identified each incorporating a distinct age group (Table 2). An attempt to extract the fourth factor did not improve the situation any further and hence it was given up; in fact, the factor took away some of the variance shared by the 3 earlier factors. Varimax rotation was employed to bring the factors as within the variables as possible.

### **Results of Factor Analysis**

The three factors extract 42.4%, 29.1% and 9.3% variance respectively and the total variance thus extracted is 80.7%.

The **first factor** focusing on the age group 15-59, differentiates areas dominated by **migrant population** from those by native **population**. The variables that have maximum positive loadings on to this factor

**Table 1: Variables Selected for Analysis**

<b>Sr. No.</b>	<b>Variable</b>	<b>Short Form Used</b>
1	Percentage of population with Marathi as mother tongue (1991)	Marathi %
2	Percentage of population with Urdu as mother tongue (1991)	Urdu %
3	Percentage of population with Gujarati as mother tongue (1991)	Gujarati %
4	Percentage of people in the age group 0-14	% < 15
5	Percentage of people in the age group 15-59	% 15-59
6	Percentage of people in the age group 60 and above	% > 59
7	Percentage of Christians in population	% Christians
8	Percentage of Sikhs in population	% Sikhs
9	Percentage of households with Electricity (1991)	Electricity
10	Percentage of households with Toilet (1991)	Toilet
11	Human Development Index (2000)	HDI 2000
12	Per Capita District Domestic Product (1998-99)	PCDDP (98-99)
13	Density of Population (Persons/Sq. Km.)	Density
14	Per Capita Income (1998-99)	PCI (98-99)
15	Contribution of Income from Primary Sector (1997-98)	Cont. of PS (97-98)
16	Total Fertility Rate (1991)	TFR (91)
17	Population per Household	Pop/HH
18	Sex Ratio (Females per thousand males)	SR
19	Percentage of Children Among Population	CAP %
20	Percentage of Scheduled Tribe Population	ST%
21	Female Literacy (%)	FL%
22	Females Among Main Workers (%)	FAW(M)%
23	Urban Population (%)	U.P. (%)
24	Migrants from within the District (%)	Intra-Dist (%)
25	Migrants from outside the State (%)	Inter- State (%)

include proportion of inter-state migrants, percentage of people with Gujarati as their mother tongue as also percentage of Christians and Sikhs in the total population. These represent the migrant population groups. While strong positive loading of urban population with this factor is suggestive of the predominant residence of the migrants, association of variables, such as, density of population, access to toilet facilities reflects on the economic opportunities and basic life support services available to these people. High loadings of the variables, such as, per capita income, per capita district domestic product or human development index is understandable with selective nature of migration with reference to skill or education and, therefore, the ability of migrants to appropriate maximum income generated in their stride. While variables, such as, female literacy, availability of electricity and proportion of Urdu speaking population do show positive loadings on to this factor, they are not strongly loaded with it and this is primarily because these are not the characteristics exclusive to these areas.

Negatively loaded variables on this factor include contribution of income from the primary sector and Marathi speaking population which reflect on native population. Negative loadings of variables like proportion of intra-district migrants, sex ratio and proportion of females among workers indicate that they are the characteristics of the areas almost entirely inhabited by the natives. Population belonging to higher age is also inversely

associated with this segment bringing out the hassle encountered in urban life, especially in large cities.

Spatially, as expectable, the factor differentiates between the urbanized districts of Greater Mumbai, Thane, Pune, Nagpur and Aurangabad, on the one hand, and less developed areas of South Konkan, and eastern hills, on the other; central parts of the State follow a middle path (Fig.1). Further differentiation in the former is based on level of urbanisation, which is also a good indication of inter-state migration, while in the latter it is related to level of development, with less developed areas tending to be more native. Surprisingly, Pune and Nagpur do not stand as high as one would expect, considering their urban status, being next only to Mumbai; their failure is due to equally strong rural development in these districts.

The **second factor** focuses on **age group of 0-14** years. The variable with high positive loading on to this factor is the **Urdu speaking population** suggesting high birth rate in the community. This is further supported by high positive loadings of variables, such as, total fertility rate, proportion of children among population and population per household. These areas are also characterised by low female literacy, low per capita district domestic product, low availability of electricity which result in low human development index; all the four variables have high negative loadings. Under these conditions, females are forced to enter the workforce to supplement household income.

**Table 2: Rotated Factor Loadings and Communalities Varimax Rotation**

Variable	Factor Loadings			Communality
	Factor 1	Factor 2	Factor 3	
Marathi %	-0.504	-0.163	-0.640	0.691
Urdu %	0.524	0.619	-0.324	0.763
Gujarati %	0.871	-0.231	0.120	0.826
% < 15	-0.210	0.953	0.111	0.965
% 15-59	0.482	-0.835	0.161	0.955
% > 59	-0.654	0.084	-0.573	0.764
% Christians	0.771	-0.385	0.127	0.759
% Sikhs	0.815	-0.179	0.104	0.707
Electricity	0.370	-0.616	-0.307	0.611
Toilet	0.899	-0.375	-0.070	0.953
HDI 2000	0.632	-0.586	-0.397	0.901
PCDDP (98-99)	0.769	-0.558	-0.052	0.905
Density	0.762	-0.189	-0.049	0.619
PCI (98-99)	0.759	-0.561	-0.065	0.895
Cont. of PS (97-98)	-0.765	0.216	0.191	0.669
TFR (91)	-0.140	0.886	0.075	0.810
Pop/HH	0.050	0.811	-0.238	0.717
SR	-0.754	-0.213	-0.098	0.623
CAP %	-0.190	0.913	0.220	0.917
ST%	-0.044	0.071	0.924	0.861
FL%	0.387	-0.770	-0.282	0.822
FAW(M)%	-0.802	0.460	-0.049	0.857
U.P. (%)	0.932	-0.217	-0.042	0.917
Intra -Dist (%)	-0.835	-0.127	-0.142	0.734
Inter- State (%)	0.824	-0.492	0.102	0.931
Variance	10.592	7.263	2.315	20.170
Variance (%)	42.4	29.1	9.3	80.7

Spatially, the factor brings out Urdu speaking pocket in Marathwada with its extensions northward into Buldana and Akola districts of Vidarbha, and, Nashik, Dhule districts in the northwest (Fig. 2). Jalna, Parabhani and Nanded districts form a core and one finds a general distance decay in different directions.

The **third factor** does not focus on age group as such but is centred on **scheduled tribe** population which has a high positive loading on to this factor. While strong negative loading of the age group 60 and above on to this factor is suggestive of poor longevity among the tribals, the negative loadings of Marathi and Urdu speaking population are suggestive of the residence of the tribals away from the main stream; they are located in areas bordering with the other states and hence this situation. Some of the tribals have their own languages.

Spatially, this factor brings out the tribal cores in bordering districts of Gadchiroli, Chandrapur, Bhandara, Yavatmal in eastern Vidarbha, and, Dhule and Thane in the northwestern parts of the State (Fig. 3). The differentiation among the districts is based on location, access, nearness to urban areas and presence of economic opportunities.

### **Age Structure and its Correlates in Maharashtra: An Overview**

The foregoing analysis has been utilised to arrive at the structuring of the State based on age and associated variables. While doing this, two highest levels in the factor

maps have been considered and mapped. Such an exercise reveals a distinctive pattern with respect to certain areas (Fig. 4). Greater Mumbai and Thane district stand out prominently in the working age group associated with migrant population that characterizes rapid urbanisation; they are followed by districts of Pune, Nagpur and Aurangabad, albeit to a lesser degree. The working age group is thus city-centred and the pattern is due to the strength of city-forming forces (Goryacheva, 1977). The difference in the districts is due to relative dominance as also the result of nature of urbanisation. While urbanisation in the former group, especially in Greater Mumbai, is due to export oriented activities that in the latter has either internal orientation, as is the case with Nagpur, or is in the shadow of the dominant city nearby, as in Pune, or is the result of superimposed or planned activities, as in Aurangabad; this difference has thrown the latter group to the second rung. All these districts attract migrants and hence the dominance of population in the middle age group with lower dependency ratio, and, higher PCI and PCDDP.

The core areas with predominance of population in the lower age group lie in the heart of Marathwada that was carved out from the erstwhile princely state of Hyderabad with predominantly Urdu speaking population and the associated variables like high fertility rate, higher percentage of children in population, larger size of household and lower female literacy. While Jalna, Parabhani and Nanded districts

represent this *par excellence*, extensions outside are seen in the districts of Nashik and Dhule in the northwest and Buldana and Akola in the north. It is noteworthy that Islam as such does not show association with this age group but Urdu language shows strong association and this differentiates the native and migrant *muslims*; the former predominate in less urbanised areas while the latter in the urbanized zones.

Absence of aged population is seen in the tribal districts of eastern Vidarbha and northwestern parts of the State; an analysis at the *tahsil* level could have brought in their relation to hilly, inaccessible areas. Remoteness of these areas with the lack of health facilities and poor nutrition explains the poor longevity in these areas.

Districts of Konkan and adjoining southern Maharashtra do not show predominance of any of the age groups as such; this is also the case with Jalgaon, Amaravati and Wardha.

### **Concluding Remarks**

The paper aimed at relating the age data to various socio-economic variables that could either indicate the cause or consequence of the dominance of a particular age group in a given region. Not all the age groups show geographical contiguity because of the nature of associated variables involved, but there is some satisfactory pattern in areas with the lower age group and those associated with absence of old age group. The absence of contiguity in areas

showing dominance of working age group is easily explicable considering the fact this age group is oriented to urbanisation, a phenomenon which shows selectivity in its spatial occurrence. Factors promoting urbanisation are not available everywhere and this is clearly reflected in distribution of cities. Functionally, however, one finds a remarkable correlation of this age group with urbanisation and the associated phenomena, having both positive and negative feedbacks. The lower age group of 0-14 shows a remarkable spatial contiguity as it goes with a section of native population which is fairly concentrated in certain pockets because of historical factors. This has happened because of the forces that operated during the period of evolution of the State at various times. Here too one finds significant functional association with variables related to poor socio-economic development; some of these are the causes while others are the consequences. Absence of aged population also shows spatial contiguity because of its association with tribal population with its marginal location in terms of territorial extent as well as relief. Associated variables here reflect on negative socio-economic development. Unfortunately, the analysis did not bring out the areas associated with the aged people.

Overall, the distribution of dominant age groups is related to socio-economic variables and this way the study has enabled the researchers to arrive at a meaningful explanation of their spatial pattern. The study can be used in economic planning

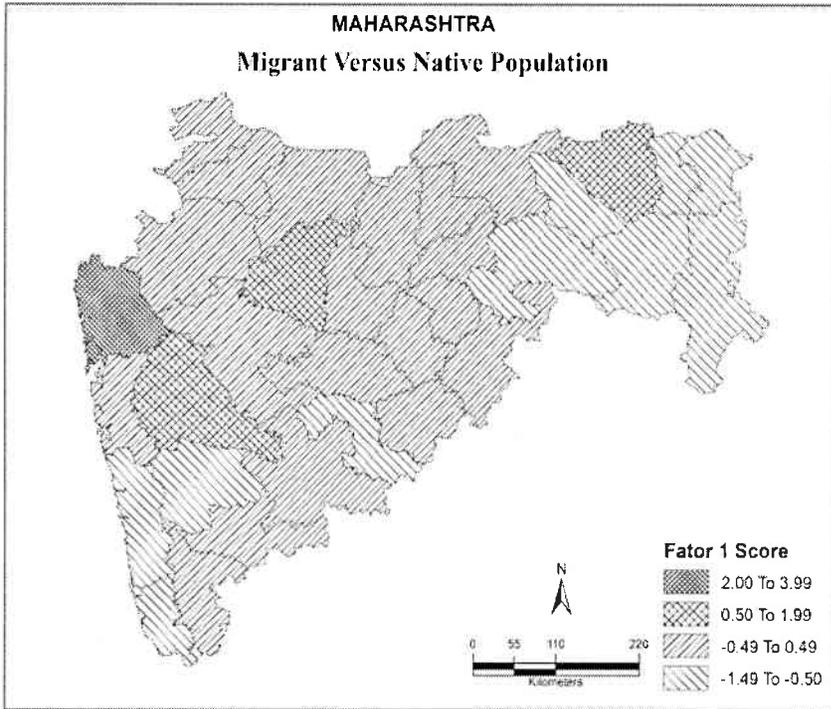


Fig. 1

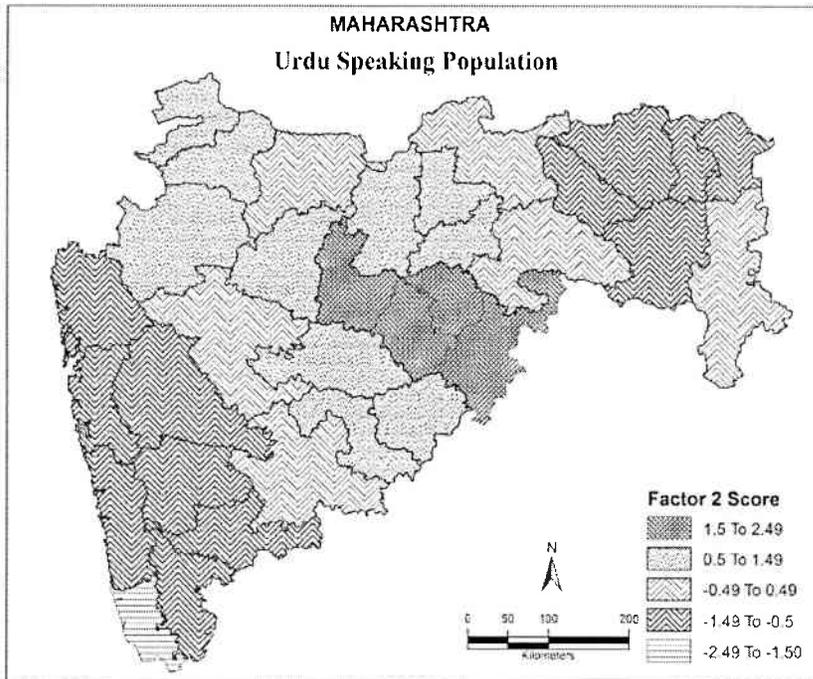


Fig. 2

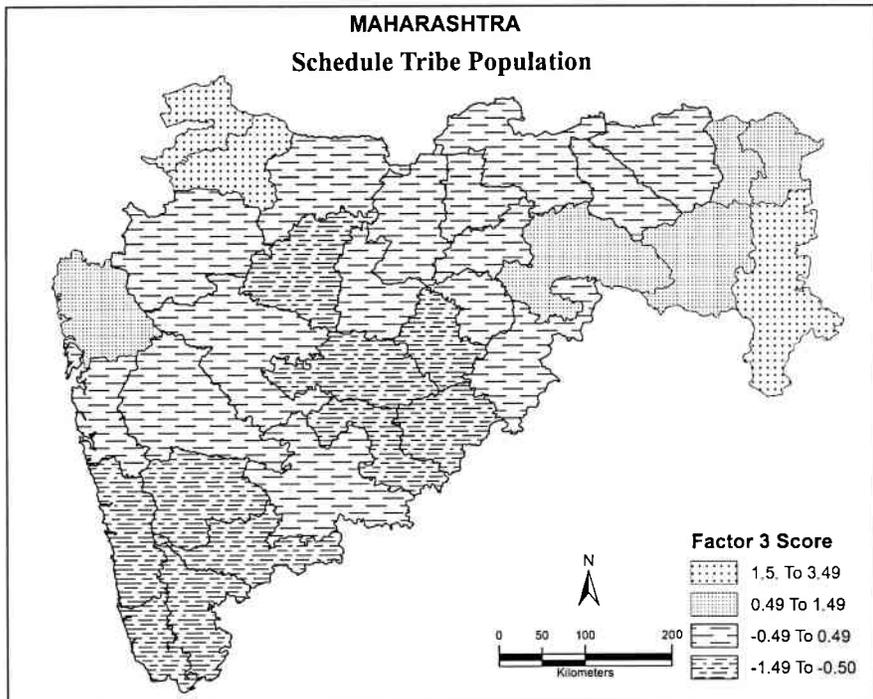


Fig. 3

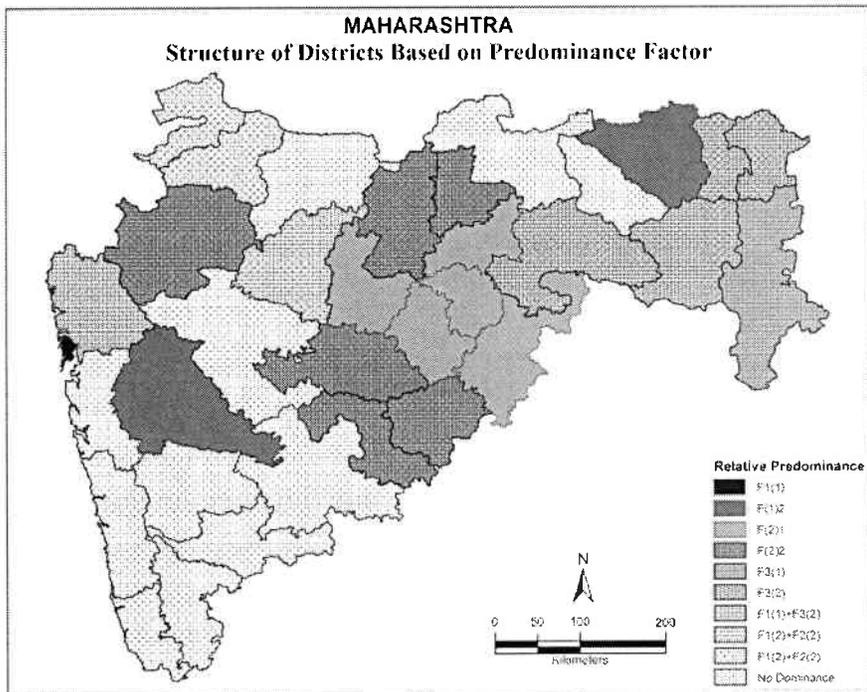


Fig. 4

for development and also location of socio-economic facilities which would change the mindset of the traditional societies. This would also enable decentralization of the development process.

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### References

- Bucher, H. (1996), 'Migration and its Impact on the Internal Distribution and Redistribution of Population', in *'Impact of Migration in the Receiving Countries, Germany'*, (eds.), M. Frey and U. Mammey International Organization for Migration, Geneva, 45-47.
- Chandrasekhar, C. P. and Ghosh, J. (2006), 'India's Potential 'Demographic Dividend'', URL:<http://www.thehindubusinessline.com/2006/01/17/stories/2006011701531100.htm>
- Choudhury, C.R. (2006), '*A Study of Quality of Single Year Age Data in India*', Seminar paper submitted for the partial fulfilment for the Master of Population Studies Academic year 2005-06, IIPS, Mumbai.
- Coale, A.J. (1956), 'The Effects of Mortality and Fertility on Age Composition', *The Milbank Memorial Fund Quarterly*, 36, 79-114.
- Coleman, D. (1994), 'International Migrants in Europe: Adjustment and Integration Process and Policies', in United Nations, Economic Commission for Europe, 'International Migration: Regional Process and Responses', U. N., New York and Geneva, 41-76.
- Daveri, F. and Maliranta, M. (2007), 'Age, Seniority and Labour Costs: Lessons from the Finnish IT Revolution', *Economic Policy*, 22(49), 117-75.
- Goryacheva, A. M. (1977), 'Factor Analysis of the Growth of India's Largest Cities and Differentiation of Economic Functions', *Soviet Geography, Review and Translation*, Vol. XXVIII(6), 384-95. Govt. of Maharashtra (2002), 'Human Development Report - Maharashtra', Mumbai.
- Haggett, P. (1972), 'Geography : A Modern Synthesis', Harper International Edition, New York.
- Hong, S. (1982), 'The Age Structure of Selected Countries in the ESCAP Region', *Population Research Leads*, 11, 1-25
- Jones, B. F. (2005), 'Age and Great Invention', NBER Working Paper Series, Working Paper 11359, May 2005.

- Kaa van de D. (1987) 'Europe's Second Demographic Transition', *Population Bulletin*, 42(1), 1-57.
- Liddle, B. (2000), 'Population Growth, Age Structure and Environmental Impact', *Population and Environment*, 21(4), 385-411.
- Mackenbach, J.P.(1995), 'Socio-economic and Cultural Determinants of Regional Mortality Pattern in the Netherlands', in A. D. Lopez, G. Caselli, and T. Valkonen, (eds.), 'Adult Mortality in Developed Countries: From Description to Explanation', Clarendon Press, Oxford, 2286-306.
- Murray, J.L. Christopher, Yang, Gonghuan., Qiao, Xinjian (1992), 'Adult Mortality: Levels, Patterns and Causes', in R. G. A. Feachem *et al* (eds.), 'The Health of Adults in the Developing Countries', Oxford University Press, 23-97.
- Phadke, V.S. and Mukherji, D. (2003), 'Age Structure of Maharashtra as revealed by the Census Data', Paper presented at the Seminar on 'Dissemination of Census Data', Organized by Directorate of Census Operations, Maharashtra, Mumbai.
- Praskawetz, A. and Lindh, T. (2007), 'The Relationship between Demographic Change and Economic Growth in the EU', Research Report 32, Institute for Demography, Vienna.
- Simonton, D. K. (1988), 'Age and Outstanding Achievement: What do We Know after a Century of Research?' *Psychological Bulletin*, 104(2), 251-67.
- Ting Yu (1990), 'Age Structure Transition of China's Population: Regional Differentials and Implications for Development Policy', *Asia-Pacific Population Journal*, 5(4), 17-34.
- Vertot N. (1990), 'The Age Structure of the Population of the Socialist Republics and Regions of the Socialist Federal Republic of Yugoslavia and Districts of the Socialist Republic of Slovenia', POPLINE Document, No. 248962.
- White, P. (1993), 'Immigrants and the Social Geography of European Cities', in R. King (ed.), 'Mass Migration in Europe: The Legacy and the Future', Belhaven Press, London, 47-66.
- Xenos, P. and Kabamalan, N. (2005), 'A Comparative History of Age Structure and Social Transitions among Asian Youth', in S. Tuljapurkar *et al* (eds), 'Population, Resources and Development', Springer, Netherlands, 57-88.
- Yeates, M. (1974), 'An Introduction to Quantitative Techniques in Human Geography', McGraw Hill, New York.