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RURAL/URBAN POPULATION AGE STRUCTURE REGIONS OF UTTAR PRADESH

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ABSTRACT : In the present paper a bifocal approach is adopted. The first is oriented to the identification of rural/urban population and age structure regions of Uttar Pradesh, based on age structure index. The second examines the relationship under three main points of interrelationship among the independent variables: simple linear correlation between age structure index and the independent variables, and factor structure.

An analysis of age structure has an important bearing on the socio-economic structure of a population. It transfers the attention of the geographer from the readily observable differences in the landscape to the obvious social and economic foundations, and consequences, of those differences (Franklin, 1958). However, it is of great importance for research in various branches of economics and sociology and for countless social problems of a more practical nature, as in calculating the potential labour force and the number of apprentices etc. ready to take over vacant positions, in market analyses where the structure of the labour force according to age groups has to be taken into consideration, in assessing future housing requirements, in the plans of social development and many other problems. Age structure is the chief element in the analysis of population (Chaddock, 1956). It has major significance because it affects a wide range of demographic and social phenomena (Dewdney, 1968) and highlights some of the fundamental and social forces at work within the country. It reveals the amount of dependency on productive group and a large number of population of productive group is associated with higher economic development and high living standards (Occhiuto, 1955). A region which has aged population appears to be economically more developed than those of the younger population. The younger population requires a large expenditure on maternity, children's care and primary education and continues heavy investments on agriculture in comparison to industry. This retards the diversion of population to secondary and tertiary groups of work and adversely affects the growth of national income (Census of India 1961, 1966).

The present problem needs to be tested in Uttar Pradesh which is the most populous state of India having a population of 110 million (1981 Census). This state, at present, is facing economic and population problems quite acutely. It has a high degree of variations in rural/urban attributes of economy, society and population. The prong of the thrust in the present paper is bifocal. The first prong of the thrust is oriented to the identification of rural/urban age structure regions in the state and the second to investigate the relationship between age structure and the thirty-four independent variables. The latter is followed by an analysis, in respect of rural and urban areas, of the linkages, linear relationship between variables and the age structure index, and factor structure. This paper is based entirely on current district level data of Uttar Pradesh, obtained from Census of India publications, bulletins of agricultural statistics of U.P., Lucknow and the Office of Registrar General and Census Commissioner of India, New Delhi for 1971. The data for a few of the thirty-four variables of population age structure for some districts were not available and therefore, they had been interpolated from previous records and the continuous districts.

Age Structure Region

The demarcation of age structure regions is attempted through a single quantitative measure of age structure which is termed as Age Structure Index (Coulson, 1968). It is based on data of decennial age groups and is expressed mathematically in the form of the following equation:

$$Y = a + bX,$$

where for each district the percentage of population in each age group (Y) may be plotted against the middle of each age group (X). The 'a' is a constant representing the value of Y, when X equals zero. The value of 'b' is regarded as age structure index for each district which is further derived from the equation:

$$b = \frac{N \Sigma XY - (\Sigma X)(\Sigma Y)}{N \Sigma X^2 - (\Sigma X)^2}$$

The values obtained from above equation for rural and urban populations of the districts are decimal fractions with a minus sign and, as such, prior to the analysis of these indices certain adjustments are made in these fractional numbers. The adjustments are so designed that without affecting the relative values of the indices they are freed from minus sign and decimal points and changed into a more convenient form. The adjusted numbers give four-digit index to each district. The general principle is that the larger the number the younger is the age structure of the population and vice versa.

The range of index numbers is arranged into five broad groups of below 3399, 3400 to 3599, 3600 to 3799, 3800 to 3999, and 4000 and over. The regional distribution of the age structure indices of the rural and urban population of the districts is shown respectively in Fig. 1 (A,B). The indices of the lowest group ranging from 2518 to 3399 for the rural population constitute a region which has two separate components. One, which is more prominent, lies in the northeastern part of the state and includes twelve districts. The other, relatively small in size, occurs in the Himalayan section and is composed of three districts, namely, Uttar Kashi (2516), Chamoli (3196) and Tehri-Garhwal (3268). The regional distribution of indices of 3400 to 3599 is irregular. Of the eleven districts which come under this range, only four, namely: Gorakhpur, Deoria, Ballia and Ghazipur delimit an identifiable region in the eastern plain (Fig. 1A). About twenty-five per cent of the districts come under the age index range of 3600 to 3799. This range forms two compact regions: one lies in the western plain comprising five districts – Meerut, Bulandshahr, Aligarh, Etah and Farrukhabad, and the other in the southwest part and comprises Jhansi, Hamirpur, Fatehpur and Unnao districts. The remaining districts of this grade are scattered too sporadically to form a distinct region. Similarly high indices ranging from 3800 to 3999 make three compact regions of almost equal size occurring in western, southwestern and southeastern parts of the State. The highest age indices of 4000 and over do not constitute any notable region. Only three districts fall under this group. They are Naini Tal (4082), Muzaffarnagar (4018) and Agra (4006).

Interdistricts variation in age indices of the urban population ranges from 3188 in Rampur to 4500 in Bareilly with an average of 3918 for the state. This range of variations is lesser than that in the rural population (2518 to 4082), though both the minimum and maximum values are higher. Thirty districts have age indices considerably less than the state average. The districts with indices fairly close to the average are by far the most numerous: their number is as high as twenty-four. Only fourteen districts have high and very high indices. The distribution of various grades of age indices is shown in Fig. 1B. It will

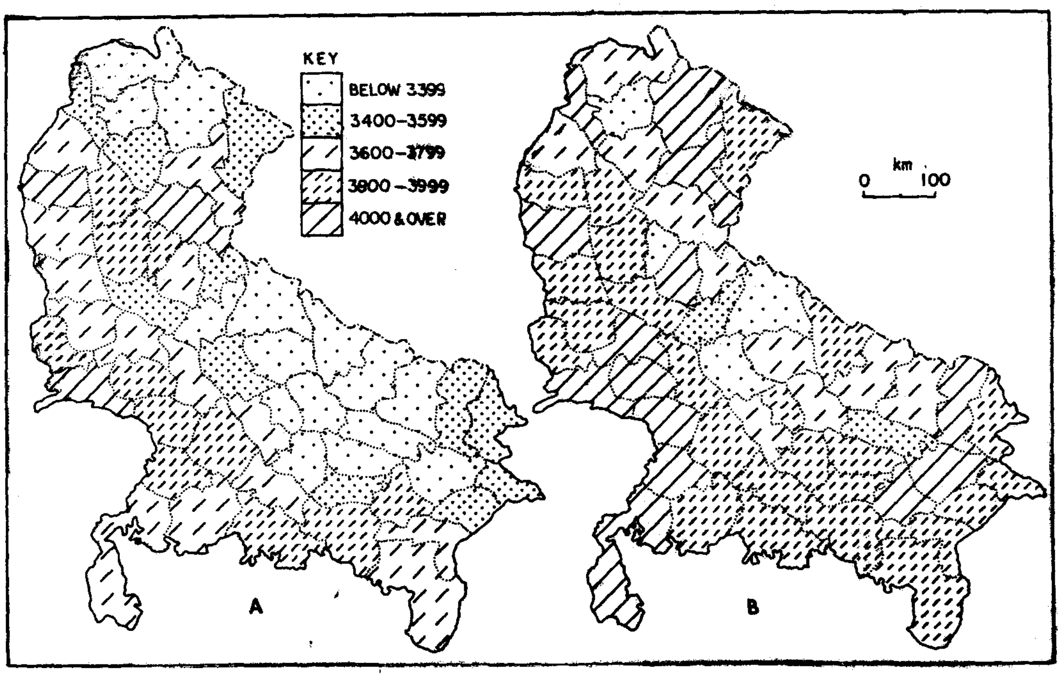

Fig. 1 - Age structure regions of A) Rural Population and B) Urban Population, U.P.

be seen from the map that the four districts of very low grade (3188 to 3399), namely, Tehri-Garhwal, Rampur, Kheri and Hardoi and the two districts of the low grade (3400 to 3599), namely, Faizabad and Shahjahanpur are so scattered that they fail to form compact regions. The ten districts falling under the range of 3600 to 3799 form two district regions: one that is found in the northern part of the state is composed of Saharanpur, Garhwal, Naini Tal and Pilibhit districts, and the other which occurs in the northeastern part comprises the districts of Sitapur, Bara Banki, Gonda and Basti. In contrast to this about forty-four per cent of the districts, that are very close to the state average (3918) fall under the grade of 3800 to 3999, form the most significant region. It runs from northwest to the southeast. The districts with very high age indices of 4000 and over constitute a number of small regions. Two of them are of fairly notable size. One lies in the eastern part and consists of Gorakhpur, Azamgarh and Jaunpur, and the other in the southwestern part which comprises the districts of Etah, Agra, Mainpuri, Etawah, Jalaun and Jhansi.

RELATIONSHIP BETWEEN AGE STRUCTURE AND THE INDEPENDENT VARIABLES

In the present investigation, relationships have been sought between age structure and thirty-four variables for rural and urban areas of the districts. Selection of each variable is based on an ability to develop a rational hypothesis of relationship between the variable and age structure. The study design required the definition of variables suitable for parametric methods of statistical analysis and made it necessary to give a quantitative value to each variable for each district. The thirty-four independent variables to be implied in the present analysis are listed in Table I.

Interrelationships among the variables are computed prior to the detailed development of the hypothetical framework. These variables are further divided into associated groups applying the technique of linkage analysis (McQuity, 1957). This analysis reveals rural/urban structure of types which are depicted in Table II for the rural sector and in Table III for the urban sector.

The simple associations between age structure and each of the independent variables have been computed and tested with the assumption that linear relationships existed in all the cases. For the test of relationship between urban population and rural age structure the null hypothesis adopted is that the high rural age structure index (Y) is not significantly related with the percentage of urban population (X_2) of the districts. The coefficient of correlation is obtained to be positive and well above the confidence level of significance and thus the null hypothesis is rejected. This means that there is acceptable validity in the assumption that the districts with higher percentage of urban population have younger age structure in the rural population. The similar is the case with the variables of X_6, X_7 and X_{13} but inverse with X_1 though the actual magnitudes of their coefficients are different (Table II). All the four variables of group II are found to be significant at 99 per cent level of confidence. In this group the direct relationship occurs between Y and X_{17} and X_{18}. In group III X_{10}, X_{19} and X_{29} are the variables which have high degree of negative relationship and X_{14} the positive relationship with Y. In other groups X_{22}, X_{31}, X_{11}, X_{12}, X_5 and X_{30} variables are found to be highly positively related with Y except the latter one and are well above the level of confidence limit. This signifies that higher the per centage of literacy, workers in secondary occupations, land and labour productivity

TABLE I : THE INDEPENDENT VARIABLES

X_1	Percentage of rural population
X_2	Percentage of urban population
X_3	Rural/urban ratio
X_4	Location quotient of towns with 50,000 population
X_5	Location quotient of villages with 5,000 population
X_6	Rural/urban migration rate
X_7	Industrialization : number of workers per 1,000 working population in registered factory
X_8	Average size of landholding in acres
X_9	Mechanization of agriculture
X_{10}	Agricultural density
X_{11}	Land productivity : Rs. per hectare
X_{12}	Labour productivity : Rs. per agricultural worker
X_{13}	Population growth rate
X_{14}	Child/women ratio
X_{15}	Sex ratio of work force
X_{16}	Population density
X_{17}	Dependency ratio
X_{18}	Juvenile dependency ratio
X_{19}	Senile dependency ratio
X_{20}	Literacy rate
X_{21}	Male literacy rate
X_{22}	Female literacy rate
X_{23}	Percentage of scheduled castes and scheduled tribes
X_{24}	Net migration rate
X_{25}	Birth rate
X_{26}	Death rate
X_{27}	Infant death rate
X_{28}	Male work participation rate
X_{29}	Female work participation rate
X_{30}	Percentage of workers in primary occupation
X_{31}	Percentage of workers in secondary occupation
X_{32}	Percentage of workers in tertiary occupation
X_{33}	Sex ratio : number of females per 1,000 males
X_{34}	Percentage of work force.

TABLE II : SIMPLE LINEAR CORRELATION OF GROUP VARIABLES WITH AGE STRUCTURE IN RURAL POPULATION OF U.P.

Variable (See Table I) GROUP	I	GROUP	III
X_1	-.367*	X_{14}	.738*
X_2	.365*	X_{16}	.081
X_3	.262	GROUP	IV
X_4	.273	X_{21}	.203
X_7	.397*	X_{20}	.328
X_{23}	.012	X_{22}	.406*
X_6	.433*	GROUP	V
X_{13}	.530*	X_{32}	.298
X_{24}	.074	X_{30}	-.393*
		X_{31}	.425*
GROUP	II	GROUP	IV
X_{18}	.857*	X_{11}	.572*
X_{17}	.744*	X_{12}	.392*
X_{28}	-.594*	X_9	.175
X_{34}	-.747*	X_5	.398*
GROUP	III	GROUP	VII
X_{15}	-.136	X_{25}	-.086
X_{33}	-.242	X_{26}	-.286
X_{19}	-.387*	X_8	.125
X_{29}	-.417*	X_{27}	-.040
X_{10}	-.506*		

* Significant at 1 per cent level.

TABLE III : SIMPLE LINEAR CORRELATION OF GROUP VARIABLES WITH AGE STRUCTURE IN URBAN POPULATION OF U.P.

Variable (See Table I)	GROUP I		GROUP III
X_1	-.190	X_{33}	.153
X_2	.190	X_{30}	-.096
X_3	.167	X_{31}	.124
X_4	.138	X_{16}	.206
X_7	.102	X_{24}	.015
X_6	.299	X_{28}	-.278
X_{15}	.116	X_{29}	.126
X_{23}	.410*	X_{13}	-.094
	GROUP II		GROUP IV
X_{17}	.537*	X_{11}	.043
X_{34}	-.521*	X_{12}	-.009
X_{18}	.616*	X_5	.130
X_{14}	.698*	X_8	.071
	GROUP III	X_9	-.171
X_{20}	.053	X_{10}	-.187
X_{21}	.074		GROUP V
X_{22}	-.145	X_{25}	.099
X_{32}	-.037	X_{26}	.119
X_{19}	-.049	X_{27}	.097

* Significant at 1 per cent level.

and large size of the villages the younger is the age structure of the rural population in the state.

In urban population, only five variables, as set out in Table III, have high degree of relationship ($r > \pm .40$) with age structure index (Y) though the magnitudes of the coefficients are dissimilar. It is hypothesized that the higher the indices of the X_{14}, X_{17}, X_{18}, and X_{23} the higher is the Y, i.e., younger is the urban population. The coefficients of correlation obtained yield significant indices well above the confidence level that has been adopted and as such the hypothesis is established to be strongly valid.

The factor analysis shows that the thirty-four original variables selected for the analysis of age structure could be collapsed to form eight new independent factors each for rural and urban areas. The factors together accounted for the total variance between the fifty-four districts. The first four factors, as Table IV shows, constituted 65.97 per cent of the variance in rural areas and 60.96 per cent in urban areas. This analysis leads to the identification of eight factors, i.e. F_1, F_2 and F_3 are of rela-age structure in rural and urban population is explained up to a cumulative percentages of 83.89 and 79.77 respectively. It will be readily seen from the table that first three factors, i.e. F1, F2 and F3 are of relatively very high significance in rural and urban sectors of the population and as such they are given special importance and consideration in the typology.

For rural areas it may be seen from the table that the first three factors explain combinedly 58.34 per cent of the total variance and the remaining five factors account for 25.55 per cent of the variance. Factor F_1 which accounts for 28.42 per cent of the total variance has high positive loadings of more than .50 on a large number of variables. They are X_2, X_3, X_4, X_5, X_6, X_7, X_9, X_{11}, X_{12}, X_{13}, X_{14}, X_{31} and X_{32}. Negative factor loadings are relatively low and the negatively correlated variables are relatively few in number. They, in descending order, are X_1, X_{30}, X_{33}, X_{15}, X_{29} and X_{10}. The factor generally describes *socio-economic situation and trends of urbanization.* Factor F_2 explains 17.41 per cent of the total variance and is very highly positively loaded on the variables X_{15} (.695), X_{20} (.787), X_{21} (.845) and X_{22} (.612); whereas negatively high correlation variable is X_{28} (.774). It may, therefore, be designated as the *literacy factor.* Factor F_3 accounts for 12.51 per cent of the total variance for rural areas. It is positively loaded on X_{14}, X_{16}, X_{17}, X_{18} and X_{19} with values ranging from .40 to .70, and negatively loaded on X_{34} (.676), X_{29} (.437), X_3 (.436), X_{32} (.435), X_{20} (.433), X_{28} (.424) and X_{22} (.402). It may be identified as the *factor of underdevelopment.* Factor F_4 which explains 7.63 per cent of the total variance shows relatively high positive loadings on X_{25}, X_{26} and X_{27} as compared to the other factors recorded in the calculations. It may, therefore, be recognized as the *vital process factor.*

For the urban areas the first two factors combinedly explain 46.20 per cent of the total variance. Factor F_1 explains 28.24 per cent of the total variance and comprises a large number of highly inter-correlated variables. This factor has positive loadings of more than .50 on the variables X_5, X_{11}, X_{16}, X_{17}, X_{18}, X_{19}, X_{31} and X_{33}; whereas the variables X_{10}, X_{20}, X_{21}, X_{22}, X_{28}, X_{29}, X_{32} and X_{34} are negatively correlated having the range of factor loadings from .49 to .87. On the whole it may be identified as the *factor of underdevelopment.* Factor F_2 explains 16.96 per cent of the total variance. It includes the variables X_1, X_{30}, X_{20}, X_3,

TABLE IV : FACTOR STRUCTURE

Factor	Common variance explained by factor			
	Per cent explained		Cumulative per cent explained	
	Rural	Urban	Rural	Urban
F_1	28.42	28.24	28.42	28.24
F_2	17.41	17.96	45.83	46.20
F_3	12.51	7.52	58.34	53.72
F_4	7.63	7.24	65.97	60.96
F_5	6.04	5.99	72.01	66.95
F_6	5.12	4.97	77.13	71.92
F_7	3.50	4.20	80.68	76.12
F_8	3.21	3.65	83.89	79.77

X_4, X_6, X_7, X_{22} and X_{27}. The first two variables are positively related with the factor having the loadings of .875 and .629 respectively. The other variables have heavy negative loadings. As such F_2 may be identified as *rurality factor*. Factor F_3, which accounts for 7.52 per cent of the variance, comprises X_{23}, X_{14} and X_6. They are all positively correlated and have the heavy factor loadings of .728, .647 and 461 respectively. The factor may be recognized as *migration rate factor*. Factor F_4 is heavily loaded on X_{25}, X_{32}, X_{26}, X_{24} and X_{28} and explains 7.24 per cent of the variance. The latter two variables have negative loadings and the former three the positive loadings. This factor qualifies to be named as *unemployment factor*. The remaining factors combinedly explain only 18.87 per cent of the total variance having a notable but small number of variables of heavy loadings and therefore, they fail to identify distinct factor.

CONCLUSION

The general pattern of age structure of population of Uttar Pradesh typifies a fairly progressive population and is characterized by a general uniformity in the distribution of age groups taken all at a time. But the age structure indices obtained by decennial age groups are distributed distinctly disuniformly in rural and urban sections of population of the districts. The graded distribution identifies a somewhat continuous zone of high rural index in western and southern parts and the regions of less than the state average in the northern part of central and eastern plains. The urban index for the state is at par with the maximum indices of the districts obtained for rural population which induces that urban population is relatively younger. Very obviously this concentration is due to the educational pull and gainful jobs of the urban centres because colleges and other centres of higher professional learning are invariably located in towns and cities and, as such, the rural youth who desire to get higher or specialized education have to migrate to such centres.

The degree and magnitude of relationship between age structure and the other variables show that rural population age structure is mainly influenced by locational structure, migration, dependency burden (total and juvenile), population growth and socio-economic situation. The position in respect of urban population is appreciably different and the variables which are positively related and notably significant with high level of confidence are child/women ratio, dependency burden (total and juvenile) and scheduled castes and scheduled tribes, and inversely and significantly related variables is work force.

The analysis of independent variables of the 34 x 54 data matrix collapsed into a smaller set of factors reveals that four significant factors *(socio-economic situation* and *urbanization, literacy, underdevelopment* and *vital processes)* combinedly explain more than 75 per cent of the variations in the rural population. But for the urban population the significant determinants are *underdevelopment, rurality, migration* and *unemployment.*

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REFERENCES

Census of India, 1961. (1966) : *U.P. General Report on the Census*, Part 1–A (i–ii), Manager of Census Publication, Delhi.

Chaddock, R.E. (1956) : Age and Sex in Population Analysis in Spengler, J.J. et al. (eds.), *Demographic Analysis : Selected Readings*, Illinois.

Coulson, M.R.C. (1968) : The Distribution of Population Age Structures in Kansas City, *Annals of the Association of American Geographers,* **58** : 155–176.

Dewdney, J.C. (1968) : Age Structure Maps of the British Isles, *Transactions of the Institute of British Geographers, 43* : 9–18.

Franklin, S.H. (1958) : The Age and Sex Structure of New Zealand's North Island Communities, , *Economic Geography,* **34** : 64–80.

McQuity, L.L. (1957) : Elementary Linkage Analysis for Isolating Orthogonal and Oblique Types and Typal Relevancies, *Educational and Psychological Measure ments*, **17** : 207–229.

Occhiuto, A. (1955) : Some Aspects of the Age and Sex Composition of the Italian Population, Proceedings of the World Population Conference, 1954, **3** : 513–26.

Siddiqui, F.A. (1980) : *Regional/Structural Analysis of the Population of U.P.*, Ph.D. thesis (unpublished), Aligarh Muslim University, Aligarh.

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