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A research technique for quantifying individual and group patterns of cyclic migration, with special reference to sub-Saharan Africa

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TIME SERIES ANALYSIS OF MIGRATORY STABILIZATION

A research technique for quantifying individual and group patterns of cyclic migration, with special reference to sub-Saharan Africa

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The literature on 'industrialization', 'urbanization', and 'modernization' in Africa[1] is replete with references to and studies of the kinds of migration that occur among 'rural' Africans who seek work in the industrial sector of their respective nations' economies. Such population movements can profitably be viewed as phenomena conceptually distinct from (1) the causes of the movement, (2) the processes whereby the movement comes about, (3) the processes of the migrant's incorporation into the social and cultural systems of urban areas, and (4) the kinds and degrees of behavioural and attitudinal changes that accompany adjustment of individuals to a new style of life. Taken together these phenomena are components of what is often called 'urbanization' or 'urban-industrialization'. In this paper I want to present a technique for rigorously quantifying individual and group variations in the patterning of the physical movement of people between rural and urban and/or industrial areas. Only by having well-defined parameters of variation, with appropriate statistics for each, can the relationships among the many dimensions of the total phenomenon of 'urbanization' be ascertained and measured.

One of the important common denominators of much of rural-urban migration that occurs in many parts of east, west, and southern Africa is its cyclic character. This is in rather sharp contrast to the largely uni-directional migration that is occurring and has occurred in North America and Europe in the last two centuries. Cyclic migration simply means that the vast majority of geographically mobile people return 'home' after some sojourn in another area. An allied concept, 'stabilization', refers to the tendency of individuals or groups to cease this travel between two points and settle permanently in one. The definition given to this term by J. Clyde Mitchell is as follows: "stabilization refers to the extent to which individuals cease to return to the point of origin of their migration; it is a statement of the change-over from the circulation of people between town and country to their permanent settlement in town".[2]

In the case of uni-directional migration, the extent of population movement is

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[1] See for example: Hilda Kuper (editor), *Urbanization and Migration in West Africa*, Berkeley, 1965; Walter Elkan, *Migrants and Proletarians: Urban Labour in the Economic Development of Uganda*, London, 1960; Sheila T. van der Horst, *African Workers in Town: A Study of Labour in Cape Town*, Cape Town, 1964; Philip Mayer, *Townsmen or Tribesmen*, Cape Town, 1961.

[2] J. Clyde Mitchell, 'Urbanization, Detribalization and Stabilization in Southern Africa', in UNESCO, *Social Implications of Industrialization and Urbanization in Africa South of the Sahara*, prepared under the auspices of UNESCO by the International Africa Institute, Paris, UNESCO, 1956, p. 697.

measured simply by enumerating the population in given localities at two points in time. Total gains or losses, not attributable to natural increase or decrease, as a function of both time and total population is a fairly safe estimate of population movement. Cyclic migration cannot be measured by such a procedure. Obviously a continuous circular movement of people could disguise mobility in any given locale by maintaining the population level constant. Stabilization as defined is a function of the degree of cessation of cyclic movement. In Africa, increases in city population have often been regarded as *prima facie* evidence of stabilization. A measurement which will reflect the amount and distribution of time spent in town as opposed to that spent in rural areas, would be by definition an estimate of stabilization.[3]

Several schemes have appeared in the literature for measuring migration and/or stabilization. These indices have taken patterns both of individual movement and those of groups as data for description. For example, a technique commonly used in Africa and elsewhere for measuring or estimating stabilization is: the percentage of some population having spent respectively 5, 10, 15, 20, . . . N years away from their rural homes, i.e. in town. Presumably the percentages are weighted by the number of years in each category, and a composite index for the total population is obtained. While such data is easy to collect, the index is virtually meaningless, in that it confounds several independent aspects of possible group as well as individual differences. First, the index fails to account for either individual absolute age or the age 'pyramid' of the group. If the number of years spent in town is a constant fraction of age lived, then group differences could be attributable solely to differences in the age structure and not to differences in exposure to the urban *milieu*. Second, the index in no way gives a clue as to the patterning of the distribution of time spent in town: e.g. when individuals first leave for town, how long they stay each visit, how frequently they return, etc. Numerous other criticisms could be made, but they are not necessary to prove the index to be a trivial one.

Mitchell has proposed an index[4] which he believes takes account of these objections: $\frac{\text{years in town since age 15}}{\text{years lived since age 15}} \times 100$. This index takes account of the age at which individuals typically leave rural areas in search of industrial work. It is a measure of industrial or urban experience as a function of total work experience. The index is weak, nevertheless, in two important ways. First, it does not account for the factor of absolute time. Anyone who leaves the reserve at an age other than 15 can have a very different length of stay in town from that of an individual who left at age 15, yet both could have the same stabilization score. Thus an individual in town since age 16 who is 18 at the time of ascertainment has the same index, (67), as an individual in town since age 25 who is 45 at the time of ascertainment. Second, this index provides no information about the patterning of the distribution of time between rural and urban areas.

The first objection to the Mitchell index could be overcome by simply weighting the obtained result by the absolute age of the individual. This would then reflect the absolute time spent in town. The second and most important weakness cannot be overcome by simple weighting procedures. An entirely different technique is apparently called for.

The major deficiency in the indices of

[3] The term 'stabilization' as used in this paper means simply the degree of population movement and nothing more. The term has no necessary implications for 'commitment' to urban life. Becoming stabilized to town life means spending longer periods of time there.

[4] J. Clyde Mitchell, 'Urbanization', p. 705.

stabilization is their static description. By taking total accumulated time spent in town as a percentage of total time lived or total time spent working, one disguises the very important information of how time between town and rural area has been distributed. An individual, for example, who after the age of 15 alternately spent one year in town and one year in the country for a period of 50 years would have the same stabilization index (using any of the proposed formulae) as an individual who after turning 15 went to town, stayed there 25 years, then returned home where he remained another 25 years to the time of ascertainment.

It is both intuitively obvious and empirically quite tenable that the patterning in an individual's migrations may be of more value in predicting and/or understanding his position on other dimensions of commitment to or involvement in urban-industrial life, than would be knowledge of the amount of time he has spent in town.

To obtain this data, the life span of the individual from some agreed base age is divided arbitrarily into three-year intervals —or any other sized intervals desired; the smaller the better. This ordinal scale shall be one of the co-ordinates of a graph. (See Graph no. 1.) The other co-ordinate shall consist of a cumulative scale of the sum of time that is or has been spent in town. In Graph no. 1 the axis of abscissas (X) is the age of the individual cumulatively plotted; the axis of ordinates (Y) is the years spent in town cumulatively plotted.

For each individual the proportion of time spent in town during each three-year interval is ascertained. Total cumulated time spent in town is graphed as a function of total time elapsed. Quite obviously a curve obtained for any given subject may be linear, multilinear, irregular, etc. In any case the *slope* of the curve, over its entire length or any segment of its length, is isomorphic with the proportion of time spent in town during the time period covered by the curve or curve segment. More exactly, the slope of any curve or curve segment is isomorphic with the *rate* at which time spent in urban areas is accumulating, relative to total time elapsing. Further, the height of the curve at any point (i.e. on the Y axis) gives the total time spent in town up to that point in time.

As is apparent from Graph no. 1, a line with a slope of 45 degrees (i.e. a line representing the equation $x=y$) provides the limit on the value y can take in respect to x. That is to say, the maximum amount of time a person can spend in town is all the time he is alive. Conversely, a line with a slope of 0 degrees represents the minimum time a person may spend in town proportional to total time elapsing.

We may obtain the slope of a line or the amplitude of an angle by simply dividing the length of the side of the right triangle opposite the angle to be measured by the base side adjacent to this angle. Thus, to measure the slope of any segment of an obtained curve, we divide (y_2-y_1) by (x_2-x_1), where x_1, y_1 and x_2, y_2 represent respectively two points falling on the curve. (See this problem diagrammed on Graph no. 1.) The line joining these two points has the slope of the quotient of the first equation. To obtain the proportion of time spent in town, we find the proportion of any obtained slope to the maximum slope. Hence,

$$\frac{(y_2-y_1)}{(x_2-x_1)} \div \frac{(y'_2-y'_1)}{(x'_2-x'_1)} = \text{p} = \text{proportion}$$

of time spent in town, where the divisor is the maximum slope and the dividend is the obtained slope. Needless to say, there are many ways to obtain the slope of a line or amplitude of an angle. These need not be dealt with here, as they are readily available in any text on trigonometry or college algebra.

This technique can be adapted to population studies. One might combine in some statistic the individual curves, or one might use the graphed data in a slightly different way. Instead of drawing curves for each individual, one would plot all values of Y for each level of X for every individual in some population.[5] The resulting information would in fact be a 'scatter diagram', i.e. points indicating every value of Y for each value of X found within and among individuals in the population or sample. Using a 'least squares' or other suitable technique for fitting a curve to observed data, a stability curve may be obtained for the population as a whole. This curve (i.e. its slope) takes account of every individual's particular migratory history.

Since a least squares line gives only point estimates of values of Y for given values of X and vice versa, it would seem realistic to take account of the means and variance in obtained values of Y for any given fixed values of X. Doing so we could obtain a 'regression curve' for Y onto X. By formulating limits of prediction we would be in a position to state with given degree(s) of confidence the probability that Y will take a value between two specified limits for fixed values of X.

It must be pointed out that in using this technique as a measure of correlation or regression we face a definite danger. Since the ages of individuals in a population will be highly variable, this will mean that most or all individuals will be contributing to the data for the early years of life, with fewer and fewer individuals being represented in the data for later and later years. If this has a significant effect on the variance in the values of Y for increasing values of X, we no longer have homogeneous variance (homoscedasticity) for both X and Y variables. This would preclude the use of any parametric measures of association.

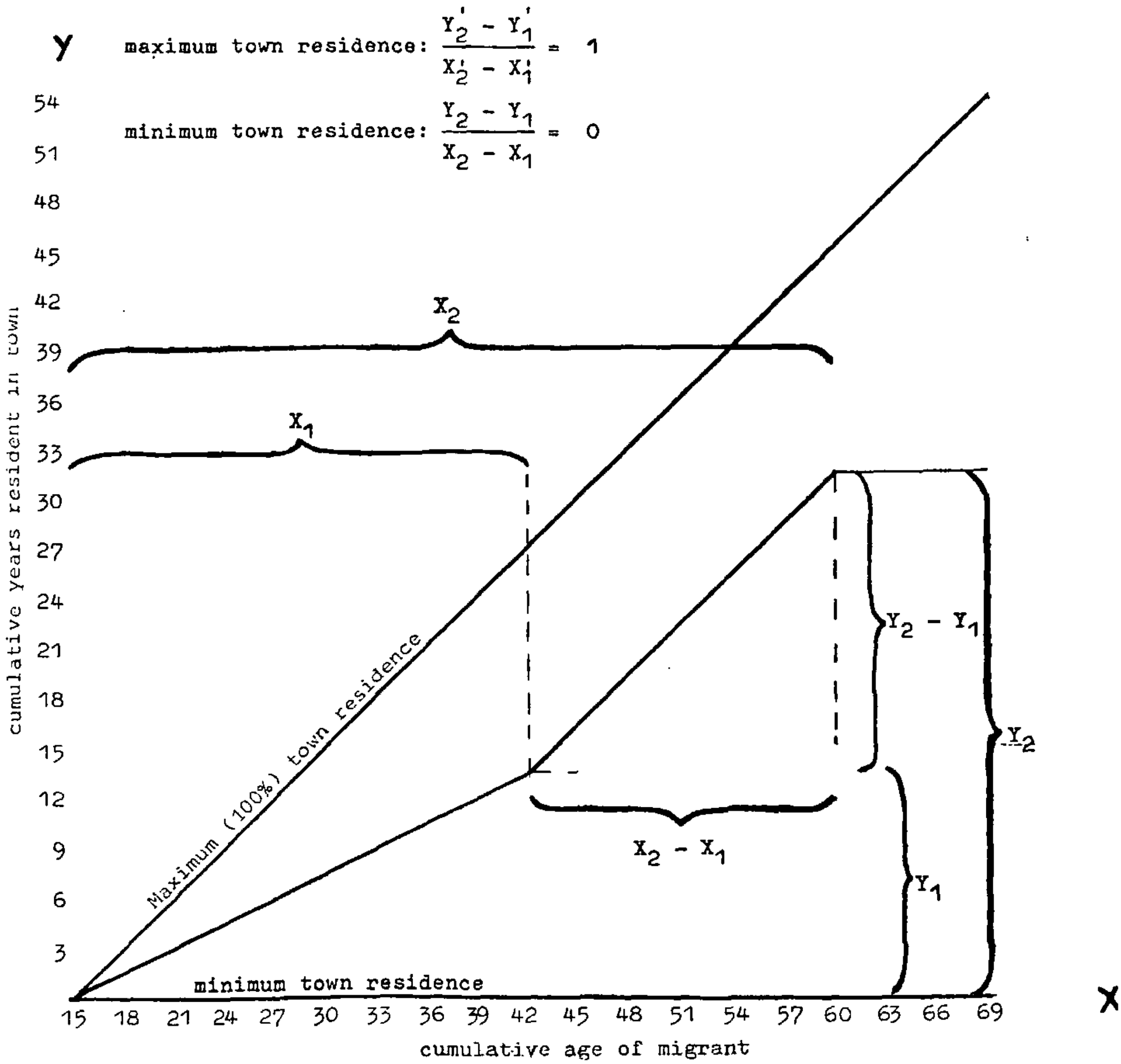
On Graph no. 2 are illustrated some actual stabilization curves,[6] obtained from informants in Johannesburg. Curve *a* represents an individual who, since the age of 22 and up to the age of 48, spent all of his time in town. Thereafter he returned to his homeland where he remained until one week before I interviewed him. Curve *b* represents a subject who between the ages of 15 and 40 spent generally 50 per cent of his time during each three year interval in town. This implies here regular and equally spaced visits to town and reserve, each lasting about 18 months. After age 40, *b* shows a trend to spending less and less time in town in proportion to time spent in his rural home. By the time of the interview at age 69, he sees the city for only a few days each year. Curve *c* represents an individual who lived exclusively in a rural area until the age of 25. Thereafter he left for town, remaining there for 11 of 12 months every year for the next 10 years. At the age of 36 he went home, where he spent the next 6 years, without visiting the city. At age 42 he returned to town, where he has stayed exclusively until the time of the interview. Note in the cases of subjects *a* and *c* that I have indicated that it is possible to handle their initial migratory histories in two ways. Since these subjects' first migrations do not come at a time in their lives which coincides with an 'age-class' boundary on the graph, one can either plot the curve from the age of the actual first migration or from the age indicated on the nearest lower class boundary.

These few diverse examples illustrate the power and fidelity of this technique. Using this instrument in conjunction with equally robust measures of other dimensions of urbanization or modernization will enable one to understand more exactly the relationships that exist between the temporal

[5] It is almost unnecessary to emphasize strongly that such data collection must take place at both ends or termini of a migratory circuit, if the data is to be in any sense representative of a migratory population.

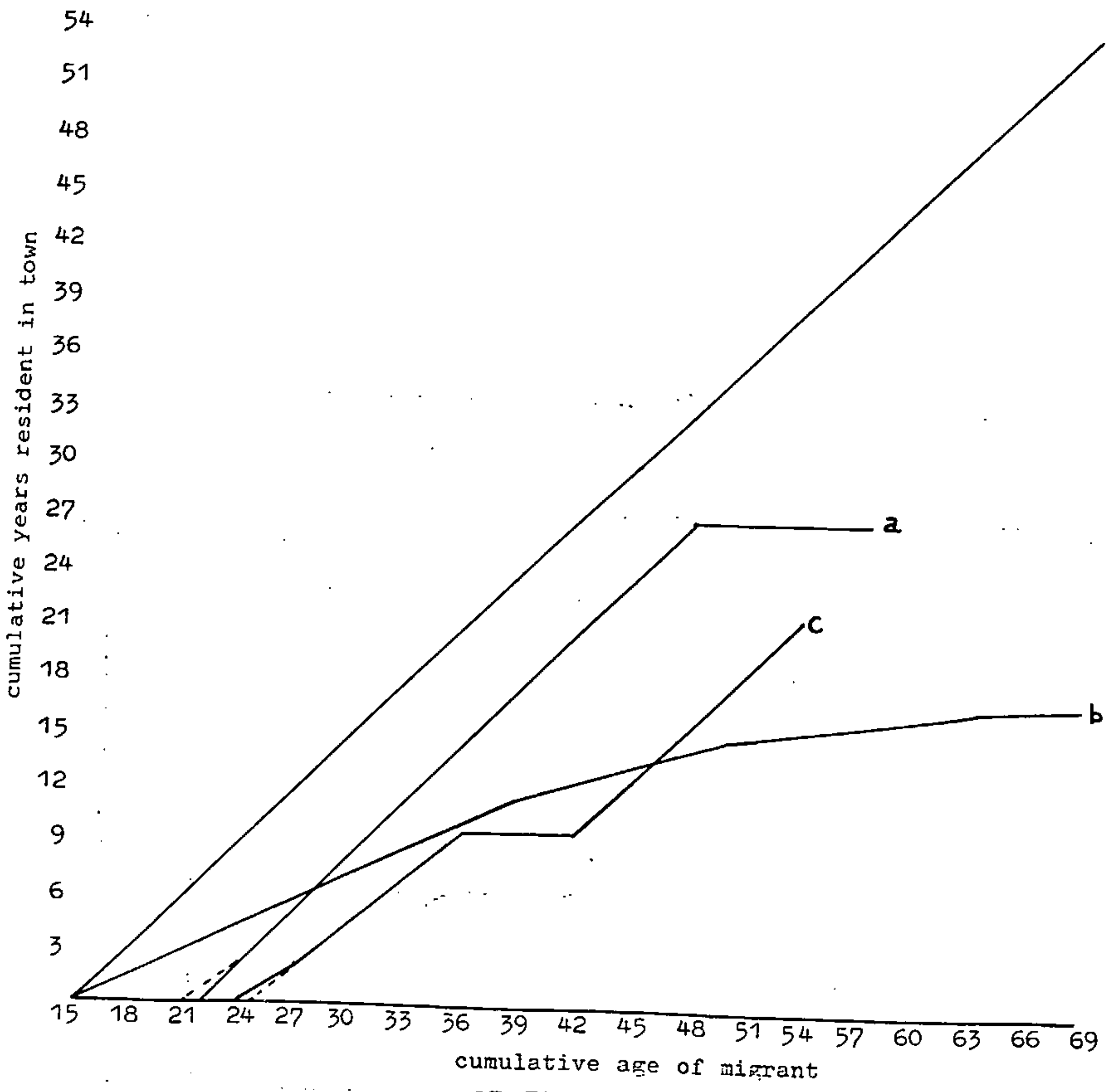
[6] I purposely selected three individuals with rather unusual migratory histories to exemplify the power of this technique to deal with idiosyncracies of any variety.

dimensions of migration and the intertwined problems of (*a*) attitude and value change, and (*b*) individual 'transition' in general from tribesman to townsman.



GRAPH No. 1
Time series analysis of migratory stabilization

a, b, and c = individual informants



GRAPH No. 2
Selected stabilization curves

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