Introduction

The history of Africa is full of the accounts of movements of people on large scales. Some of the movements had occurred in the form of conquests in war and some had taken place by a slow and largely peaceful shift to new lands. Such movements we are told, have been a feature of Africa in the past and are one of its most important demographic features at present.

There is no phase of African history which can be understood without reference to the movements of people both before and during it. However, there are differences in types, magnitudes and the casual factors of the past and present migration in Africa. Prothero divides migration in Africa on the basis of continuity and change into three categories as follows: (a) movements that took place in the past which no longer exist but which may help explain the present distribution of population (b) movements that have continued from the past into the present such as seasonal pastoral migrations, long term migratory drift, and religious pilgrimages and (c) movements that have developed in the recent times, such as downhill or rural-urban migrations.

The bulk of migration studies now focus on the third category and justifiably so. In a World Bank Sector Working Paper of 1972, it was shown that migration exceeds fifty per cent of the total population increase in some of the cities in the developing nations. For example, according to the Bank's statistics, about 75% of the total population increase between 1952-62 in Lagos, Nigeria was due to migration and Nairobi, Kenya gained 50% of its population from migration during...
the same period. The concern of the governments had been aroused by this migration to the urban centers. The high rates of rural-urban migration in the developing nations has resulted in what some scholars had termed 'over urbanization' (see Davis and Golden, UNESCO, 1957 and also for an analysis of the concept by Sovani). Ignoring the issue of whether the thesis of over urbanization is correct, there is no doubt that the migration to the African urban centers are increasingly creating problems, especially when the resources of these cities have been taxed almost to the limit.

There have been a host of studies on migration in Africa. In many of these, attempts had been made to explain the causal factors of the migration process. Recently, increasingly sophisticated, analytical tools have been employed (and are still being used) to test some set of hypotheses. Of particular importance are the studies utilizing migration models. Since most of these models had been originally employed in the studies of migration in the developed nations, the question always arises as to their relevance in an African context. For a long time, quantitative model construction was shunned in Africa because it was thought that migrants there were not acting rationally as were their counterparts in Europe and America. The reasons for migration were seen for a long time in terms of interpersonal and intertribal differences, civil wars, and the attraction of the bright lights of the cities. The question is whether this is still the case.

**In Search of Migration Theory**

Perhaps, the most famous and earliest scholarly work on migration is that of Ravenstein which appeared in the Journal of the Royal Statistical Society of June 1885. The title of the article itself, 'The Laws of Migration', was ambitious and many scholars criticized it for not coming forth with any clear, explicit, concrete laws. However, the article remains a classic and is still the starting point for migration theory. When one looks at the summary of the Ravenstein's 'laws', the importance of the article becomes obvious and as Lee says, few additional generalizations had been made anyway so far to the laws. The main points of Ravenstein's laws could be summarized as follows:

1. Migrants only proceed a short distance from the point of origin and when they go long distances, they proceed by preference to one of the great commercial and industrial centers.
2. Migration usually proceeds in stages whereby the inhabitants of the country immediately surrounding a town of rapid growth, flock into it, and the gaps created in the rural areas are in turn filled by migrants from more remote areas.
3. Each wave of migration produces a compensating counter-current.
4. Females appear to predominate among short distance migrants.
5. The inhabitants of towns are less inclined to migrate than are those of the rural areas.
6. Technological advancement (transportation, manufac-
turing, etc.) enhances migration.

7. The dominant motive for migration 'arises from the desire inherent in most men to better themselves in material respects'.

Ravenstein's article remained the best example of a systematic analysis of migration but his notion of general laws of migration was ignored for a long time. Zipf and Stouffer of whom more will be written (about later in this paper) were among scholars that successfully utilized and reinforced Ravenstein's 'laws' of migration.

Lee also improved on Ravenstein's ideas and attempted to formulate a theory of migration. He advanced four factors entering into the process of migration as follows: (1) factors associated with the area of origin (2) factors associated with the area of destination (3) intervening obstacles and (4) personal factors. Lee also advanced certain hypotheses in regard to volume of migration, the establishment and counterstream, and the characteristics of migrants.

Many typologies of migration have been proposed, of which Fairchild's and Petersen's are among the famous ones. Fairchild classified migration into four categories as follows: (a) invasion (b) conquest (c) colonization and (d) immigration. Petersen formulated five broad classes of migration distinguishing what he termed 'innovating from conservative migration' and including the level of migrants' aspiration. The categories devised by Petersen are primitive, forced, impelled, free and mass migration.

There is still a lack of consensus on what constitutes a migration theory. However, there is no doubt that these studies and others like them have contributed tremendously to our understanding of the phenomenon.

Studies of Migration in Developed Nations

In migration studies in the developed nations, the concern of economists had been mainly on the theory of labor mobility, or "the response of individuals to economic opportunity at a distance." While the importance of pure economic variables in determining the direction and magnitude of migration cannot be overemphasized, the non-economic variables, or 'the socio-geographic factors (as like or dislike for densely populated metropolitan areas, preferences for or against the 'four seasons', the proximity of beaches and/or mountains, family ties, and the like' cannot be discounted. However, the vast majority of the empirical studies of migration have concentrated on the economic variables. This is in line with the picture of rational human beings responding to pure economic forces and this confirms one of the Ravenstein's 'laws' that the dominant motive for migration 'arises from the desire inherent in most men to better themselves in material respects'.

Migration Models

Substantial number of empirical studies have concerned themselves with the testing of hypotheses based on economic variables by using multiple regression models. The concentration on economic variables is also made more
appealing by the ease with which they (income, unemployment rate, etc.) can be quantified. In these studies, migration is seen as primarily caused by spatial socio-economic differences exerting 'push' and 'pull' forces on potential migrants. As Olsson aptly puts it, the assumption is of migrants behaving rationally and this "in turn makes it possible to consider migration as a means for achieving a state of spatial equilibrium in income and employment." Many geographers and regional scientists have also taken this approach using social gravity analyses.

The type of migration models utilized in a study may depend on the focus of the research. As Rogers puts it: Internal migration may be approached from two different points of view: from the point of view of migration streams and from the point of view of migration differentials... whereas analyses of streams are concerned primarily with the effect that variations in environmental conditions at origins and destinations have on volume of flow, studies of differentials are concerned with the traits of migrants in various age-sex-income-race classifications.

Gravity Models
There had been a variety of gravity models. The earliest approaches involve metropolitan migration. Mathematical formulas were employed to predict migration between two cities in terms of push, pull and resistance. This model started with the principle of frictional effects of distance.

Zipf's model was based on the principle that gross migration between two places varies positively with the product of their sizes, and negatively with the distance separating the places. Zipf's $P_1P_2/D$ formula considers the force of attraction to be the product of the populations of two areas and the resistance to be the highway mileage between them.

Stouffer's intervening opportunities model was based on accumulated intervening opportunities between the origin depends on an auxiliary relationship that expresses the accumulated intervening opportunities between the origin and destination as a function of distance. Here the focus is on the goals of the migration whereby opportunities in the receiving area are the force of attraction and intervening opportunities between the city and the city of destination are the resistance factor. Stouffer's intervening opportunities model is of the form:

$$M = \frac{K M_i M_j a}{m_1 M_0}$$

where

$$M_{i-j} = \text{total migration from } i \text{ to } j.$$  
$$M_i = \text{total out-migration from } i \text{ to all other places}$$  
$$M_j = \text{total in-migration to } j \text{ from all other places}$$  
$$M_{i} = \text{total in-migration to places located between } i \text{ and } j$$
MO = competition offered by migrants from places other than i for a presumably limited number of opportunities at the place of destination, j.

Zipf's and Stouffer's models had been criticized, and subsequently been elaborated upon and modified by many scholars. One of the shortcomings of the models is that they offer no value for prediction of future migration between two places. Another reason for modification is based on the belief that comparative economic opportunity is the driving force of interregional migration.

One of the famous and currently used models is the Lowry model or its variations: (see Rogers 1968: 74)

This model is as follows:

\[ M_{ij} = K U_i W_j L_i L_j E_{ij} \]

or in its generalized-log transformed form:

\[ M_{ij} = B_0 + B_{11} \ln U_i + B_{21} \ln U_j + B_{31} \ln W_i + B_{41} \ln W_j + B_{51} \ln L_i + B_{61} \ln L_j + B_{71} \ln D_{ij} + E_{ij} \]

Where

- \( M_{ij} \) = number of migrants from i to j
- \( L_i, L_j \) = number of persons in the non agricultural labor force at i and j respectively
- \( U_i, U_j \) = unemployment as a percentage of the civilian, non agricultural labor force at i and j respectively
- \( W_i, W_j \) = hourly manufacturing wage at i and j
- \( D_{ij} \) = airline distance between i and j
- \( E_{ij} \) = error term.

The parameters, B's are interpreted as elasticities describing the percent change in migration associated with a percent change in the appropriate independent variable. This model incorporates the classical gravity model and the notion of the differences between regions. Whereas the classical gravity model includes the effects of population size and the concept of distance decay, this new model incorporates such regional differences as indicated by the differences in wage rate, unemployment levels, growth in the labor force and so on.

This model had been empirically applied in many migration studies in developed nations and had been generally confirmed (see for example Lowry'4, Gallaway et al.12 1967, and Greenwood'7), and hence the conclusion that interregional migration is a response to economic opportunity measured by wage and unemployment variables and the frictional effects of distance.

Research on Migration in Africa

The study of population movements in Africa has seemed to follow two general approaches which are not really mutually exclusive. For our purpose here, the approaches can conveniently be subsumed under the following headings: (1) the earlier studies which placed emphasis on the problems of those 'who live between two worlds - the tribal society and the urban environments' and (2) the studies of
late which utilize the rigorous quantitative tools used in the research of migration patterns in Europe and America. The former approach was largely employed by the anthropologists and sociologists and the latter approach is found in the works of economists, geographers and demographers.

Hypotheses on the Causal Factors of Migration in Africa

Many hypotheses have been advanced for the cause of migration in Africa. Among these factors are: (1) the attraction of towns to Africans living in the rural areas (this factor is sometimes referred to as the 'bright light hypothesis'). (2) Rural deprivation and (3) Economic reasons.

According to the first factor, many Africans are attracted to the big cities because of the freedom, excitement and modernity available there. This is illustrated in the following passage by Little: "...the idea of town being a centre of civilization. Its modern amenities like electric lighting, large stores and shops, cinemas, bars, and dance halls have a particularly strong appeal for individuals whose mental horizons has hitherto been bounded by the bush enclosing their villages."

However, some other empirical studies suggest that this factor has probably been overexaggerated (see e.g. Mitchell and Skinner). The second factor refers to migration in response to soil exhaustion, drought, pressure on the land and the perceived rural-urban disparity. Most studies of late now seem to agree that the predominant motive behind most decisions to migrate is economic in nature. According to Todaro, the wage differential in rural and urban areas is perceived by potential migrants who then make the decision to migrate by taking into account the likelihood of obtaining employment, the difference in the cost of living and the social amenities of the urban areas and the cost of making the move.

Many other factors have been advanced including that of education or contact with Western culture (Evans, 1962), the effect of new extended transportation networks, political motivation, etc.

Application of Migration Models in Africa

Many migration studies in Africa are increasingly using complex analytical tools. There are differences in the types of analysis employed. However, there are substantial number of studies which have followed an analytical framework similar to the gravity-differentials model written about earlier in this paper. A review of a limited number of these studies will be done here in order to discover how useful the models have been in the investigations of migration in Africa. These studies are different in the number of variables or the hypotheses employed to explain the phenomenon. The studies are similar however in that they represent a systematic attempt of testing many hypotheses formulated to explain migration in Africa.

Beals, Levy, and Moses in their study of migration in Ghana estimated the effects of income and other variables on the pattern of interregional labor migration.
The authors postulated many hypotheses on causal factors of migration. Income or average return to labor is one of the variables the authors thought are important in individual decisions to migrate. An individual is presumed to move toward regions of high per capita income and high wages. Migration is also thought to be negatively related to distance because of the cost of moving. Distance therefore was made to serve as a measure of transfer costs. Population of both the origin region and the destination region is hypothesized to affect the number of migrants. Two other variables introduced are education and urbanization because these may account for the differences in individual responses. Education is measured by the percentage of adult males in the region who have attended school, and urbanization is measured by the percentage of regional population residing in towns of 5,000 or more.

The model used therefore is of the form:

\[ \frac{M_{ij}}{P_i} = f(d_{ij}, Y_i, Y_j, P_i, E_i, E_j, U_i, U_j) \]

Where

- \( M_{ij} \) = number of males, age 15-54, born in region i and enumerated in region j;
- \( d_{ij} \) = road distance in miles between major cities of region i and region j;
- \( Y_i, Y_j \) = average labor income in origin and destination regions, Yi and Yj respectively;
- \( P_i, P_j \) = number of males age 15-54 born in origin and destination region, Pi and Pj respectively.

\( E_i \) and \( E_j \) = percentage of males age 15 or more enumerated in origin and destination regions who have attended schools.

\( U_i \) and \( U_j \) = percentage of population of origin region i and destination region j residing in cities of 500 or more.

All the variables in combination were found to be important in explaining the variation in migration rates. However as Riddell and Harvey pointed out, when the explanatory variables were related to migration rates separately, the associations were generally weak. Separately, none of the variables was associated with more than forty per cent of the variance in migration rates but in combination, when simultaneously related to migration rates, in a multiple regression format, the level of explanation rose to 91 per cent. The general conclusion of the authors is interesting to be quoted in extenso: "...we have demonstrated that migration in Ghana is responsive to income differentials. Distance is a strong deterrent to migration...Regions of large population are attractive to migrants. These results are similar and consistent with conclusions for Western countries."

In another study of migration in Sierra Leone, Riddel utilized a similar model in his investigation of population movement to Freetown. In his study, Riddell posited fifteen explanatory variables to represent a set of hypotheses which were related to a dependent variable, per capita rates of migration, \( \frac{M_{ij}}{P_j} \). Per capita rates of movement from the 147
chiefdoms of Sierra Leone were related to the hypotheses represented by the variables measuring distance, the timing of the connection into the transport network, population pressure, urbanization indexes, education and literacy, the location of administrative functions, traditional and modern employment, the timing of the spread of schooling, the proximity to alternative employment in the diamond fields.

Riddell used the multiple linear regression form below to consider simultaneously the explanatory variables in their association with migration:

\[ y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \]

Where \( X_1, X_2, \ldots, X_n \) = the explanatory variables
\( \beta_0, \beta_1, \ldots, \beta_n \) = the estimating parameters

The regression coefficients, the betas, indicate the extent to which a unit change in each of the explanatory variables is associated with increases or decreases in migration rates. When all the variables are considered in combination, 60.0 per cent of the variances in migration rates are accounted for but the strongest variables are the distance from the diamond fields, the date at which the area was connected to the transport system and population density. However, because many of the variables are neither statistically nor conceptually independent, the author successively eliminated the least significant variables until only six variables which contribute meaningfully to the explanation remain with only a slight reduction in the level of explanation from 60.0 per cent to 57.9 per cent. Riddell therefore concluded that migration rates to Freetown was a function of distance, decay effects, population density, the size of the largest urban center in the chiefdom, and the date of establishment of native-administration form of government. The main thing however is that economic factors along with other social factors play a preeminent role in the population movements to Freetown.

Mabogunje employed a multiple regression analysis to test eleven hypotheses “postulated both as to the direction and the pattern of the permanent migration flows in Nigeria and the various factors underlying the pattern.” His aim was to test whether the demographic, social, and economic situations hypothesized (represented by eleven independent variables) are efficient linear predictors of the pattern and direction of migration flows.

The eleven variables accounted for about 70 per cent level of explanation of the migratory flow to the province. However, four of the eleven variables; trading, agriculture, other occupations and per capita revenue contributed most to the explanation.

The author therefore concluded that migration within Nigeria is strongly determined by economic factors of employment and income.

In his study, Mabogunje utilized the 1952/53 census figures. However, in 1963 another census figures became available which showed the accelerating increase in the migration drift from the rural to urban areas. The question is whether the underlying causal factors of migration found by
Mabogunje has changed within this period. McCain in another study in Nigeria analyzed the migration period pattern on an interregional basis during the period of 1952-63. The author’s hypotheses were that migration in the country was a function of perceived economic opportunity and that the perceived economic opportunity was in turn a function of perceived opportunities for employment.

The model used is of the form:

\[ M_{ij} = \text{function (economic opportunity)} = \text{function (employment)} \]

where

\[ M_{ij} \] - migration from the point of origin \( i \) to the point of destination \( j \).

Employment \[ f(P_i.P_j.U_j.L_j.\frac{A_i^1}{I Pi} - \frac{A_i^2}{I Pi} + \frac{E_i}{I Pi} + E_j) + e \]

where

\( P_i \) and \( P_j \) = Population in the regions of origin and destination respectively.

\( U_j \) = unemployment in the region of destination.

\( L_j \) = Labor force of males over 15 in salaried non-agricultural employment.

\[ \frac{(A.P_i^1)}{I.P_i^1} \] = the employed or active population at the point of origin in 1952 over the inactive population for the same year.

\[ \frac{(A.P_i^2)}{I.P_i^2} \] = the employed or active population at the point of origin in 1963 over the inactive population for the point same year.

\( E_i + E_j \) = employment in industries in 1963 at the points of origin and destination respectively.

\( e \) = error term

The author utilized the step-wise multiple regression analysis to correlate the migratory flow \( Y \) within the eight independent variables for each region. The eight independent variables accounted for about 91 percent level of explanation of
interregional migration. However, only three independent variables, the 1952 population at the point of destination, males employed in nonagricultural sector at the point of destination, and the ratio of employed population over the unemployed population at the point of origin, best explain the interregional migration in Nigeria. The conclusion therefore was that 'a low population density at the point of destination combined with a high rate of employment for males at the point of destination serve to attract or pull potential migrants away from their home regions'. This study buttressed other findings the importance of economic factors in the migratory drifts in Africa.

A Critical Analysis of the Migration Models

The few studies examined in this paper have shown that the migration models are useful in testing hypotheses concerning migratory flows in Africa. In other words, there is no doubt that these models could be successfully utilized in the African context. Judging from the studies examined and others not mentioned here, their applications have proved to be insightful though short of expectations. However, there is a reservation as to the extent to which these models can explain migration that had occurred over a given time interval in either developed or developing nations. Since these models attempt to explain migration that has occurred over a given interval by means of variables defined for the end of the period and/or variables relating to changes that occurred over the period, they may have a methological problem, cautioned Greenwood. The problem is, points out Greenwood:?

Since migration may influence end-of-period levels of explanatory variables by influencing the behavior of these variables over the period of migration, simultaneous equations bias may be inherent in the parameter estimates of the many single equation, multiple regression analysis.

A major obstacle confronting researchers in Africa is the paucity, or lack, of data. Even where data is available, their accuracies are often questionables. A majority of the studies rely on the census figures which often fail to record considerable amounts of movements. Since a census is conducted for more than detecting population movements, users have to make many assumptions and inferences. The census often has a record only of the residences and the place of births and not the actual movements of the population. However, most of the researchers are very much aware of this problem which defy easy solution. According to Mabogunje: these census materials offer us the only usable data for testing hypotheses...these data represent, as it were, a one time instantaneous description of a dynamic situation. They are therefore not wholly appropriate for studying a time dependent phenomenon such as migration flows.

Beals et. al. were confronted with the same situation in Ghana in which 1960 census data were used. They were aware that the 'data are
not ideal for a study of migration: multiple movements by the same person cannot be detected, flows of migrants over a long period of time are lumped together and must be related to explanatory variables measured at a point in time. This problem is not wholly a reflection on the model but on the environment in which they are employed. However, the environment in which a model is to be used must always be taken into account as to its relevance in the first place. An alternative way of getting around data problem is for the researchers to conduct their own surveys. This will be very prohibitive on a national than a local level. Caldwell's study in Ghana which utilized detail questionnaires of a stratified random sample of the population shows that census data can be ignored or supplemented to produce a good study.

Another problem common to these models is the problem of multicollinearity in which there is correlation between all or subset of the independent variables. This problem affects the Beals et al. study. Multicollinearity may bias the interpretation of the regression coefficients. Multicollinearity is a fault of the paucity of data and not of the model. This problem could be alleviated by collection of additional data and information. Another solution is that if two of the variables are highly correlated, computation with only one of the variables present at a time is helpful. The step-wise multiple regression analysis employed by McCain removed the problem of multicollinearity since it gauges the impact of each independent variable in isolation on the dependent variable.

Conclusion

In spite of the differing contexts, it is clear that the migration models could be successfully applied to explain the similar population movements in developing nations. Instead of formulating a list of factors thought to be responsible for migration and then stopping at this point, these models show that these factors can lead to hypotheses which in turn can be empirically tested. The models have also helped in dispelling the notions of the irrational migrants in Africa.

Writing in the context of the situations in developed nations, Rogers argues that internal migration is "held to be an important way by which people respond to changing economic opportunities and thereby redirect the spatial allocation of labor toward a more optimal pattern". This view is also true to a great extent of the internal migration in Africa. That is not to deny the fact that there are differences in the magnitudes and the dynamics of population movements in the two areas.

FOOTNOTES

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