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MODELLING ON RURAL OUT-MIGRATION SYSTEM: A PROBABILISTIC APPROACH

HIMANSHU PANDEY
Department of Mathematics & Statistics, university of Gorakhpur GORAKHPUR-273009 (INDIA)

The aim of this paper is to develop a probability model describing the variation in the number of total out-migration at micro-level data. The parameters involved in the models are estimated with the help of method of moment, proportion of zeroth cell and one'th cell respectively, the suitability of model tested through observed demographic survey data.

INTRODUCTION

The term migration has generally been restricted to change in residence between specifically designed political or statistical areas. Along with the size and composition of population, it influences the socio-economic and cultural characteristics of the concerned population. The flow of money from urban to rural areas through migrants has increased the social and economic status of the migrants families, which in turn may lead to a rise in the level of aspirations. Certainly migrants play an active role in the social and economic developments of their household particularly in developing countries. Thus out-migration from rural areas is an important vehicle for socio-economic and demographic change in the native villages. A number of attempts have been made during the past few decades to study the migration phenomena at macro-level (Friedlander and Roshier, 1966; Lee, 1966; Greenwood, 1971). They have generally used a macro-level deterministic approach. These studies might not provide the adequate explanation for the tremendous regional and local heterogeneity planning, specially in developing countries. In recent years the studies of migration decision process at micro-level have proved useful in which main emphasis on probabilistic and stochastic models of migration is made. In this respect number of descriptions and theoretical studies of migration have appeared in both developed and developing countries (De Jong and Gardner, 1981; Bilsborrow et al, 1987). Micro-level studies governing number of migrants per household is essentially a random variable and thus requires a stochastic approach for its study.

Nature of Migration

Human grouping is a very vital event in the study of out-migration pattern at micro-level. The most common unit of human grouping is a household. The characteristics of a household are bound to play an active role in the decision of an individual to move or not to move from a household. Considering the out-migration from rural to urban areas, the household can be categorized into two main groups.

(i) An adult male aged fifteen years and above alone migrates from the villages leaving behind his family.

(ii) Individuals (males) migrate along with their family.

These two groups of migrants have different socio-economic and cultural characteristics. The objective of the present paper is to develop a probability model for total out-migration pattern from the household which includes both (i) and (ii) types of migration pattern and apply to demographic data to observe its suitability.

MODEL FOR TOTAL OUT-MIGRATION

Assumptions

Following are the assumptions which are used in development of the probability model for total out-migration pattern:

(I) Let β be the probability that a household is exposed to the risk of migration at the survey point and $(1-\beta)$ be the probability that household is not exposed to the risk of migration.

(II) The number of migrants from a household moves in group. The number of group, G, follows a Poisson distribution

$$P[G=j]=\frac{e^{-\theta}\theta^{j}}{j}, \quad j=0,\ 1,\ 2,\ \ldots. \tag{1}$$

where θ is risk parameter.

(III) There are two types of household which is exposed to the risk of migration at the survey point. In one type of household only males aged fifteen years and above migrate and in another type of household males migrate with their family member. Let m_1 and m_2 be the respective proportions of two types of exposure households to the risk of migration such that $m_1 + m_2 = \beta$.

(IV) From the survey data it is clear that probability of K males migrating from a household is more than the probability of $(K+1)$ males migrating ($K = 1, 2, \ldots.$). Thus the probability is a decreasing function of K and therefore is assumed that the number of migrants from both m_1 and m_2 proportions of group follows a displaced geometric distribution such as

$$P[M=K]=q_1^{K-1}p_i, \quad k=1,2, \quad p_i=1-q_i \tag{2}$$

where i = 1,2 stands for m_1 and m_2 proportion of groups respectively.

The Model

Under these assumptions and using the technique of compounding the distributions (Johnson & Kotz, 1969), the probability model for the number of total out-migrants, X, from a household is given as

$$\begin{aligned} &P[X=0]=1-\beta+\beta e^{-\theta}, \quad for \quad K=0, \\ \text{and} \quad &P[X=K]=\sum_{i=1}^{2} m_i f(p_i, \theta), \quad for \quad K=1, 2, 3, \dots \end{aligned} \tag{3}$$

where

$$f(p_i, \theta)=e^{-\theta} q_i^K \sum_{j=1}^{K} \binom{K-1}{J-1} \left(\frac{\theta p_i}{q_i}\right)^j / j$$

for j = 1, 2, ... K.

and i = 1, 2, stands for m_1 and m_2 group respectively.

Estimation

This model consists of five parameters β, θ, p_1, p_2 and m_1. These parameters are estimated by equating the proportions of zeroth cell, "proportion of first cell", "sample mean excluding zeros", first row moment, and second row moment to their corresponding theoretical values represented by the following equations:

$$\frac{N_0}{N}=1-\beta+\beta e^{-\theta} \tag{4}$$

$$\frac{N_1}{N}=\theta e^{-\theta} \sum_{i=1}^{2}(m_i p_i) \tag{5}$$

$$\mu_1^*=\theta e^{-\theta} \sum_{i=1}^{2}\left(\frac{m_i}{p_i}\right) \tag{6}$$

$$\mu_2^* = \theta \sum_{i=1}^{2} m_i \left\{ \frac{(1+\theta+q_i)}{p_i^2} \right\} \tag{7}$$

$$\mu_1^* = \frac{\mu_1^*}{1-e^{-\theta}} \tag{8}$$

where N_0, N_1 and N denote the number of observation in zeroth cell, first cell and sample as whole respectively, μ'_1 and μ^*_1 denote the observed mean and observed mean excluding zeros respectively, μ'_2 denotes second row moment. The estimated value of the parameters are obtained by solving equations (4) to (8) in few steps of iteration with the help of the Methodox P.C. Computer

Sukhatme et al. (1976) have pointed out that sample mean and sample proportions are the consistent and unbiased estimators of the population mean and population proportions respectively. Thus in the present model, the estimators $\hat{\beta}$, $\hat{\theta}$, $\hat{p}_1$, $\hat{p}_2$ and $\hat{m}_1$ of the parameters are consistent and unbiased.

TO TEST THE SUITABILITY OF MODEL

Application

For suitability of the proposed model the data were taken from a survey entitled "Rural Development and Population Growth—A Sample Survey 1978". A research project "Evaluation of Impact of Development Activities and Fertility Regulation programmes on Population Growth Rate in Rural Areas" is conducted by the Centre of Population studies, B.H.U., India, for the three types of the villages "Semi-urban", "Remote" and "Growth Centre".

Conclustion

Table 1 gives the distribution of observed and expected number of household according to the total number of out-migrants in three types of villages. The risk of migration in a household, β, is highest ($\hat{\beta} = 0.6879$) in Remote villages and lowest ($\hat{\beta} = 0.3426$) in semi-urban areas. θ gives the average number of cluster per household. The estimates of θ are 0.3920, 0.4112, and 0.4382 for Semi-urban, Remote and Growth Centre type areas respectively. $\theta \sum_{i=1}^{2} \left(\frac{m_i}{p_i} \right)$ gives the number of migrants per household, which

TABLE 1. DISTRIUBTION OF OBSERVED AND EXPECTED NUMBER OF HOUSEHOLDS ACCORDING TO THE TOTAL NUMBER OF OUT-MIGRANTS FROM A HOUSEHOLD IN THREE TYPES OF VILLAGESL

Number of migrants	Types of Villages					
	Semi Urban		Remote		Growth Centre	
	Observed	Expected	Observed	Expected	Observed	Expected
0	1032	1032.00	871	871.00	972	972.00
1	58	58.00	139	139.00	124	124.00
2	23	24.79	52	53.38	32	41.61
3	6	12.26	15	23.80	25	19.31
4	10	8.47	14	13.46	12	12.55
5	8	6.11	11	8.98	10	7.41
6	7	5.56	10	6.44	5	5.48
7	1	13.08	6	17.94	5	19.64
8+	16		16		17	
Total	1161	1161.00	1134	1134.00	1202	1202.00
$\hat{\theta}$	0.3920		0.4112		0.4382	
$\hat{\beta}$	0.3426		0.6879		0.5392	
$\hat{p}_1$	0.8973		0.8893		0.9097	
$\hat{p}_2$	0.2936		0.3162		0.2909	
$\hat{m}_1$	0.1458		0.4049		0.3362	
χ^2	5.2964		6.6522		5.1511	
d.f.	2		2		2	

are 0.3265, 0.5547 and 0.4677 in these three types of villages respectively. Due to a greater number of commuters from the Remote villages, it was found that the average number of migrants per household from Remote villages was higher (0.5547) than the Semi-urban (0.3265) and Growth Centre (0.4677).

For applying a χ^2 test, the calculated χ^2 is significant at 5 percent level of significance for the model in Semi-urban and Growth Centre type village, whereas calculated χ^2 is significant at 2 percent level of significance for the Remote type villages. This suggests that the proposed model for observing the variation in the number of out-migration are reasonable approximation to the situation at the micro-level. Thus it is useful in calculating the various probabilities of migrants related with the process of migration.

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