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A Study Of Relationship Between Migration and Fertility

Introduction

IN recent years, demographers and other social scientists have focussed their increasing attention for a thorough study of the relationship between migration and fertility. This is, however, widespread in developed countries for which a large number of studies on migration and fertility have been conducted, but it has not been studied seriously in developing countries like India. Migration specially in developing countries plays an important role for changing the socio-economic and cultural environments of the people living in rural areas and hence it is expected that whenever migration occurs, it may have an important bearing on fertility.

There are various socio-economic and biological factors which affect human fertility and mechanism through which they influence fertility is quite complex. Some of the biological factors involved in the human reproduction process are fecundability, incidence of physiological sterility, chances of conceptions terminating in a foetal death or in a live birth and the period of temporary sterility comprising gestation and post partum-amenorrhea (PPA).

Besides several other empirical studies, demographers and researchers have realized that the probability models describing quantitative aspects of human reproduction are of recent origin, which include most of the biological and socio-cultural factors affecting human fertility. Recently, one of the areas of probability models for studying the human reproduction process is the open birth interval (OBI) which has been shown as a sensitive index of current fertility. However, it tells us about the fact that how many women of a cohort are exposed to the risk of conception at a particular point of time and thus it can be utilized to ascertain the current fecundability of the women belonging to a marriage cohort (See, Pathak, 1971). If human mobility exists at such particular point of time, open birth interval may be chosen to study the linkage of fertility with migration.

A number of probability models for open birth interval have been proposed in recent years (Srinivasan, 1967,1968; Leridon, 1969;Pathak, 1971,1974; Chakraborty, 1976; Singh and Yadava, 1977; Singh *et* a/., 1978-79, 1981, 1982; Pandey, 1981 and others). These

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models have been framed for the couples where both the partners are permanently residing at home.

So far as temporary withdrawal from cohabitation is concerned, it occurs mainly due to physical separation of husband from wife. One of the reasons of such separation may be due to the migration of male partner. In this regard, female living in villages gets less time of exposure for conception, consequently birth interval and fertility performance of the couple is affected. The effect of such separation on fertility depends on the proportion of wives who are thus separated from their husbands and the period of their separation. For application purposes, one has to assume the steady state model of OBI which is quite simple, sensitive to the changes in fecundability and takes into account of the variation in the reproductive parameters of migrants and non-migrants simultaneously, so that fecundabilities may be compared for the migrants and non-migrants at one place.

The objective of the present paper is to estimate the conception rates for the couples living together at their home and the couples of whom one partner is migrated. The model is given in Section 2 while Section 3 deals with its application.

The Model

A probability model for describing the variation in the length of OBI of a woman with marital duration T has been derived under the following assumptions:

(i) The female is living in the village at her home permanently and the husband either living with his wife at his home or visiting his residence once in a year at some interval of time. Obviously, the husbands living outside the village visit their home on some occasions like marriage, house construction, festival etc., or any such functions which usually are performed at some fixed time in the year. Such types of couples are called migrated couples. Let α and (1 - Let α) be the respective proportions of migrants and non-migrants couples respectively, (ii) The time interval of first conception after marriage follows an exponential distribution with p.d.f.

$$f_{11}(t) = \lambda_1 e^{-\lambda_1 t}\ ; \quad \lambda_1 > 0,\ t > 0 \tag{1}$$

$$f_{12}(t) = \lambda_2 e^{-\lambda_2 t}\ ; \quad \lambda_2 > 0,\ t > 0 \tag{2}$$

where λ_1 and λ_2 are known as the risk of conception for migrants and non-migrants respectively.

(iii) Every conception involves a period of non susceptibility called the rest period comprising the duration of pregnancy and post partum-amenorrhea. Thus, the duration between r^{th} and $(r + 1)^{th}$ conception follows a displaced exponential distribution with p.d.f.

$$f_{21}(t) = \lambda_1 e^{-\lambda_1 (t-h)}\ ; \quad \begin{matrix} t > h \\ \lambda_1 > 0 \end{matrix} \tag{3}$$

$$f_{22}(t) = \lambda_2 e^{-\lambda_2 (t-h)} \; ; \quad \begin{matrix} t > h \\ \lambda_2 > 0 \end{matrix} \tag{4}$$

The assumption (iii) implies that after a conception there is no possibility of another conception for a constant time *h*, where *h* is the sum of duration of pregnancy and post partum-amenoirhea associated with a birth. The distribution functions of p.d.f. (3) and (4) are given by

$$f_{21}(t) = 1 - e^{-\lambda_1 (t-h)} \; ; \quad \begin{matrix} t > h \\ \lambda_1 > 0 \end{matrix} \tag{5}$$

$$f_{22}(t) = 1 - e^{-\lambda_2 (t-h)} \; ; \quad \begin{matrix} t > h \\ \lambda_2 > 0 \end{matrix} \tag{6}$$

(iv) The time intervals of conceptions are mutually independent.

The proof of O.B.I. is given in several papers (Srinivasan, 1967, 1968; Singh and Yadava, 1977; Pandey, 1981 and others). However, for simplicity our probability model of O.B.I. is derived as follows :

Let X denote the length of open birth interval and $f(x)$ be the corresponding p.d.f. and T (marriage duration) to be large, then as given in Cox and Miller (1968, Chapter 9)

$$f(x) = \frac{1 - F(x)}{\mu} \tag{7}$$

where $\mu = E(X)$ and $F(X)$ is the distribution function corresponding to $f(x)$.

Under the above assumptions and results cited in equation (5), (6) and (7), the p.d.f. $f(x)$ in respective proportion α with risk of conception λ_1 (migrants) and proportion $(1 - \alpha)$ with risk of conception λ_2 (non migrants) is given by

$$f(x) = \frac{\alpha \lambda_1}{(1 + \lambda_1 h)} + \frac{(1 - \alpha)\lambda_2}{(1 + \lambda_2 h)} \; ; \quad 0 < x < h \tag{8}$$

$$= \frac{\alpha \lambda_1 e^{-\lambda_1 (x-h)}}{(1 + \lambda_1 h)} + \frac{(1 - \alpha)\lambda_2 e^{-\lambda_2 (x-h)}}{(1 + \lambda_2 h)} \; ; \quad x > h \tag{9}$$

As mentioned above the non-susceptible period (/i) consists of gestation plus PPA. Singh and Bhaduri (1971) have demonstrated that the duration of PPA associated with live birth is bimodal, the first and second peaks occurring at 2-3 months and 12-13 months respectively. Thus, if, as a first approximation it is assumed that *h* takes two values *h*\ and /i2 and

π_1 and π_2 ($\pi_1 + \pi_2 = 1$) are the proportion of females with the value of h as h_1 and h_2 respectively. That is, the values of h_1 and h_2 are assumed respectively as $h_1 = 1.00$ year (9 months of gestation + 3 months of PPA) and $h_2 = 1.75$ years (9 months of gestation + 12 months of PPA). The values of π_1 and π_2 are assumed as 0.3 and 0.7 respectively (Singh and Bhaduri, 1971; Bhaduri, 1975; Pandey, 1981; Singh, 1983).

Then, the p.d.f. $f(x)$ is given by

$$f(x) = f_1(x) = \pi_1 \left[\frac{\alpha\lambda_1}{(1+\lambda_1 h_1)} + \frac{(1-\alpha)\lambda_2}{(1+\lambda_2 h_1)} \right]; \; 0 < x < h_1 \tag{10}$$

$$= f_2(x) = \pi_1 \left[\frac{\alpha\lambda_1 e^{-\lambda_1 (x-h_1)}}{(1+\lambda_1 h_1)} + \frac{(1-\alpha)\lambda_2 e^{-\lambda_2 (x-h_1)}}{(1+\lambda_2 h_1)} \right]; \; x > h_1 \tag{11}$$

$$= f_3(x) = \pi_2 \left[\frac{\alpha\lambda_1}{(1+\lambda_1 h_2)} + \frac{(1-\alpha)\lambda_2}{(1+\lambda_2 h_2)} \right]; \; 0 < x < h_2 \tag{12}$$

$$= f_4(x) = \pi_2 \left[\frac{\alpha\lambda_1 e^{-\lambda_1 (x-h_2)}}{(1+\lambda_1 h_2)} + \frac{(1-\alpha)\lambda_2 e^{-\lambda_2 (x-h_2)}}{(1+\lambda_2 h_2)} \right]; \; x > h_2 \tag{13}$$

Thus, $E(X)$ and $V(X)$ will be given as

$$E(X) = \int_0^{h_1} x f_1(x)\,dx + \int_{h_1}^{\infty} x f_2(x)\,dx + \int_0^{h_2} x f_3(x)\,dx + \int_{h_2}^{\infty} x f_4(x)\,dx$$

$$= \pi_1\alpha \left[\frac{1}{\lambda_1} + \frac{\lambda_1 h_1^2}{2(1+\lambda_1 h_1)} \right] + \pi_1(1-\alpha) \left[\frac{1}{\lambda_2} + \frac{\lambda_2 h_1^2}{2(1+\lambda_2 h_1)} \right]$$

$$+ \pi_2\alpha \left[\frac{1}{\lambda_1} + \frac{\lambda_1 h_2^2}{2(1+\lambda_1 h_2)} \right] + \pi_2(1-\alpha) \left[\frac{1}{\lambda_2} + \frac{\lambda_2 h_2^2}{2(1+\lambda_2 h_2)} \right]$$

and

$$E(X)^2 = \pi_1\alpha \left[\frac{\lambda_1 h_1^3}{3(1+\lambda_1 h_1)} + \frac{1+(1+\lambda_1 h_1)^2}{\lambda_1^2(1+\lambda_1 h_1)} \right]$$

$$+ \pi_1(1-\alpha) \left[\frac{\lambda_2 h_1^3}{3(1+\lambda_2 h_1)} + \frac{1+(1+\lambda_2 h_1)^2}{\lambda_2^2(1+\lambda_2 h_1)} \right]$$

$$+ \pi_2 \alpha \left[\frac{\lambda_1 h_2^3}{3(1+\lambda_1 h_2)} + \frac{1+(1+\lambda_1 h_2)^2}{\lambda_1^2(1+\lambda_1 h_2)} \right]$$

$$+ \pi_2(1-\alpha) \left[\frac{\lambda_2 h_2^3}{3(1+\lambda_2 h_2)} + \frac{1+(1+\lambda_2 h_2)^2}{\lambda_2^2(1+\lambda_2 h_2)} \right]$$

Application

The proposed model is applied to the data collected in a survey entitled, 'Rural Development and Population Growth — A Sample Survey, 1978'. The details of the survey are given in Sharma (1988). In order to estimate the conception rates for migrants and non-migrants, we assume that *hi* = 1.00 year, *hi* = 1.75 years, *KI* = 0.3 and $7C_2$ = 0.7. The parameter a is estimated from survey data as a = 0.12. The other two parameters1X1 and *"h.* are estimated by the method of moments in few iterations. Table 1 presents the observed and expected distribution of open birth intervals of 1290 (couples) females with marital duration 10 to 19 years and having at least one birth prior to the survey point.

TABLE 1 : DISTRIBUTION OF OBSERVED AND EXPECTED NUMBER OF COUPLES FOR OPEN BIRTH INTERVAL WITH E.M.D. (10-19) YEARS

Birth interval (in years)	*Observed*	*Expected*
0-1	396	383.5
1-2	346	327.2
2-3	205	226.1
3-4	123	131.3
4-5	78	77.0
5-6	39	45.8
6-7	28	27.7
7-8	22	17.1
8-9	12	10.8
9-10	11	43.5
10 and above	30	
Total	1290	1290.0
$\hat{\lambda}_1 = 0.27$		$\chi^2 = 6.69$
$\hat{\lambda}_2 = 0.58$		d. f. = 7

The estimated values of A,i and A,2 to the distribution of open birth interval with effective marriage duration (E.M.D.) 10-19 years are 0.27 and 0.58 respectively. This represents the probability of a conception in one unit of time which is one year in this case. It should, however, be noted that migrated couples are not exposed to the risk of conception throughout the year but the males migrated to long distance places generally visit the homes only for about one to three months in a year. Thus, if as a first approximation, we assume that migrated couples are exposed for conception for two months in a year, the fecundability (probability of conception in one month) comes out to be nearly for a migrant as 0.135 while that for a non-migrant as 0.048. Singh *et al.*, (1981) explored the impact of temporary separation, due to the migration of males leaving their wives at home, on fertility through a theoretical model proposed under reasonable assumptions. They applied the model to an observed set of data relating to migrants from the same locality and reported that although the fertility of such separated couples is slightly lower than the couples living together but their fecundability is quite high (0.18) in comparison to the fecundability (0.05) of the couples living together. A comparative study of the fertility performance of the migrated and non migrated couples of the area has revealed that the total marital fertility rate for two types of couples is 6.4 and 7.5 respectively (Yadava, 1977). The value of fecundability for non-migrated couples of the area has been estimated to be nearly 0.05 (Singh *et al.*, 1974).

Thus, it is seen from Yadava (1977) that although the difference between fertility performance of the two types of couples is not large, there is a big gap between their fecundabilities. This may be due to high coition rate of migrated couples whenever male partners visit their households. The low value of fecundability of females living in the rural areas is perhaps due to many social and cultural systems. It should, however, be pointed out that the level of fecundability of migrated couples is quite near to values reported for females of'&eveloped countries (Sheps, 1964; Potter and Sokoda, 1967).

Once the estimates of Xi and *i* are obtained, the expected frequencies are easily calculated and are given in Table 1. The value of % do not approach significance at 5% level. This shows that the above proposition is a better approximation to the situation under consideration.

The effect of rural out-migration on marital fertility is examined according to the present status of migrants at survey point. Such data, while providing useful insights, have several major weaknesses for purposes of assessing interrelations between migration and fertility. In the survey, the eligible couples either migrants and non-migrants contain information only on total number of children ever born, it is not possible to distinguish those births that occurred before migration from those that occurred after the move. Any assessment of the inter relations between migration and fertility, therefore, reflects only migration differentials in cumulative fertility behaviour of the couples. More refined analysis of the interaction between migration and fertility requires both migration and pregnancy histories, as it is not done in the paper.

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