Madan Mohan Patnaik

The Impact of Sex and Surival of Infants on Fertility Behaviour : AFactorialAnalysis

Introduction

MARRIED couples often desire a particular size of family and within that size a specific number of children of sex they prefer. But there is a little human control over sex determination and mortality. As such, a non-favourable outcome in their procreation may cause frustration among affected couples and discourage them in limiting the size of their family. This, in turn, may lead to high fertility in human communities. Thus the tendency to limit family size on the part of couples depends largely on how close is the association between their targets and achievements. Decisions regarding control of fertility takes a definite shape in majority of cases by the time the couples have had two or three children and observed the survival during infancy of these initial birth-orders. In general, the outcome of sex and survival of infants of the first two birth-orders is sufficient to influence and explain the reproductive behaviours of couples in a community.

The effect of sex preference on family size under certain stopping rules has been examined by Shops (1963) and subsequently by Mitra (1970) but without taking into consideration of child mortality. When mortality is taken into consideration, the preference as to sex is reflected in surviving children. Krishnamoorthy (1974) developed probabilistic expressions to measure the combined effects of sex preference and child mortality on completed fertility under some stopping rules. The findings of Prasad and Bagchi (1976) are notable. They examine how the outcomes of sex and survival of the first two births alone influence and explain the reproductive behaviour of couples in a real population. They note that the sex and survivorship status during infancy of the first two births is generally sufficient to explain the fertility behaviour of

couples in a community. They find that the birth of a female child and mortality incidence affecting the first and second births are not favourable to low fertility in a community where there is a definite preference for sons over daughters and mortality takes a heavy toll of human lives during infancy.

The present work is an extension of these studies. It tries to examine the extent to which the outcome of sex and survival of infants of the first two births orders alone explains the reproductive behaviour of couples in a population categorised by type of family, place of residence, education, occupation and income. The analysis uses the technique of factorial experiments.

Technique

At any birth-order, the possible four combinations of outcomes of sex and survivorship status during infancy of a child are: 'Infant born is male and survives*. 'infant born is male but dies1, 'infant born is female and survives* and 'infant born is female but dies'. These differing outcomes of a given birth-order are denoted symbolically by *Mi Si, Mi* Di, Fi, Si, and *Fi Di* in that order where *M* and *F* refer respectively to 'male' and 'female' and *S* and *D* to survival and death of child during infancy respectively. When the first two birth-orders taken together, the possible combinations of outcomes are 16 in all, viz. M_t *Si* M_2 S_2; M_1 S_1 M_2 D_2; M_1 S_1 F_2 S_2; M_1 S_1 F_2 D_2; M_1 D_1 M_2 S_2; M_1 D_1 M_2 D_2; M_1 D_1 F_2 S_2; M_1 D_1 F_2 D_2; F_1 S_1 M_2 S_2; F_1 S_1 M_2 D_2; F_1 S_1 F_2 S_2; F_1 S_1 F_2 D_2; F_1 D_1 M_2 S_2; F_1 D_1 M_2 D_2; F_1 D_1 F_2 S_2; and F_1 D_1 F_2 D_2. Corresponing to each of the 16 combinations, mean value of distribution of couples by number of children ever born to them can be obtained.

This permits us to establish an analogy with, a generalised factorial experiment. The concept of a generalised factorial experiment (Prasad, 1976) involved factors each employed at a number of levels which are in fact factorial combinations of level of some sub-factors purposely introduced in the experiment. Suppose the first and second birth-orders are regarded as factors employed at four levels, viz. *M1 S1 M1 D1* F1 *S1* and F1, *D1 i*= 1,2. Then both sex and survivorship status during infancy of a child may be treated as sub-factors, each obviously assuming two values, male and female for sex and survival and death during infancy for survivorship status. Thus the levels of the two-factors (birth-order) generate in all 16 treatment combinations. The mean value obtained from the distribution corresponding to a given combination can be considered to be the 'yield' or 'response' due to this treatment combination. This enables one to adopt the technique of analysing a generalised factorial experiment aimed at an unified analysis of data to study how the sex and survivorship status of infants at the first two birth-orders influence and explain the fertility behaviour of couples in a community. The concept of the generalised factorial experiments, however, reduces to a simple factorial experiment if one regards the present scheme as an experiment involving four factors viz. sex at

the first birth, survivorship status at the first birth, sex at the second birth and survivorship status at the second birth, each of them being employed at two simple levels not factorial in nature.

The findings of the present study are based on primary data collected from the heads of 800 households located in Patna town and in a village 30 km away from Patna.

With 16 treatment combinations, the 15 degrees of freedom can be split into 15 single degrees of freedom for 15 orthogonal components of main effects and interactions. The total of mean effect of each component is estimable. Yates' method can be used to obtain total of mean effect, sum of squares and mean squares due to each components.

Discussion of Results

For the present, analysis the couples with at least two births to their credit at the time of survey have been taken. They number 766. From the fertility history of each couple, the distribution of couples by number of children ever born to them corresponding to each treatment combination is obtained. The distributions and the corresponding mean values are given in Table 1.

Explanation of Main Effects and Interactions

It may be observed from Table 2 that effect of sex of the second birth order appears to be somewhat greater than that of the first birth order. Similarly, the effect of 'survivor status' of the second birth order is found to be larger than that of the first birth order. The magnitude of the values of 'survivorship status* both at the first birth order and second birth order is indicative of the fact that mortality during infancy exerts considerable influence on fertility behaviour of couples. The magnitude of interaction between sexes of the first and second birth orders suggests that they do not independently exert influence on fertility behaviour. In other words, the female first order birth followed by a female second order birth seems to encourage couples to produce on the average more children. Survivals of the first and second birth orders arc not likewise independent. Mortality during infancy both of the first and second birth orders encourages couples to produce on the average more children.

Type of family. A perusal of the distribution of mean values for the 16 combinations for the first two birth orders by type of family suggests that in nuclear family the effect of sex of the first and second birth orders appears to be more or less the same. But in joint family the effect of sex at the first birth order is much more pronounced than that of the second birth order. Also female first birth order births in joint family tend to encourage couple to adopt a behaviour largely favourable to high fertility. Further, in both nuclear and joint families, death during infancy of child leads to high fertility of couples.

TABLE 1-DISTRIBUTION OF COUPLES BY NUMBER OF CHILDREN EVER **BORN** AND MEAN VALUES **CORRESPONDING TO** 16 COMBINATION **OF OUTCOMES OF** SEX **AND** SURVIVAL **OF INFANTS** AT THE **FIRST TWO BIRTH-ORDERS**

Combination of outcomes of first two birth-orders	*Number of children ever born*									*Total*	*Mean values*
	2	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*		
$M_1S_1M_2S_2$	36	40	48	16	6	1	—	—	-	147	3.449
$M_1S_1M_2D_2$	3	7	12	8	5	2	2	-	—	39	4.487
$M_1S_1F_2S_2$	22	29	36	10	8	3	1	1	2	112	3,848
$M_1S_1F_2D_2$	3	8	18	7	3	2	1	—	1	43	4.348
$M_1D_1M_2S_2$	2	5	9	7	2	1	1	1	—	28	4.500
$M_1D_1M_2D_2$	I	8	7	5	1	2	2	1	7	34	5,706
$M_1D_1F_2S_2$	1	4	5	6	-	1	1	—	2	20	4.950
$M_1D_1F_2D_2$	2	3	4	3	4	—	2	2	1	21	5.333
$F_1S_1M_2S_2$	19	25	55	17	6	2	1	—	—	125	3.808
$F_1S_1M_2D_2$	1	2	8	2	—	1	1	2	—	17	4.882
$F_1S_1F_2S_2$	12	19	37	9	10	4	2	—	—	—	4.309
$F_1S_1F_2D_2$	1	2	9	—	3	—	1	—	—	—	
$F_1D_1M_2S_2$	2	4	7	—	2	—	—	—	1	16	4.125
$F_1D_1M_2D_2$	1	1	5	2	1	1	2	1	1	15	5.333
$F_1D_1F_2S_2$	1	2	8	3	2	1	—	—	1	18	4.666
$F_1D_1F_2D_2$	1	1	6	1	1	2	—	2	2	16	5.730

This is evident from the magnitude of the values of the main effect of "survivorship status' both at the first and second birth orders. However, in nuclear families, the impact of infant mortality of the first birth order is relatively stronger than that of the second birth order, whereas the reverse is the case in joint families.

In both nuclear and joint families, sexes of the first and second births do not tend to be independent in exerting influence on fertility behaviour. But the impact of female first and second order births in a nuclear family is found to be less than that in joint family. In both nuclear and joint families, the

TABLE **2—ANALYSIS** OF MAIN EFFECTS AND **INTERACTIONS**

Sources of Variation		*D.F.*	*Total effect*	*Mean Square*
First birth (3 d.f.)	(Se) I	1	1.453	0.1319
	(Sur. St.) 1	1	6.433	2.5865
	(Sex Sur. St.) 1	1	-2.281	0.3252
	(Se) 2	1	1.715	0.1838
	(Sur. St.) 2	1	7.381	3.4049
	(Sex Sur. St.) 2	1	—2.069	0,2675
Interaction	(Se) 1 x (Se) 2	1	1.041	0.06773
First birth	(Se) 1 x (Sur. St.)	1	1.129	0.0797
Second birth	(Se) I x (Sex sur. St.) 2	1	0.652	0,02569
(9. d.f.)	(Sur. St.) 1 x (Se.) 2	I	—0.043	0.0001155
	(Sur. St.) I x (Sur. St.) 2	1	0.777	0.0397
	(Sur. St.) 1 x (Sex Sur. St.) 2	1	0.227	0.0032
	(Sex Sur. St.) 1 X (Se.) 2	1	0.323	0.0065
	(Sex Sur. St.) 1 x (Sur. St.) 2	1	0.0675	0,0285
	(Sex Sur. St.) 1 x (Se Sur. St.) 2	1	0.343	0.0073

survival of the first and second birth orders is more or less independent. However, in joint families, the magnitude of interaction is greater than that in nuclear families.

Place of residence. Next we examine the means values of the 16 out come combinations for respondents classified by place of residence. Our detailed examination reveals that in urban areas, the effect of sex of the first order birth is more than that of the second order. But in rural areas, the corresponding effect is more or less the same. It is evident that the birth of a female child stimulates fertility in rural areas. Irrespective of place of residence, mortality during infancy does affect fertility of couples. However, the impact is greater in rural areas. Also the effect of survival of the first birth is greater than that of the second birth order in rural areas.

In urban areas the influence of sex of the first two orders is independent of each other. In the case of rural areas, such an independence of the first two birth order on fertility behaviour is not observed. However, the survival of the

first two birth orders appears to be more of less independent in both rural and urban areas.

Education of husband. Similar exercise was conducted by taking education of the husband as a stratification variable. This revealed that for illiterates, the effect of sex of the second birth order is greater than that of first birth order; for those who attended school, the comparative position was reversed. While for the group of those with college education, there was no such difference. Both sex and survival of the first two births exerted influence on overall fertility in all educational groups so formed. Among the groups both types of outcomes had the greatest impact on fertility among the illiterates.

Occupation of household, main effects and interactions. For relating the impact of sex and survival of the first two birth orders to occupation we divided the respondents into three categories, i.e. (i) 'office workers' and 'professionals', (ii) 'cultivators' and 'shopkeepers' and (iii) 'peons', 'durwans', 'skilled workers', 'unskilled workers' etc.

Detailed examination of results of this exercise indicated that the effect of sex of the second birth is more than that of the first birth for the first and third categories of occupation, while for the second category, the effect of sex of the first order is more than that of the second order. Further, the impact of sex is the maximum for the category of peons, durwans and etc. Similarly, the maximum impact of mortality during infancy on fertility is recorded by 'peons, durwans and etc.' and the minimum by 'office workers and professionals'. The impact of infant mortality of the first is relatively stronger than that of the second order for the first and third categories but not for the second.

It appears also that sexes of first two birth orders are independent for the category of 'office workers and professionals', whereas for the other two categories they are independent in exerting influence on fertility. However, survival of the first and second birth orders are not independent for all categories of occupation of husband.

Income. The examination of income differentials in the impact of sex and survival of the first two birth orders on fertility behaviour suggests that irrespective of the level of income of family, the effect of sex of the first birth order is more than that of the second birth order. However, it appears that the effect of sex of the first order is the maximum for those in the middle income class. The same is true of the impact of survival of the first two birth orders. With regard to sex of the first two births, their influence is independent of each other for the highest income class but not for the lower classes.

Conclusions

The above analysis suggests that sex and infant deaths of the first two orders

are generally sufficient to influence and explain the fertility behaviour of couples in a community. The birth of a female child and mortality during infancy of both the first and second orders is not favourable to low fertility in a community where there is definite preference for sons over daughters and mortality takes a heavy toll of human lives during infancy. The couples with the low educational background and of poor economic status are more concerned about the sex and survival of infants of the first two birth orders. These findings may be of great consequence to policy makers and programme executors of family planning.

References

1. Krishnamoorthy, S., 1974, Effects of sex preference and mortality on family size, Demography India, 3 :120-132.
2. Mitra, S., 1970, Preference regarding the sex and children and their effects on family size under varying condition, Sankhya, B, 32 : 55-62-
3. Prasad, R. and Bagchi, A. *K.*., 1976, Sex and Survival of Infants and Fertility Behaviour : A Factorial Analysis, D. R. C. Mimeograph Service No. 54, Demographic Research Centre, Department of Statistics, Patna University, Patna, p. 15.
4. Sheps, Mindel C., 1963, Effects on family size and sex ratio of preferences regarding the sex of children, Population Studies, 17 : 66-72.