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An Econometric Model of Human Fertility Behaviour

Introduction

IN the recent past a number of econometric models have been estimated to explain variations in the human fertility[1]. The important among explanatory variables are various socioeconomic variables e.g., education of husband, education, and earnings of wife, incidence of child mortality in the family etc. Most of the models estimated so far treat husband's education and wife's education as two separate independent variables in the same regression equation. Usually these two variables have high correlation and when both are used as explanatory variables in the same equation, multicollinearity problem is encountered (De Tray, 1973; Schultz, 1973; Gardner, 1973). Researchers have shown their awareness of this problem but have hardly tried to seek a solution. Their main hypotheses have been to find out what affects fertility more — husband's education or wife's education, or husband's earnings or wife's earnings. The primary concern of the present paper is to treat couple's education as a single variable alongwith other explanatory variables. This avoids the multicollinearity problem. Two alternative indices are constructed to measure couple's education. It is to be found out as to which index of couple's education explains fertility more. The other hypotheses to be tested in this paper relate to the signs and Statistical significance of the regression coefficients of other explanatory Variables. These hypotheses are listed in the next section.

1. See articles and reference^ in *Journal of Political Economy, 81* (2), Part II, March/April, 1973.

The Model and Hypotheses

It is postulated that if couples have the knowledge of reliable family planning methods, they would stop or delay childbearing as and when they want i.e., they would exercise control over fertility. The completed family size, however, would depend on various socioeconomic considerations. It is therefore justified to analyse the fertility behaviour through a regression model.

In the functional form the model proposed to be estimated may be written as :

$$CEB = f(CED, I, CM, FS, RB)$$

where, *CEB :* Children ever born to a couple
CED : Couple's education
I: Family income
CM : Child mortality in the family
FS ; Family status, i.e., joint family or non-joint family
RB : Residential background, i.e., rural or urban.

The description of these variables follows.

Children Ever Born. The fertility is measured by the number of children ever born to a couple by the end of the reproductive span, i.e., when the family size is completed. This variable represents the fertility level of couples which is adjusted to the deaths of children in the past and the expected risk of the same. Other definitions of fertility such as number of pregnancies etc. have been avoided as they require additional data on miscarriages etc. These data were not available and hence this aspect is ignored.

Couple's Education. It is the most widely and frequently observed phenomenon that couple's education affects fertility adversely. Michael (1973) outlines the mechanism through which education influences fertility. In this study two indices are used to measure couple's education *(a) HED + WED/2*, and *(b) S HED + D WED/S + D*, where *HED, WED, S* and *D* denote husband's education, wife's education, number of sons and number of daughters respectively. The first index is a simple one whereas the second is a weighted index. The rationale of using the weighted index is that sons' (expected) educational level is influenced more by father's educational level while daughters' (expected) educational level is influenced more by mother's educational level and, therefore, the weighted index should be a better representative of the total educational costs of children. However, this is an empirical question as to which index of couple's education explains fertility more.

Yet another problem is that of defining the educational levels of husband and wife. Two educational levels—at the time of marriage and at the time of last child birth—are considered in the present empirical analysis by estimating the alternative models. The educational level is quantified by converting it to the number of years that should be taken to achieve the same e.g., B.A. = 14, M.Com. or B.E. = 16 and so on. It is to be found out empirically as to which educational level explains fertility better.

Income. The effect of income on fertility has been a matter of controversy in the literature[2]. An increase in income enables a couple to afford more children of a given quality, but at the same time it raises the relative desire for material goods (Easterlin, 1969). Other results from the same data used for the present study show that an increase in income increases expected educational level of children and decreases child mortality. And also expected educational levels of children are largely determined by parents' own educational levels. Therefore, other things i.e., child mortality, couple's education etc. remaining the same, effect of income on fertility should be positive.

Child Mortality. Fertility is affected by the risk of child mortality. Parents try to compensate for the average incidence of death by seeking the number of births that will give them the desired number of surviving children. Since mortality in childhood is concentrated in the first years of life, the number of children ever born to a couple by the end of reproductive span should represent mortality-adjusted and risk-adjusted fertility. Thus, child mortality is an important factor that needs to be considered as an independent variable in explaining fertility behaviour.

Family Status. The institution of joint family is considered to be one of the main cultural factors favouring high fertility. Davis (1957) has isolated some characteristics of joint families which arc conducive to high fertility. Lorimer (1965) also holds the same views and has stated that "the whole cultural context in which extended families tend to be idealized is likely to be conducive to high fertility". Liu (1967) found that Taiwanese couples living in joint families had a little higher fertility than those who lived in non-joint families. However* contradictory empirical evidence is also found in abundance[3]. But all these studies compare the differential fertility i.e., the average number of children born to couples in these family statuses. In the present study it is proposed to test

2. **See Leibenstein** (1957, 1974) **and Becker (1960).**
3. **See Agarwala** (1970), Nag (1965), **Poti and Datta (1960).**

this hypothesis by using a dummy variable for the family status in the regression model.

Residential Background. Almost all demographic and fertility surveys indicate that rural couples have much higher fertility than the urban couples. The main occupations in rural areas are agriculture and other related activities which provide increasing opportunities of labour force participation to children. This partly explains withdrawal of children from higher education and therefore general low level of education in rural areas. Thus it is pertinant to study, keeping other factors e.g., couple's education, child mortality etc. constant, whether or not residential background has any significant contribution in determining the fertility level. A dummy variable is used to test this hypothesis.

The hypotheses outlined above may be summarized as follows :

(i) the coefficient of couple's education bears a negative sign i.e., 9 *CEB/a CED* < 0.
(ii) the weighted index of couple's education explains fertility variations more than the simple index;
iii) the coefficient of income is positive i.e., a *CEBJ3I* > 0;
(lv) the couples living in joint families have a higher fertility than those living in non-joint families i.e., 9 *CEB/a FS* > 0, where the dummy *FS*is assigned value 1 for joint families and zero for non-joint families;
(v) rural residence enhances fertility i.e., a *CEB/a RB* > 0, where rural residence is assigned value 1 and urban residence is assigned value 0 for the dummy variable *RB.*

In addition, statistical significance of these explanatory variables is to be determined.

Sources of Data

Hie empirical analysis of the present study deals with the data collected through a household survey. The survey was conducted in Kanpur city as well **as** in 10 villages of Chaubepur Development Block of Kanpur district during October, 1976-March, 1977. The couples were selected through random sampling from the Electoral Roll (Voters' List). Couples in the age group of 40-45 years were selected who were expected to have completed their family sizes. In actual empirical analysis data on only such couples were used who satisfied the following requirements ; (i) those who had completed their family sizes, (ii) who had known the modern reliable methods of family planning at the time of last

child birth or had used any reliable method at any time during the reproductive span, and (iii) who bad a normal fertility. The number of such rural and urban couples was 98 and *194*, respectively.

Empirical Results and Discussion

The results of the regression analysis arc presented in Table 1. As the earlier discussion indicates, alternative models are estimated with both definitions of the educational level and with both indices of couple's education. To include family status and residential background in the regression, dummy variables have been used in the following way :

joint family — 1, non-joint family = 0, and
rural residence — 1, urban residence = 0.

TABLE I—THE REGRESSION RESULTS (DEPENDENT VARIABLE : *CEB)*

Independent variables	*Couple's education as weighted index*		*Couple's education as simple index*	
	Educational level at marriage (Regression 1)	*Educational level at last child birth (Regression 2)*	*Educational level at marriage (Regression 3)*	*Educational level at last child birth (Regression 4)*
CED : Couple's Education	—0.1636+ (6.18)	—0.1463+ (5.86)	— 0.1593f (5.65)	-0. 1434+ (5.33)
I: Family Income	0.0130+ (1.37)	0.0122+ (1.27)	0.0138+ (1.41)	0.0127+ (1.29)
CM : Child Mortality	0.7313+ (11.41)	0.7374f (11.46)	0.7341+ (11.33)	0.7410+ (11.40)
FS : Family Status	—0.3377* (1.20)	—0.3588* (1.27)	-0.3346* (1.18)	—0,3447* (1.21)
RB : Residential Background	0.1328 (0.63)	0.1490 (0.70)	0.0803 (0.37)	0.0977 (0.44)
Constant	5.8618	5.7912	5.8196	5.7540
$\bar{R}^2$	.4664	.4600	.4559	.4499
F	51.5	50.2	49.4	48.2
N	292	292	292	292

+Significant at .005 level
+Significant at .10 level
•Significant at .15 level
Figures in parentheses show t-values.

The results show that the coefficients of couple's education and child mortality are statistically very strong in all alternative models. The signs of these coefficients also confirm our hypotheses. It is to be noted that whatever index for couple's education is used, educational level at the time of marriage is more important than the educational level at the time of last child birth. Moreover, the results confirm our hypothesis that the weighted index of couple's education explains fertility more than what the simple index does.

The signs of the coefficients of income and residential background also confirm our hypotheses, although the coefficient of income is statistically much stronger than that of residential background. The coefficient of *RB* is not significant even at .20 level. It shows that if other variables of the model are kept constant, rural residence does not contribute much towards fertility.

The present study contradicts the belief of Davis (1957) and Lorimer (1965) that joint families have higher average number of children. The negative coefficient of family status in this study supports the empirical findings of Nag (1965), Agarwala (1970) and others. The adverse relationship may be subscribed to lower coital frequency among the women in joint families as a result of lack of privacy, social taboos etc.

Conclusion

The results of this study confirm the existing views regarding the effect of education, child mortality and residential background (rural-urban) on fertility.

The estimation of alternative models suggests that couple's educational level at marriage is more important than the educational level at the time of last child birth, as far as its effect on fertility is concerned. It is also confirmed that the weighted index of couple's education explains fertility more than the simple index The results shown in the Appendix (Table 1) indicate that the weighted index of couples education explains fertility more than what husband's education and wife's education can do when included as two independent variables in the same equation.

The results also confirm Becker's theoretical hypothesis (1960) that income effect should be positive.

An important result of this study is that joint family affects fertility adversely, other things remaining unchanged. The coefficient of the residential background is statistically not very important to explain the phenomenon of fertility behaviour.

The overall results of this study are not expected to change even if some left out variables e.g., household wealth, caste etc. are added in the model. This is

because R^2 in these regressions is between ,44 and .47 which can be considered as fairly high in case of a micro level study which attempts to explain fertility behaviour*.

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APPENDIX I

TABLE 1— REGRESSIONS TREATING *HED* AND *WED* SEPARATELY

Independent variable:	*Educational level at the time of marriage Regression 1*	*Educational level at last child birth Regression 3*
BED : Husband's Education	-0.0240 (0.86)	—0.0265 (0.94)
WED : Wife's Education	-0.1327 (193)	—0.1299 (3.73)
I : Family Income	0.0142 *(1.46)*	0.0142 (1.45}
CM: Child Mortality	0.7219 (11.07)	0.7250 (11.09)
FS : Family Status	—0.3842 (1.35)	-0.3852 (1.35)
RB :Residential Background	0.0690 (0.32)	0.0747 (0.34)
Constant	5.6831	5.6785
R^2	.4573	.4542
F	41.55	41.06
N	292	292

TABLE 2— SIMPLE CORRELATION MATRIX FOR REGRESSION 1

	HED	*WED*	*I*	*CM*	*FS*	*RB*
HED	1.0	0.743	0.412	—0.245	0.068	—0.410
WED		1.00	0.453	—0.339	0.020	—0.460
I			1.00	—0.193	0.112	—0.220
CM				1.00	—0.072	0.275
FS					1.00	0.059
RB						1.00