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IMPACT OF PUBLIC PROGRAMS ON FERTILITY AND GENDER SPECIFIC INVESTMENT IN HUMAN CAPITAL OF CHILDREN IN RURAL INDIA: CROSS SECTIONAL AND TIME SERIES ANALYSES

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ABSTRACT

This paper examines the impact of the public programs, namely family planning, health and education, on household child investment decisions within a household production framework using district level aggregate time series of cross section data for two periods, 1971 and 1981 for rural India. The cross sectional estimates show that the own program effects of health reduce family size in both years and education increases the investment in the sex-specific schooling of children only in 1971. Family panning clinics exert a significant negative effect on fertility only in 1971. The cross program effects show that the presence of a secondary school in a village reduces the demand for number of children in both years whereas the primary health centers and hospitals increase the schooling of both boys and girls only in the most recent period. An important finding is that an increase in the proportion of females with matriculation and above would reduce the family size and increase schooling of female children , and thus reduce the inequality in male and female enrollments. The fixed effects estimates based on the two period panel data also confirm most of the cross sectional findings. However the effect of hospitals seems to be overstated in the cross sectional analysis , while the effects of and the family planning and secondary schools are under estimated. Both the cross sectional and panel estimates reveal gender differences in the effects of several exogenous variables on child schooling.

1. INTRODUCTION

Evidence on the demographic trends in India reveals that the annual rate of population growth has risen from around 1 percent between 1901 and 1951 to around 2 percent thereafter, reaching a peak of 2.2 percent around 1971. This population growth has been a cause of great concern among planners and policy makers and the response to it took the form of public subventions to bring about fertility decline.

India was the first country to introduce official family planning measures, as part of the planning process even as early as 1952. Since then it has grown in coverage and diversity. The most pervasive studies in this area have been on the evaluation of family planning programs, and these programs are judged to have contributed to the increase in couple protection rates from 10.4 percent in 1970-71 to 37.5 percent in 1986-87. Similar indices of inputs of services can be found to suggest that the health and education sectors have performed well. For instance, the number of hospital beds and number of doctors per 100,000 population have increased from 32 in 1951 to 81 in 1977 and from 16 in 1950 to 33 in 1975 respectively. Data on the number of educational institutions in India show that between 1950-51 and 1975-76 the number of primary schools doubled while during the same period middle schools and secondary schools have increased by nearly seven times and five times respectively (ICSSR, 1983).[1]

Alternative indicators of success in a program are measures of outcomes of the efforts. For example, the official figures show that the family planning measures have averted over 61 million births between 1956 and 1984 (India, 1985) and the health programs have contributed to increase in life expectancy at birth from 32 to 51.3 between 1941-51 to 1971-81 and to the declines in infant mortality per thousand live births from 192 to 114 during 1941-51 to 1971-81. The efforts of the education sector has led to increase literacy rate from 16.7 percent in 1951 to 36.2 percent in 1981.

The approaches to evaluating public programs based on the output of public services or on the inputs used in the production of that services do not lead to precise assessment of the programs' overall impact (Schultz, 1988a). First, evaluating programs in terms of final outcomes may be unsatisfactory because of the complexities involved in translating input services into their respective outcomes. For one thing, such an approach that links an outcome, such as births averted, uniquely to a program, such as birth control measures, may overstate program performance. This is because it is possible that a reduction in births may be the result of concurrent efforts of the health and education sectors. Second, the measured impact of the programs may be biased due to heterogeneity in the controlled and comparison groups. As Schultz argues in the case of family planning programs that couples may be motivated to adopt birth control measures, either because they are more fecund or because they have less than average preference for children. In either case, there is a selection rule that separates the acceptors from non acceptors and this can distort evaluation of the success of the family planning programs from comparisons of fertility in these groups. Lastly, no attempt is made to link the policy instruments to human behavior. People respond to public interventions because the program services alter the constraints and opportunities facing them, thereby affecting behavior. The role of other social and economic factors that also determine changes in the behavior are overlooked.

Public policies are expected to alter the environment in which families make decision and thereby affect resource allocation. Hence, a more promising approach for evaluating public programs is to examine how public programs influence the household's decision making, based on a constrained utility maximization framework. Within this integrated approach, cross program effects or more specifically, the effect of schools on fertility, medical and family planning programs on child schooling enrollments, are also examined.

Studies investigating the impact of public programs on household decision making concerning fertility, child mortality (health) and child schooling, have used cross sectional household data along with matching community level data on program interventions (Rosenzweig and Schultz 1982 for Columbia; Rosenzweig and Wolpin, 1982 for India; and Hossain, 1989 for Bangladesh).[2] The earlier study for India by Rosenzweig and Wolpin (1982) utilized household data, spread over fifty Indian districts, for the year 1971.[3] One objective of the present study is to estimate cross sectional variations in program impacts on household decision making by using a wider geographical coverage of district level data for 1971 and 1981 as well as changes within districts over this decade. The 1981 Indian census provides more information, at the district level, on total fertility rate, and children ever born per woman. These superior measures of fertility are exploited for 1981.

Recent studies on intrafamily allocation of resources document the gender specific differences in investment in child survival (Bardhan, 1974; Rosenzweig and Schultz, 1982), schooling (Detray, 1986; Schultz, 1988b), nutrition (Sen and Sengupta, 1983; Behrman, 1988), medical care (Gertler and Alderman, 1989). How public program subsidies affect these differences has not been explored in India. Our second objective then is to analyze how the variation in the public program subsides and services influence sex-specific investments in the schooling of boys and girls. Schooling is measured by a synthetic cohort "expected years of schooling" of boys and girls

(Schultz, 1988b), constructed from age-sex-specific enrollment information available from the population census. The expected years of schooling is defined as the sum of age-sex-specific enrollment rates of those age 5-9, ..., 20-24, weighted by the five year length of age intervals.

The third objective of this paper is to use the panel feature of our data to examine the bias, if any, in cross section estimates, by employing fixed effects methodology. The program effects estimated from single cross sections may be biased if, as Rosenzweig and Wolpin (1986) argue, programs are placed in such a way that they are systematically correlated with factors affecting the household's demographic decisions, through unobserved, time invariant, district specific components.

The organization of the paper is as follows: Section 2 outlines the theoretical model based on the utility maximization framework and derives the reduced form demand equations for the empirical analysis. Section 3 discusses the data, measurement of variables and estimation methods. The cross sectional and fixed effects estimates are reported in Section 4. The conclusions of the study are presented in Section 5.

2. THEORETICAL FRAMEWORK

The theoretical model outlined in this section is based on the household production framework developed in Rosenzweig and Wolpin (1982, 1986). The essential features of the model are described below:

The families' preferences over number of children (N), sex-specific investment in human capital of children measured by schooling of male children (H_m) and female children (H_f), and a composite consumption good (Z), can be expressed by the utility function

$$U = U(N, H_m, H_f, Z) \tag{1}$$

Public programs provide subsidized or free services and supplies and thereby reduce the input prices related to schooling and contraception. The budget constraint incorporating the program subsidies can be written as

$$F = P_N N + (P_C - S_C)(N^* - N) + (P_H - S_H)(H_m + H_f) + P_Z Z \tag{2}$$

where N^* represents biological supply of births (natural fertility) in the absence of fertility control, $N^* - N \geq 0$ is the number of births averted by fertility control methods, F is the exogenous money income, P_N, P_C, P_H, and P_Z are respectively the prices of number of children, contraceptives, child schooling and other consumption goods, and S_C, and S_H denote, respectively, the contraceptive and schooling subsidies.

The additional features of the household production models, such as time inputs, time constraints, biological reproduction, production function for farm goods, etc., are not explicitly introduced into the simple framework because data are not available on these issues. The main focus of this study is on the effects of public program subsidies or services.

Maximizing the utility function (1) subject to the budget constraint (2), the demand functions can be derived and expressed in terms of the exogenous variables as:

(3) $$i = f(P_N, P_Z, S_C, S_H, F)\ ,\ \ i = N, H_m, H_f \text{ and } Z\ .$$

The effects of the program subsidies (S_i) on the choice variables can be deduced from price and income effects. A decrease in the price of contraceptives due to program subsidies or free supplies would lead to a greater demand for fertility control and hence lower the birth rates, on the assumption that the income effect of the price change is small in magnitude. A reduction in the price of schooling inputs would increase investments in human capital per child thereby increasing school enrollments.

Equation (3) indicates that a program influences not just its related outcome, but potentially has effects on all of the household choices. That is, a subsidy towards contraceptives generally affects schooling also. These 'cross' effects cannot be predicted by the model but they are as discussed above unlikely to be zero. However, it is difficult to predict theoretically the sign of these cross subsidy effects.

3. DATA, EMPIRICAL MODEL AND ESTIMATION METHODS

3.1. Data

The impact of education and health subsidies and services on household's decision concerning quantity and quality of children is examined using district level aggregate panel data for rural India for the periods 1971 and 1981. The data have been compiled from various secondary sources. Information on the availability of public services in each district are given in district census handbooks which are published only for about fifty percent of the Indian districts in 1981. This study utilizes data for 120 districts. These districts constitute about 40 percent of the total districts in major Indian States and cover about 50 percent of the rural population. The geographical coverage is shown in Appendix Figure 1.

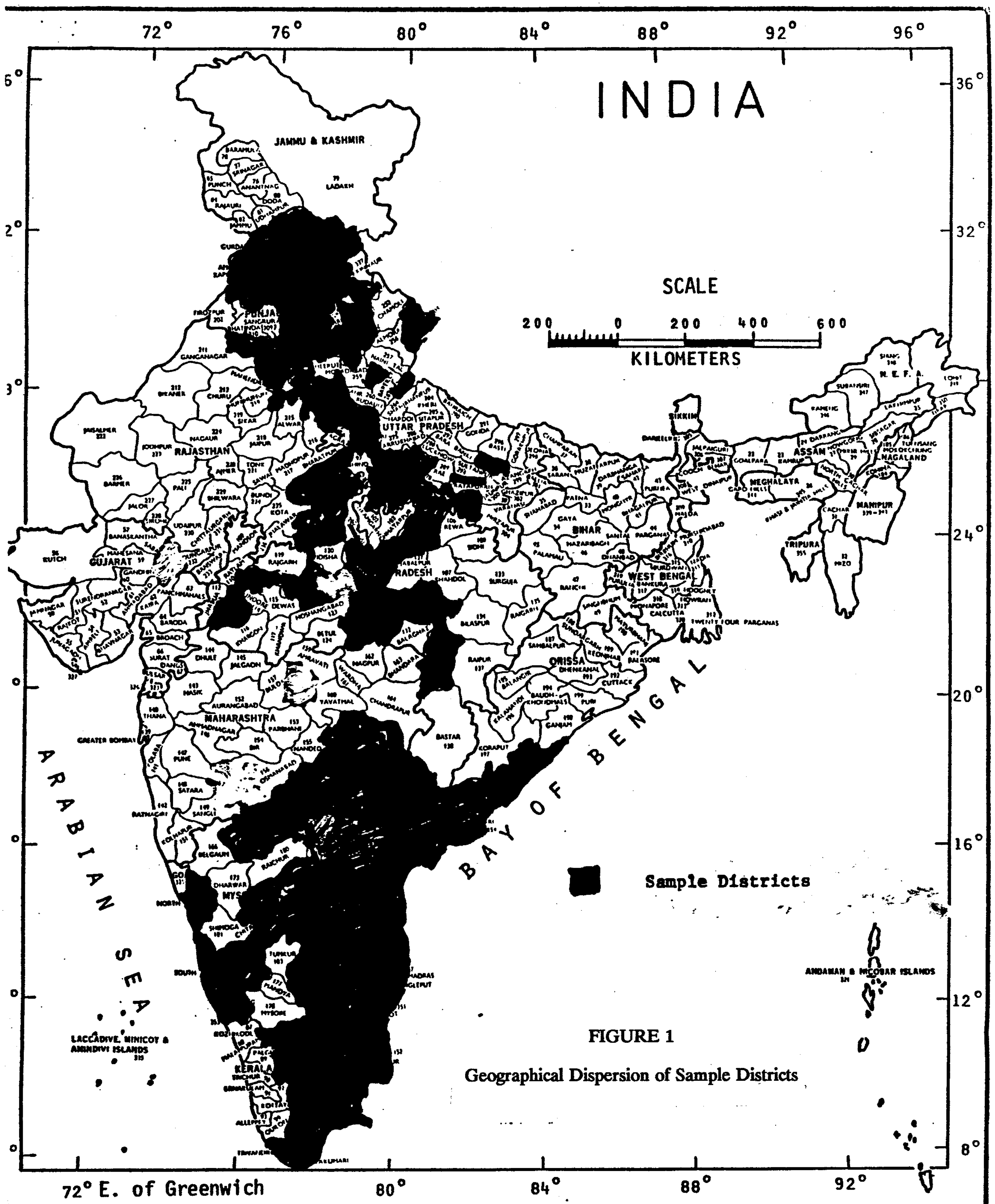


FIGURE 1

Geographical Dispersion of Sample Districts

3.2. Empirical Specification of the Model and the Variables

Assuming a linear relationship, the demand functions for N , and S are specified as:

(4) $$Y_{it} = \alpha_0 + \alpha_1 S_{Cit} + \alpha_2 S_{Hit} + \alpha_3 F_{it} + \alpha_4 E_{it} + u_{it}\,, \quad i = 1, ..., I \text{ districts}, \quad t = 1971, 1981$$

where $Y = [N, S]$ are the dependent variables; $R = [S_C, S_H]$, are the program subsidies, F is the nonlabor income, E is a set of control variables, u_{it} is the disturbance term and α_i's are the parameters to be estimated. The measurement of the variables and the expected signs of the parameters α_i's are discussed below.

The dependent variables, namely fertility and child schooling, are measured in several ways. The common measure of fertility used by economists is children ever born to a woman, which is a stock variable representing cumulative fertility. Information on this variable is available for the first time in the Indian Census of 1981. In order to indirectly standardize for the age pattern of fertility, the number of children ever born per women is age standardized as follows:

(5) $$SCEBi = \frac{CEB_i}{\Sigma_j P_{ij} ACEB_j}\,, \quad j = 15\text{–}20, ..., 45\text{–}49\,.$$

where $ACEB_j$ is the national average number of children ever born to a women in the jth age group in rural India, CEB_i is the number of children ever born to a woman aged 15 to 49 in the ith district, and P_{ij} is the proportion of women in the jth age group in the ith district. The second measure of fertility is the number of surviving children in the age group of 0-4 per woman aged 15 to 49. In order to shed some light on child mortality we also consider the number of surviving children aged 5-9 per woman 15-49 as a dependent variable. These two measures are constructed from the tables in the population census and are available for both 1971 and 1981. The third empirical construct of fertility is the total fertility rate defined as the sum of age specific birth rates, in the year prior to 1981, for women age 15 to 49. This measure reflects the number of births a woman could expect to have if she survives to age 49, assuming the age specific birth rates remain unchanged at their 1980 level. This measure of fertility could reflect more precisely the effects of current level of the fertility determinants.

Sex-specific investments in the human capital of children is measured by a synthetic cohort measure called "expected years of schooling" of male children and female children (Schultz, 1988b). This is defined as:

(6) $$EYS_k = 5\left(\frac{EN_k\,5\text{–}9}{POP_k\,5\text{–}9}\right) + 5\left(\frac{EN_k\,10\text{–}14}{POP_k\,10\text{–}14}\right) + 5\left(\frac{EN_k\,15\text{–}19}{POP_k\,15\text{–}19}\right) + 5\left(\frac{EN_k\,20\text{–}24}{POP_k\,20\text{–}24}\right), \quad k = m, f_k$$

where EN_k refers to number of children attending schools in the relevant age-sex group and POP_k is the population in that age-sex group.[4] The weights are the maximum possible years of schooling in the relevant age group. The assumption underlying this calculation is that each child in a particular age group who enrolled receives one year of schooling for each year in the age class interval.[5]

The determinants of fertility and child schooling are the public program variables, household nonlabor income, and a set of control variables, namely education of adult males and adult females, caste, religion and rurality of the district. The empirical measurement of these variables and the signs of their expected effects are discussed below.

The amount of subsidy or benefit received by a household through a public program is difficult to measure unless extensive and detailed social experiments are conducted. The presence of externalities and interactions among private and public services further complicate the quantification of program benefits. However, the program subsidies and services are proxied by the availability of subsidized or free services in the localities. The provision of public services in a locality alter the prices faced by households by reducing the direct (monetary) and the indirect (travel and time) costs of these inputs. The public programs studied are family planning, health and education.[6]

In India, the family planning and health programs are in general intertwined with institutions within the health care delivery system, such as hospitals, primary health centers etc., that also provide family planning services and supplies. Hence, to capture the family planning program effects we consider not only the number of family planning clinics but also other health institutions in the district.[7] The five year development plans seek to create a network consisting of village health guides or workers, primary health centers and subcenters, dispensaries and hospitals to provide health care services. The Seventh Plan (1985-1990) has set the targets for one primary health subcenter per 5000 population, a primary health center per 30,000 population and a Community health center per 100,000 population (Planning Commission, 1985). In view of this, the health program variables are measured as number of health institutions, namely, family planning clinics, primary health centers, and hospitals per thousand population.[8,9]

An increase in the number of family planning clinics per thousand population is expected to reduce birth rates by increasing the awareness and/or availability of birth control techniques. The other health institutions, namely, primary health centers, and hospitals are expected to be negatively associated with fertility both by subsidizing birth control supplies and services and improving the infant and child survival rates. The effect of family planning clinics and other health variables are expected to be positively associated with child schooling, if family size and child schooling are substitutes.

The other program variables considered in the study are availability of schooling services. There is no district level data on the size (e.g. number of teachers), expenditure, or some dimension of quality of (public, private, etc.). In rural India, distance of schools seems to be an important factor in determining the school attendance rates (Duraisamy, 1988). Availability of schools at the village level may capture the distance factor. Hence the schooling variable is defined as the percent of villages in the district with secondary (middle or secondary, higher secondary and matriculation) schools.[10] The secondary schools variable is expected to display a positive effect on sex-specific expected years of child schooling. Its effect on fertility is predicted to be negative on the assumption that family size and child schooling are substitutes.

District level information on household nonlabor income is not available. The nonlabor income is proxied by wealth or asset variables. The most important form of asset of cultivating households in rural India is land. Information on the average size of land per operational holding is available at the district level.[11] The average size of land holding is included as a proxy for wealth. Size of land holding is expected to display a positive wealth effect on fertility. Land is moreover probably positively associated with productivity of child labor exerting a further positive effect on demand for children on rural households. By virtue of the offsetting price and income effects, the effect of land size on school enrollment cannot be predicted a priori. Another variable, namely percent of male adult agricultural landless laborers to total male workers, is included to capture the landless labor households demand for fertility and for child schooling.[12] Percent of male agricultural laborers is expected to reflect the opportunity cost of time and so it should exert a negative effect on fertility and child schooling.

Adult educational attainment is measured as the percent of males and females aged 15 and above who have at least matriculates, which is completing 10 years of schooling in India. In general, the effect of education is a combination of price, income and information effects. The more educated have a higher opportunity cost of time and if time is an essential input in producing child health, schooling, and children themselves, then the price effect exerts a negative impact on the demand for these goods. This also implies that female education should have much stronger negative effect than male education. On the other hand, education may also be taken to indicate family's income levels (income effect) so that better educated adult households are better off and may demand more children, and also invest more in the human capital of their children. Then there is the information effect of education, e.g., the more educated parents are able to obtain better and earlier information on contraceptives, health and education programs, etc. As a result such families are in a better position to avert births and are also likely to have more schooled children compared to households where the adults are less educated. These complex roles of education make it hard to prescribe the impact of education variables. A set of variables namely percent of scheduled castes and scheduled tribes and percent of Muslim is included to capture the influence of sociocultural and institutional factors on fertility and child schooling decisions. Percent of rural population is also added to the set of explanatory variables in order to capture the remoteness of the district from urban labor market opportunities and urban public services.

The variable means and their standard deviations based on the cross sectional data for 1971 and 1981, and the data sources are reported in Table 1.

3.3. Estimation Methods

The strategy followed in estimating the demand equation (4) depends upon the assumptions about the disturbance term. If we assume that u_{it}'s are normally distributed with zero mean, constant variance, and uncorrelated with the explanatory variables, then equation (4) may be estimated by Ordinary Least Squares (OLS) method separately for 1971 and 1981.

The disturbance term u_{it} generally captures the effect of omitted variables, errors in optimization, errors in variables, functional form etc. The stochastic structure of the error term can be specified as:

(7) $$u_{it} = \mu_i + e_{it}$$

where e_{it} is the random disturbance term and μ_i represents time invariant district specific environmental factors, uncorrelated with e_{it}. Estimation of (4), given the error-component specification as in (7), depends upon the assumption about μ_i. If μ_i is assumed to be random variable and uncorrelated with the explanatory variables in (4), then random effects estimation is more efficient than the fixed effects estimation. Otherwise, if the μ_i's are correlated with the regressors, then the random effects estimates are biased and inconsistent. The appropriate estimation method then would be the fixed effects method which yields unbiased and consistent estimates (Hsiao, 1986). The fixed effects estimation in the case of two period panel data is the first difference method. Then the estimating equation becomes

TABLE 1

Variables Definition, Means and in parentheses Standard Deviations: Rural Indian Districts, 1971-1981

Variable Definition	1971	1981
Endogenous variables:		
Number of children aged 0-4 per women aged 15-49 (× 100)[a]	67.8 (10.6)	57.6 (8.99)
Number of children aged 5-9 per women aged 15-49 (× 100)[a]	68.4 (9.64)	64.3 (10.2)
Number of children ever born per women aged 15-29, age standardized[b]	not available	1.02 (0.155)
Number of children ever born per women aged 30-49, age standardized[b]	not available	1.02 (0.132)
Number of children ever born per women aged 15-49, age standardized[b]	not available	1.02 (0.126)
Total fertility rate of women aged 15-49[b]	not available	4.05 (1.03)
Expected number of years of schooling of male children in 5-24 years[c]	5.39 (1.86)	6.81 (1.84)
Expected number of years of schooling of female children in 5-24 years[c]	2.15 (1.68)	3.21 (2.02)
Exogenous program variables:		
Number of family planning clinics per thousand population[d]	.00783 (.0124)	.0121 (.0153)
Number of primary health centers per thousand population[d]	.0127 (.0137)	.0528 (.0617)
Number of hospitals per thousand population[d]	.0204 (.0202)	.0210 (.0272)
Percent of villages with middle or secondary level schools[d]	19.5 (23.6)	33.5 (31.2)
Exogenous Socioeconomic Characteristics of Population:		
Average size of land per operational holding (in hectares)[e]	2.60 (1.53)	2.27 (1.38)
Percent of male agricultural landless laborers aged 15 and above[f]	22.7 (11.3)	22.2 (11.3)
Percent of males aged 15 and above with matriculation and above[g] matriculation and above[g]	5.95 (2.49) (1.28)	10.8 (5.39) (3.55)

TABLE 1 (continued)

Variable Definition	1971	1981
Percent of females aged 15 and above with matriculation and above[g]	1.01	2.67
Average education (matriculation) of males and females aged 15 and above[g]	3.48 (1.75)	6.74 (4.23)
Ratio of female matriculates to male matriculates aged 15 and above[g]	.145 (.116)	.209 (.146)
Percent of population belong to scheduled castes and tribes[h]	24.0 (11.5)	27.5 (12.7)
Percent of muslim population[h]	6.56 (7.87)	6.66 (8.21)
Percent of district population in rural areas[h]	82.6 (10.9)	79.4 (11.7)
Number of districts	120	120

Data Sources

[a]Census of India, 1971 and 1981, Social and Cultural Tables (State volumes), Part II-C Tables C-II for 1971 and C-series, Tables C-6 for 1981, New Delhi: Office of the Registrar General of India.

[b]Census of India, 1981, F-series, Fertility Tables (State volumes), Tables F-21 and F-27, New Delhi: Office of the Registrar General of India.

[c]Census of India, 1971, General Economic Tables (State volumes), Table B-VIII for 1971; Census of India, 1981, Social and Cultural Tables, Table C-3, Part B for 1981, New Delhi: Office of the Registrar General.

[d]Census of India, 1971 and 1981, District Census Handbooks (District volumes), Appendix A, New Delhi: Office of the Registrar General of India.

[e]Agricultural Situation in India (monthly issues), New Delhi: Ministry of Agriculture.

[f]Census of India, 1971 and 1981, General Economic Tables, Part II-B Table B-I Part A for 1971 and B-series, Table B-3 for 1981, New Delhi: Office of the Registrar General of India.

[g]Census of India, 1971 and 1981, Social and Cultural Tables, Table C-III Parts A and B for 1971 and C-series Tables C-2 and C-2 Part A for 1981, New Delhi: Office of the Registrar General of India.

[h]Census of India, 1971 and 1981, Primary Census Abstracts, Part II-A, Table A-V for 1971 and A-series Table A-5 for 1981, New Delhi: Office of the Registrar General of India.

(8) $$(Y_{it} - \bar{Y}_i) = \beta\,(X_{it} - \bar{X}_i) + (e_{it} - \bar{e}_i)$$

where $Y = [N, H_m, H_f]$ are the dependent variables, $X = [S_C, S_H, F, E]$, are the exogenous variables, $\bar{Y}_i$, $\bar{X}_i$, $\bar{e}_i$ are the district level averages of the panel observations and β is a vector of parameters to be estimated.

Although the fixed effects estimator is not efficient, it reduces the multicollinearity among the explanatory variables particularly in aggregate panel data. But it relies on change in variables over time "within" districts which may lead to imprecise estimates. A priori it seems reasonable to assume that the unobserved μ_i component, to the extent that it arises from omitted regionally persistent variables, is invariant over time and the fixed effects method is appropriate. However, we apply both estimation methods and report the specification test proposed by Hausman (1978).

One other econometric problem inherent in both the cross sectional and pooled fixed effects estimates is the bias due to sample selection. The sample of districts included in the analysis is not randomly selected but is based on the availability of district census handbooks for the year 1981. We do not have any a priori basis to identify the sample selection rule, and thus must ignore this issue.

4. EMPIRICAL RESULTS

4.1 Cross sectional Estimates

The OLS estimates of the fertility and child schooling equations based on cross sectional data for 1971 and 1981 are reported in Tables 2 and 4, respectively.[13] The elasticities of the public program and education variables, computed at the sample means, are presented in Table 5. Using the Breush and Pagan (1979) Lagrange Multiplier test, we test for possible heteroskedasticity in the residuals. The χ^2 test statistics rejects (at 5 percent level) the homoskedaticity of errors in the equations determining child (0-4)-women ratio in 1981, expected years of schooling of girls in both the years, and of boys in 1981. Hence, the standard errors are corrected in all cases for heteroskedasticity, as suggested in White (1980). The estimates in general show that the statistically significant coefficients (hereafter at 5 percent level) have the expected sign in all the equations.

An increase in the family planning clinics reduces the number of surviving children in 1971. However its effect is not significant on any of the measures of fertility in 1981. This effect in 1971 may be due to the early introduction of a number of family planning programs in 1966. The Government's policy since 1971 has been to integrate the family planning programs with maternal and child health care, nutrition and minimum needs

TABLE 2

Regression Estimates of Fertility Equations, Rural Indian Districts, 1971 and 1981

	1971		1981			
	Child (0-4) -Women Ratio	Child (5-9) -Women Ratio	Child (0-4) -Women Ratio	Child (5-9) -Women Ratio	Children Ever Born	Total Fertility Rate
Programs:						
Family planning clinics	-203. (-3.05)[a]	-188. (-2.85)	-2.74 (-.09)	22.0 (.52)	-.514 (-1.00)	-5.11 (-1.30)
Primary health centers	-220. (-4.96)	-103. (-2.06)	-32.8 (-3.55)	-49.3 (-4.97)	-.256 (-1.99)	-3.81 (-3.00)
Hospitals	8.691 (.19)	-85.1 (-2.02)	-66.2 (-3.86)	-81.7 (-4.12)	-1.30 (-5.29)	-2.00 (-1.05)
Secondary schools	-.0466 (-1.20)	-.0722 (-2.06)	-.0875 (-2.64)	-.0732 (-2.34)	-.00143 (-2.71)	-.00862 (-2.25)
Socioeconomic Characteristics of Population:						
Size of landholding	3.31 (8.26)	2.59 (5.87)	1.82 (3.42)	1.66 (2.53)	.051 (8.25)	.279 (4.97)
Male agricultural landless laborers[b]	-.201 (-3.25)	-.110 (-2.03)	-.257 (-4.11)	-.231 (-3.33)	-.00339 (-4.64)	-.0294 (-3.97)
Male matriculates	1.12 (3.31)	1.69 (5.01)	.291 (1.77)	.641 (4.07)	.00765 (3.14)	.0409 (1.75)
Female matriculates	-2.42 (-2.73)	-2.36 (-2.80)	-.563 (-1.40)	-1.37 (-3.39)	-.0063 (-1.41)	-.0432 (-.88)
Percent of scheduled castes and tribes	.0927 (1.40)	.104 (1.96)	.00181 (.03)	.025 (.45)	-.000368 (-.43)	-.000136 (-.02)
Percent of muslims	.412 (5.73)	.414 (5.82)	.359 (5.29)	.473 (6.05)	.00305 (3.22)	.0211 (1.97)
Percent of population in rural areas	.102 (1.54)	.126 (2.05)	.095 (1.62)	.073 (1.19)	.000499 (.70)	.0164 (2.15)
Constant	51.3	46.8	53.7	58.9	.955	2.90
$\bar{R}^2$	.630	.577	.558	.604	.613	.380
F(11,108)	19.43	15.78	14.66	17.50	15.57	7.62
Breusch and Pagan statics (χ^2)	6.06	4.42	24.7	17.7	6.88	11.9
Number of districts	120	120	120	120	120	120

[a]'t' values in parentheses.

[b]Tested for endogeneity.

programs. This change in program structure might explain the decline in the district effect of family planning clinics by 1981. The estimates in 1971 indicate that a ten percent increase in the number of family planning clinics per 1000 population reduces the child-woman ratios by .2 percent. The primary health centers are also negatively associated with child-woman ratios in 1971 and 1981, but in this case a ten percent increase in the number of primary health centers reduces fertility by .2 to .4 percent. The presence of hospitals significantly reduces all the measures of fertility in both years except the child(0-4)-woman ratio in 1971 and the total fertility rate in 1981. The coefficients imply that a ten percent increase in the number of hospitals per 1000 population reduces the child (5-9)-woman ratio in 1971 and also in 1981 by .3 percent and by about .2 percent in the child (0-4)-woman ratio and children ever born in 1981. The presence of a secondary school in a village reduces all measures of fertility in both years. A ten percent increase in the coverage of secondary schools, according to these estimates, would reduce the fertility by .1 to .7 percent. In sum the most substantial program impact on fertility is associated with the coverage of primary health centers, but if health, family planning and schools are all increased by ten percent, the total fertility would be 1.5 percent lower.

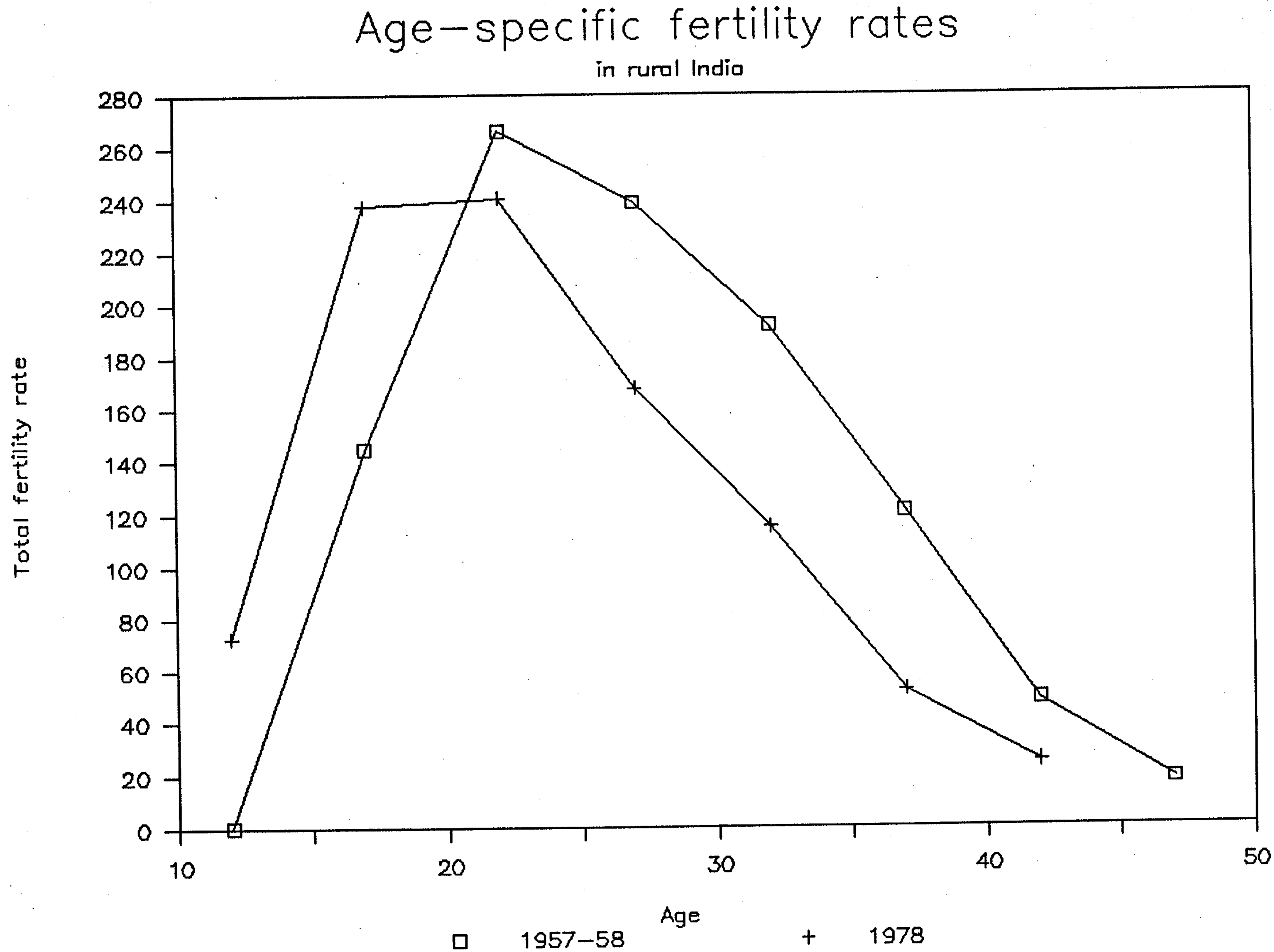
An increase in the average size of land holding significantly increases the demand for children reflecting wealth effects on the demand for child labor. The percent of agricultural landless laborers appears to reduce fertility by a statistically significant amount, reflecting the lower opportunity value of the time of children among landless laborer families. The same condition may lead them to invest relatively more in the schooling of their children. Percent of scheduled castes and tribes is positively associated with number of surviving children in 1971. An increase in the percent of muslim population and the rural population in the district increases the fertility.

The coefficients of the adult schooling variables show that male matriculates (income effect) significantly (at 10 percent) increases all measures of fertility, while female matriculates (opportunity cost of time and information effects) significantly reduces the child-woman ratios in 1971 and child (5-9)-woman ratio in 1981. The weak effect of female matriculates may be due to the high correlation of female education with male education and also with secondary schools.[14] In order to reduce the collinearity between male and female educational levels and to examine the robustness of the education and program variables, we introduce as an alternative specification the average percent of male and female matriculates, as a measure of family wealth, and the ratio of the female to male matriculates, as an indicator of relative investments in women's education, instead of the male and female educational levels. The regression estimates are reported in Appendix Table A1. The average male and female education shows a positive effect while the ratio of female to male education has a negative effect on all measures of fertility. The effects of secondary schools and other program variables remain the same except for the effect of primary health centers on the child (5-9)-women ratio in 1971 and children ever born.

The determinants of fertility included in this study have a more or less similar effect on all four measures of fertility in 1981. From the theoretical perspective, the more appropriate measure of fertility is the lifetime number of children ever born to a woman. One of the limitations of using this cumulative measure of fertility is that the values of some of the determinants of fertility pertain to the time when the census is collected rather than the time when the fertility decisions were made. This discrepancy increases with the age of the woman. Further, the age-specific fertility rates in rural India are changing over this period of time, 1957-1978 (see Figure 2). In order to assess the determinants of fertility for different age groups, we estimate the children ever born (age standardized) separately for two groups of women, namely age 15-29 and 30-49. The regression estimates are reported in Table 3. The results show that the primary health centers, male matriculates and percent of Muslims exert a significant influence on the fertility decisions of women in 30-49 age group. In addition, hospitals, secondary schools, landholding and landless variables exhibit a consistent effect on fertility in both the younger and older groups of rural Indian women.

Regression estimates of the sex-specific schooling enrollment equations for 1971 and 1981 are given in Tables 4. The null hypothesis that there is no difference in the estimates of the effects of the exogenous variables in the schooling equations of boys and girls is rejected by the F test at 5 percent ($F(11,218) = 58.06$ for 1971 and $F(11,218) = 62.68$ for 1981). The presence of a secondary school in the village significantly increases the expected years of schooling of both boys and girls in 1971. A ten percent increase in the coverage of secondary schools in 1971 is associated with .7 percent and 1.5 percent rise in the expected years of schooling of boys and girls, respectively. Availability of primary health centers significantly increases the expected years of schooling of both sexes, and more hospitals increase only the schooling of boys in 1981. A ten percent increase in the primary health centers increases in 1981 schooling of boys by .6 percent and schooling of girls by .2 percent. None of the health and family planning program variables exerts a statistically significant cross effects in 1971. Program and adult education effects on fertility and child schooling are summarized in terms of elasticities shown in Table 5.

Figure 2



Data Source: United Nations (1982), <u>Population of India</u>, Country Monograph Series No. 10, Economic and Social Commission For Asia and the Pacific, New York: United Nations.

TABLE 3

Regression Estimates of Children Ever Born per Women by Age of Women, Rural Indian Districts, 1981

Variable	Children Ever Born per Women Ages 15-29	Children Ever Born per Women Aged 30-49
Programs:		
Family planning clinics	-.971 (-1.25)	-.378 (-.76)
Primary health centers	-.258 (-1.13)	-.251 (-1.82)
Hospitals	-1.794 (-3.21)	-1.13 (-5.52)
Secondary schools	-.00140 (-2.09)	-.00141 (-2.34)
Socioeconomic Characteristics of Population:		
Size of landholding	.0296 (4.11)	.0587 (8.54)
Male matriculates	-.000465 (-.19)	.0102 (3.75)
Female matriculates	-.0105 (-1.34)	-.00464 (-.94)
Percent agricultural landless laborers	-.00218 (-2.18)	-.00375 (-4.62)
Percent of rural population	.000676 (.73)	.000475 (.63)
Percent of Scheduled castes and tribes	-.564 (-.42)	-.000293 (-.36)
Percent of muslim	.643 (.55)	.003857 (3.71)
Constant	1.10	.902
$\bar{R}^2$	.502	.538
F(11,108)	11.91	13.61
Breusch and Pagan Test statics ($\chi 2$)	34.45	7.49
Number of districts	120	120

't' values in parentheses.

TABLE 4

Regression Estimates of Child Schooling Equations, Rural Indian Districts, 1971 and 1981

Variable	1971 Expected Years of Schooling of Boys	1971 Expected Years of Schooling of Girls	1981 Expected Years of Schooling of Boys	1981 Expected Years of Schooling of Girls
Programs:				
Family planning clinics	-5.41	-8.84	1.97	4.10
	(-.48)[a]	(-1.18)	(.27)	(.74)
Primary health centers	-2.61	4.53	8.05	12.4
	(-.27)	(.69)	(3.62)	(6.03)
Hospitals	13.2	-.574	9.09	5.87
	(1.54)	(-.11)	(3.26)	(1.32)
Secondary schools	.0205	.0166	.00138	.00352
	(3.11)	(2.82)	(.26)	(.67)
Socioeconomic Characteristics of Population:				
Size of landholding	-.199	-.259	-.0284	-.202
	(-2.91)	(-6.15)	(-.43)	(-3.59)
Male agricultural landless laborers[b]	-.006	.019	-.00984	.288
	(-.47)	(2.74)	(-.97)	(3.55)
Male matriculates	.454	.206	.172	.00589
	(7.59)	(3.59)	(3.79)	(.21)
Female matriculates	-.0918	.514	.184	.343
	(-.63)	(4.16)	(.27)	(3.70)
Percent of scheduled castes and tribes	.00306	.0151	-.0252	-.0134
	(.34)	(2.85)	(-2.58)	(-1.92)
Percent muslims	-.0431	-.0340	-.0397	-.0493
	(-3.99)	(-3.97)	(-3.19)	(-4.67)
Percent of population in rural areas	-.00264	.00444	-.0171	-.0298
	(-.21)	(-.51)	(-1.91)	(-3.53)
Constant	3.26	.573	6.81	4.16
$\bar{R}^2$	.621	.787	.574	.805
F(11,108)	18.7	41.082	15.587	46.451
Breusch and Pagan Test statistics (χ^2)	18.991	29.138	41.997	144.320
Number of districts	120	120	120	120

[a]'t' values in parentheses.

[b]Tested for endogeneity.

TABLE 5

Elasticities Computed at Sample means

Estimating Equation/ Dependent Variable	Public Program Variables				Matriculaties	
	Family Planning Clinics	Primary Health Center	Hospitals	Secondary Schools	Males	Females
Fertility Equation, 1971						
Child (0-4)-women ratio	-.0240	-.0423	.000256[a]	-.0135[a]	.0983	-.0361
Child (5-9)-women ratio	-.0222	-.0197	-.0250	-.0207	.147	-.0350
Fertility Equation, 1981						
Child (0-4)-women ratio	-.00057[a]	-.0302	-.0241	-.0506	.0545	-.0261[a]
Child (5-9)-women ratio	.00041[a]	-.0407	-.0267	-.0381	.107	-.0571
Children ever born	.00609[a]	-.0133	-.0268	-.0470	.0810	-.0165[a]
Total fertility rate	-.0150[a]	-.0498	-.0103[a]	-.0745	.109	-.0284[a]
Schooling Equation, 1971						
Expected years of schooling of boys	-.00803[a]	-.00628[a]	.0489[a]	.0725	.501	-.0172[a]
Expected years of schooling of girls	-.0328[a]	.0274[a]	-.00530[a]	.154	.0967	.00704
Schooling Equation, 1981						
Expected years of schooling of boys	.00347[a]	.0627	.0280	.00492[a]	.273	.0722[a]
Expected years of schooling of girls	.0153[a]	.0243	.0384[a]	.0418[a]	.00500[a]	.286

[a]The underlying coefficient is not statistically significant at 10 percent level.

Size of land holding exerts a significant negative effect on the school attendance of girls in both years and of boys in 1971. The percent of male agricultural laborers increases in both years the schooling of girls but not of boys. This may be due to the increase in family income due to male's labor market participation. An increase in the proportion of scheduled castes and tribes reduces the schooling of both boys and girls in 1981, but it increases the schooling of girls in 1971. Districts in which the proportion of Muslim population is higher, the expected years of schooling of both sexes is significantly lower.

The proportion of male matriculates has a positive effect on boy's schooling in both years and also on girl's schooling in 1971, whereas the female matriculates increases only the educational attainment of girls. A ten percent increase in the percent of male matriculates increases the boy's schooling by 5 percent in 1971 and only 3 percent in 1981. A similar increase in the female matriculates would increase the schooling of girls by .1 percent in 1971 and by about 3 percent in 1981. Adopting the alternative specification with the average male and female matriculates and the ratio of female to male matriculates confirms that increases in the average education increases educational attainments of boys and also girls in both years. Increases in the ratio of female to male education increases only the schooling of girls. In general, these results suggest that more educated parents are more inclined to invest in child quality, and closing the gap in educational attainment between women and men will become a reinforcing process.

4.2. Panel Estimates

The district fixed effects estimates based on the two period cross section data are presented in Table 6. The specification test suggest by Hausman (1978) is first performed to test whether the random-effects specification is more appropriate while the alternative hypothesis is the fixed effects model. The test statistics (χ^2), reported in Table 6, rejects the random-effects specification as misspecified and thus only the fixed-effects specification of the model is reported.

The own-program effects of family planning clinics and primary health centers on fertility and the cross-program effects of secondary schools on fertility are negative and statistically significant on both measures of the child-woman ratio. The effect of hospitals on surviving children is not statistically significant. The effect of size of land holding is to increase the child (0-4)-woman ratio. An increase in the percent of scheduled castes and tribes significantly increases the number of surviving children per women.

TABLE 6

District Fixed Effect Estimates of the Fertility and Child Schooling Equations, Rural India, 1971-81

Variable	Child (0–4) -Women Ratio	Child (5–9) -Women Ratio	Expected Years of Schooling of Boys	Expected Years of Schooling of Girls
Programs:				
Family planning clinics	-240. (-5.36)	-184. (-4.10)	-1.07 (-.11)	4.22 (.81)
Primary health centers	-28.7 (-2.25)	-28.2 (-2.22)	6.52 (2.43)	10.4 (7.04)
Hospitals	45.4 (1.58)	15.2 (.53)	9.71 (1.60)	9.01 (2.71)
Secondary schools	-.164 (-3.83)	-.147 (-3.44)	.00753 (.84)	.00877 (1.77)
Socioeconomic Characteristics of Population:				
Size of landholding	7.42 (4.86)	1.42 (.93)	-1.02 (-3.17)	-.428 (-2.42)
Male agricultural landless laborers	-.0256 (-.20)	-.0708 (-.56)	.0360 (1.35)	.0326 (2.23)
Male matriculates	-.750 (-3.26)	-.0808 (-.35)	.0956 (1.97)	.0400 (1.50)
Female matriculates	.900 (2.41)	-.382 (-1.02)	-.104 (-1.32)	.0205 (.47)
Percent of scheduled castes and tribes	.213 (1.98)	.212 (1.97)	.0215 (.95)	-.00480 (-.39)
Percent muslims	-.127 (-.39)	-.244 (-.76)	.0419 (.62)	.000787 (.02)
Percent of population in rural areas	.201 (1.49)	.086 (.29)	-.0442 (-1.55)	-.0307 (-1.97)
S.E.E	4.702	4.577	.966	.941
Hausman Test (χ^2)	249.5	32.0	68.4	139.9
Number of districts	120	120	120	120

't' values in parentheses.

Comparing the fixed effect estimates with our cross sectional estimates shows that the impact of family planning clinics and secondary schools are under estimated from the cross section. In an earlier study for Taiwan, Schultz (1974) finds that the cross sectional estimates of the family planning program on fertility are about one half of their effects in panel estimates.

The fixed effect estimates of the sex-specific child schooling equations show that the cross-program variables, namely primary health centers and hospitals, have a stronger positive effect on the schooling of girls than on the schooling of boys. The presence of a secondary schooling within the village increases significantly (at a 10 percent confidence level) the schooling of girls, but not boys. Size of land holding is negatively associated with child schooling as observed in the cross sectional analysis. An increase in the percent of male matriculates increases the schooling of boys whereas rurality reduces the schooling of girls.

Caste and religion are virtually time invariant variables except due to differences between the groups in migration and population growth rates. Consequently their effects are imprecise and much reduced in the panel estimates.

5. CONCLUSION

In this study we have presented empirical estimates of the impact of the variation in the public programs, namely family planning, health, and education, on household child investment decisions using district level aggregate data for rural India for 1971 and 1981. In the cross sectional own-program effects of health reduce family size in both years, but secondary schools increase the school enrollment of boys and girls only in 1971. Family planning clinics exerts a significant negative effect on the demand for surviving children only in 1971. The cross program effects show that the presence of a secondary school in a village reduces the demand for number of children in both years whereas the primary health centers and hospitals encourage schooling of both boys and girls only in the most recent period. The coefficient estimates suggest that doubling the number of primary health centers per 1000 population would reduce the total fertility rate from 4.05 (observed in our sample) to 3.85, while a doubling of the coverage of secondly schools would reduce by itself the total fertility rate to 3.75. Thus, this doubling of health and schooling facilities would be associated with a 12 percent decline in fertility, contributing to a decrease in population growth of about one fifth. In the most recent period, male matriculates increase the schooling of boys, while female matriculates increase the schooling of girls. An important finding, from the policy point of view, is that promoting female higher education (matriculation and above) would reduce family size and increase the schooling of female children, and thus reduce the inequality in male and female child enrollments in the future. An increase in the proportion of Muslim population increases fertility and reduces the expected years of schooling of both boys and girls. The panel estimates suggest that if we control for the unobserved district-specific time-invariant levels, several of the conclusions derived from the cross sectional analysis are changed. The effects of hospitals are overstated in the cross sectional analysis, while the effects of family planning and secondary schools are underestimated.

Both the cross sectional and panel estimates reveal gender differences in the effects of several exogenous variables. An increase in the provision of secondary schools improves markedly the schooling attainment of female children and thus reduces intergenerationally the sex-specific differences in enrollment rates.

FOOTNOTES

1. Comparable data on various aspects of the public programs overtime and for the most recent periods are not available. The amount of money spent on the program is an aspect of the program effect. The average expenditure at current prices on family welfare programs per eligible couple increased from Rs. 3.5 to 15.3 (Jolly, 1986) and at constant (base year 1949) price from Rs. 1.5 to 2.8 between 1969-70 to 1981-81. The per capita expenditure at current prices on health has gone up from Rs. 17 in 1950 to Rs. 32 in 1975. But in real terms the per capita health expenditures decline from Rs. 15.2 to Rs 8.3 during same period. The per capita expenditures on education at current prices have gone up from Rs. 34 in 1970-71 to Rs. 69 in 1977-78, and at constant prices it has slightly increased from Rs. 15 to Rs. 17.5 during the same period. Thus, expenditures by the public sector on health and education as a share of income appear to have declined in this period in India.

2. A number of studies include presence of school, family planning clinic, and some characteristics of the public environment like sewage system etc., to capture the impact of public programs in the developing country (Behrman and Wolf, 1982 and others). In a recent study Schultz (1989) investigates the impact of public and private family planning program expenditure on fertility in Thailand. Although these studies provide many interesting insights, they nevertheless examine only the own program effects.

3. Jain (1985) examine the effects of contraceptive use, infant mortality, female age at marriage, percent of villages having a high school and a medical facility on crude birth rates using state level aggregate data. The results are very sensitive due to small sample size. The potential bias due to endogeneity of most of the variables considered to explain fertility is ignored.

4. Detray (1974) defines a similar measure to represent investment in child quality by weighting the age-specific enrollment ratios by expenditure on education. This measure may be appropriate since it takes into account of the variation in the direct cost of education. However, district level educational expenditure data are not available for India.

5. The theoretically prescribed measurement requires enrollment and population for each year starting from 6 to 24. In practice the years are grouped, since the 1971 Census does not report the enrollment figures for individual years in an age group. Furthermore, more information on number of children enrolled in the age groups of 5-9 and 10-14 are not available for 1971 and so these two age groups are combined to calculate the expected years of schooling for the year 1971.

6. In India, the health institutions operate under three different schemes: health, family welfare and minimum needs program.

7. A set of variables measuring the sources of water supply, namely tap, tube well, well, river and tank, were also considered. The sources of water supply did not exert a significant influence on fertility and child schooling equations. Hence these variables are dropped from this study.

8. Dispensaries per thousand population is included as one of the explanatory variable in the first draft of this paper, but dispensaries is highly correlated with other exogenous variables in the model. This variable was itself insignificant in explaining additional variance in the instability of the other parameter estimates. As a consequence it is excluded in these final estimates.

9. We also examined the percent of villages in a district having a particular type of service and found that the results did not widely differ. However the population based measures, defined above, considerably reduces collinearity among the family planning and primary health centers and improves the precision of the parameter estimates. The zero order correlation between the percent of villages with primary health centers and the percent of villages with family planning clinics is .57 in 1971 and .65 in 1981. Percent of villages with hospitals are also highly correlated with secondary schools (.80 in 1971 and .81 in 1981).

10. We considered alternatively the percent of villages having a primary school in a district. This variable did not show a statistically significant effect on fertility and child schooling. Distance to a school does not seem to be an important factor in the case of primary schools, perhaps because more than 75 percent of villages already have schools within the village in 1981.

11. An operational holding is defined in the Agricultural Census as, "all land which is operated as one technical unit by one person alone or with others without regard to legal form, size or location". The technical unit refers to, "that unit which is under same management and has the same means of production, such as, labor force, machinery and animals".

12. The change in the definition of workers between the 1971 and 1981 censuses posses problem of comparability. As there is no way of correcting this problem, we must ignore it. This does not affect our cross sectional estimates. However, the coefficient of this variable in the fixed effects estimates should be approached with caution.

13. The percent of male agricultural laborers was considered as an endogenous variable. The fertility and child schooling equations were estimated by Two Stage Least Squares (TSLS) where the set of identifying variables includes the number of factories and workshops per household, percent of factories and workshops using fuel and percent of cropped area irrigated. The results were reported in an earlier version of this paper. The Hausman endogeneity test statistics ('t' = .24, .17, .82, 1.72, -.96, and -2.39 respectively for the six fertility equations reported in Table 2 and .44, -1.84, .74 and -.62 respectively for the four schooling equations reported in Table 3) are not statistically significant at 5 percent level in any of the fertility and child schooling equations except in the total fertility rate equation. The OLS and TSLS parameter estimates are sufficiently close to each other. This implies that the percent of male agricultural laborers can be treated as an exogenous variable and hence we report only the more efficient OLS parameter estimates.

14. The zero order correlation between the adult educational levels is .78 in 1971 and .70 in 1981 and between female education and secondary schools is .72 and .63 in 1971 and 1981 respectively.

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APPENDIX TABLE A1

Regression Estimates of Fertility Equations: With Average Male and Female Education and Ratio of Female to Male Education, Rural Indian Districts, 1971 and 1981

	1971		1981			
	Child (0-4) -Women Ratio	Child (5-9) -Women Ratio	Child (0-4) -Women Ratio	Child (5-9) -Women Ratio	Children Ever Born	Total Fertility Rate
Programs:						
Family planning clinics	-217. (-3.07)	-205. (-2.90)	-1.65 (-.05)	19.5 (.53)	-.518 (-1.04)	-5.11 (-1.37)
Primary health centers	-192. (-4.40)	-71.2 (-1.37)	-21.5 (-2.44)	-31.5 (-3.44)	-.166 (-1.28)	-2.67 (-2.14)
Hospitals	1.41 (.03)	-93.4 (-2.16)	-62.5 (-4.19)	-74.9 (-4.59)	-1.25 (-5.65)	-1.63 (-.87)
Secondary schools	-.0541 (-1.39)	-.0818 (-2.31)	-.112 (-2.89)	-.0915 (-2.51)	-.00128 (-2.46)	-.0116 (-2.37)
Socioeconomic Characteristics of Population:						
Size of landholding	3.12 (7.85)	2.38 (5.42)	1.71 (3.49)	1.35 (2.27)	.049 (8.48)	.268 (5.33)
Percent agricultural landless laborers	-.205 (-3.43)	-.115 (-2.20)	-.206 (-3.42)	-.168 (-2.60)	-.00313 (-4.35)	-.0242 (-3.12)
Average male and female education	1.31 (2.57)	2.29 (4.88)	.355 (2.46)	.506 (3.17)	.00973 (4.24)	.0598 (2.68)
Ratio of female to male education	-28.1 (-2.66)	-31.5 (-3.38)	-24.5 (-4.20)	-40.6 (-7.82)	-.262 (-2.84)	-2.36 (-2.73)
Percent of scheduled castes and tribes	.102 (1.47)	.114 (1.97)	-.0108 (-.19)	.00899 (.15)	-.000378 (-.45)	-.00156 (-.18)
Percent of muslims	.413 (5.72)	.415 (6.03)	.288 (4.56)	.369 (5.31)	.00253 (2.69)	.0139 (1.28)
Percent of population in rural areas	.0799 (1.20)	.102 (1.64)	.0326 (.57)	-.0188 (-.33)	-.000058 (-.01)	.0103 (1.33)
Constant	57.2	53.5	62.9	74.3	1.04	3.80
$\bar{R}^2$	.628	.572	.626	.681	.589	.433
F(11,108)	19.28	15.47	19.13	24.117	16.49	9.26
Breusch and Pagan Test statics (χ^2)	9.52	7.57	7.11	14.12	5.38	8.44
Number of districts	120	120	120	120	120	120

't' values in parentheses.

APPENDIX TABLE A2

Regression Estimates of Child Schooling Equations: With Average Male and Female Education and Ratio of Female to Male Education, Rural Indian Districts, 1971 and 1981

Variable	1971 Expected Years of Schooling of Boys	1971 Expected Years of Schooling of Girls	1981 Expected Years of Schooling of Boys	1981 Expected Years of Schooling of Girls
Programs:				
Family planning clinics	-5.50 (-.46)	-6.02 (-.11)	-.0408 (4.33)	3.78 (5.96)
Primary health centers	-1.93 (-.17)	-.747 (-.11)	8.91 (4.33)	9.88 (5.96)
Hospitals	12.5 (1.40)	.410 (.08)	9.10 (3.20)	4.50 (1.33)
Secondary schools	.015 (2.26)	.0143 (2.64)	-.00395 (-.81)	.000236 (.05)
Socioeconomic Characteristics of Population:				
Size of landholding	-.215 (-2.98)	-.234 (-5.41)	-.0631 (-.88)	-.157 (-3.30)
Percent agricultural landless laborers	-.00628 (-.51)	.01976 (3.05)	-.00925 (-.81)	.0201 (2.79)
Average male and female education	.696 (7.87)	.441 (5.42)	.240 (3.81)	.127 (3.20)
Ratio of female to male education	-2.08 (-1.30)	4.12 (2.95)	-.103 (-.07)	7.44 (8.42)
Percent of scheduled castes and tribes	.000856 (.09)	.0115 (2.36)	-.0278 (-2.92)	-.0131 (-2.27)
Percent of muslims	-.432 (-3.86)	-.343 (-4.43)	-.0428 (-2.92)	-.0342 (-4.27)
Percent of population in rural areas	-.00133 (-.10)	.000932 (.11)	-.0175 (-1.62)	-.0148 (-2.18)
Constant	3.85 (3.11)	-.177 (-.22)	7.47 (7.16)	1.80 (2.73)
$\bar{R}^2$	.599	.806	.604	.886
F(11,108)	17.15	45.97	14.98	75.94
Breusch and Pagan Test statics (χ^2)	17.99	40.09	52.59	42.84
Number of districts	120	120	120	120

't' values in parentheses.

APPENDIX TABLE A3

District Fixed Effect Estimates of the Fertility and Child Schooling Equations:
With Average Education of Males and Females and Ratio of Female to Male Education,
Rural Indian Districts, 1971-81

Variable	Child (0–4) -Women Ratio	Child (5–9) -Women Ratio	Expected Years of Schooling of Boys	Expected Years of Schooling of Girls
Programs:				
Family planning clinics	-194. (-4.34)	-170. (-4.09)	-4.99 (-.53)	3.25 (.65)
Primary health centers	-29.6 (-2.28)	-16.3 (-1.36)	7.15 (2.63)	9.79 (6.74)
Hospitals	59.1 (1.98)	33.4 (1.21)	8.84 (1.41)	7.85 (2.35)
Secondary schools	-.152 (-3.72)	-.111 (-2.93)	.0104 (1.20)	.00925 (2.01)
Socioeconomic Characteristics of Population:				
Size of landholding	7.81 (5.18)	.178 (.12)	-1.13 (-3.57)	-.383 (-2.27)
Percent agricultural landless laborers	-.0338 (-.26)	-.0853 (-.71)	.0354 (1.31)	.0327 (2.27)
Average male and female education	-.327 (-1.45)	.0584 (.28)	.0563 (1.19)	.0626 (2.48)
Ratio of female to male education	-30.1 (-2.44)	-47.7 (-4.17)	.724 (.28)	1.94 (1.40)
Percent of scheduled castes and tribes	.223 (2.07)	.195 (1.96)	.0185 (.82)	-.00472 (-.39)
Percent of muslims	-.0799 (-.24)	-.317 (-1.06)	.0293 (.43)	-.000242 (-.00)
Percent of population in rural areas	.0739 (.50)	-.187 (-1.38)	-.0417 (-1.36)	-.0197 (-1.20)
S.E.E	4.656	4.307	.974	.797
Number of districts	120	120	120	120

't'values in parentheses.