Poverty, Fertility and Child Labor: Does Demand Theory of Fertility Matter? An Exploratory Study in India

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Abstract

It is hypothesized that fertility, poverty and child labor are jointly determined variables; neither can be assumed to be an independent determinant of the other. In a simultaneous equation framework, we find that demand theory of fertility does hold good even at the lower level of income where the females are compelled to go outside home for cash in order to avoid destitute and they prefer less number of children. Therefore, in order to regulate fertility in India, one can suggest increasing female employment opportunity at the informal sector, since formal sector job is severely restricted in India. It is observed that child labor is caused by lower health status and poor human capital investment. Thus, if we increase the per capita social sector expenditure on education and healthcare, it directly augments enrollment of the children in school. Since health and education is treated as complementary to each other, a rise in social sector investment has some spillover benefits to the society.

Keywords: Demand theory of fertility, Poverty, Female labor force participation in unorganized sector, Social sector expenditure

1. Introduction:

Household economic theory of fertility which is known as demand theory was developed by Chicago-Columbia School led by Gary Becker during 1960s. The theory is based on microeconomic approach, assuming couples would have as many children as they could if children are costless in terms of money and opportunity cost of time. Demand theory of fertility hypothesize that the true income elasticities for both child quality and quantity are positive but as income increases, however, the couples demand higher quality children [Barro and Becker 1989]. Since higher quality children are more expensive, the couples now demand fewer children resulting negative income elasticity for the number of children. Despite considerable empirical evidence in support of the basic premises of demand theory of fertility decisions from the developed economies, the model has not found extensive applications to the developing countries like India.

In contrast with Becker's approach, the social theory of fertility decline points to changes in preferences as a result of social development, such as expansion of education in general and female education in particular. The social theory of fertility is multidisciplinary in nature and it is known as syntheses model based on social and economic variables. This syntheses model[1] of fertility has been emerged as a criticism of economic theory which incorporates both the supply as well as demand side factors affecting fertility [Caldwell 1977, Easterlin, Pollak and Wachter 1980, Bongaarts 1980]. Both the demand and social theories of fertility have merits in explaining the cross-country variation of fertility but a debate has been emerged regarding the relative merits of the two theories [Bryant 2007].

The family allocation of rights, gender relations, impact of social institution are not incorporated in demand theory of fertility. The behavior regarding family size of a particular household is influenced by the behavior of his neighbor. The factors most often studied in relation to fertility differential among different societies are education, age at marriage, son preference, infant mortality, female employment, caste, religion, urbanization, contraceptive prevalence rate etc. Therefore, economic factors are not just factors but are important factors in fertility decisions because the socio-cultural ends of a society largely determine the economic ends.

The Chicago-Columbia fertility model does not attempt to control for changes in child quality in their empirical models of family size. They make the theoretical assumption that the child quality and quantity decisions are made simultaneously. Considering the problems associated with simultaneity assumption, Turchi [1975], Borg [1989] and Birdsall [1991] have developed reduced form equations of fertility decisions[2]. Lord and Rangazas [2006] have developed a quantitative theory that highlights three mechanisms that relate schooling, fertility and economic growth. There has been some preliminary evidence of statistical support to the economic theory of fertility in some developing countries but the theory is more applicable to the developed countries [Todaro 1991]. Why fertility is found to be high in the less developed countries? The explanation given by Basu and Van [1998] and Bardhan and Udry [1999] is quite relevant and acceptable[3].

1.1 Objective of the Study:

The objective of this paper is to verify the inter-linkage between poverty, fertility and child labor in a simultaneous equation framework. We have incorporated both the economic as well as socio-cultural variables in our model with a view to examine the relevance and importance of the variables in the two theories (viz. demand and social theories of fertility). We strongly believe that the economic variables are not independent of the social variables but there are few socio-cultural variables which are not dependent on economic directly; the opposite is also true.

1.2 Model Formulation: A Theoretical Framework

Basu and Van (1998) model of child-labor-poverty-fertility is simplified by Bardhan and Udry(1999) and this model is an extension of the household economic theory of fertility and more relevant and applicable to the poor countries. Since, the concentration of poor people is disproportionately high in India; India shares the maximum concentration of poor people viz. 20 percent of the global poverty having 17 percent share of the world population [World Development Report 2007]. Therefore, we can well examine the relevance and practical applicability of the model on fertility-poverty inter-linkage in India considering each state as unit of analysis. In order to study the inter-linkage between poverty-fertility and child labor, we formulate the following three simultaneous equations:

$TFR=\alpha_0+ \alpha_1.HCR+ \alpha_2.FLC+ \alpha_3.SSE+ \alpha_4.MAM+u_i$……………………………(1)
$HCR=\beta_0+ \beta_1.SSE+ \beta_2.CL+ \beta_3.IMR_{(t-3)}+ \beta_4.HCR_{(t-6)}+v_i$ ……………………(2)
$CL=\gamma_0+ \gamma_1.TFR+ \gamma_2.HCR_{(t-6)}+ \gamma_3.IMR_{(t-3)}+ \gamma_4.SSE+w_i$……………………….(3)

Where, TFR=total fertility rate, HCR=head-count ratio, FLC=percentage of female who go outside home for cash in total female labor force, SSE=per capita social sector expenditure viz. education and health, MAM=mean age at female marriage, $IMR_{(t-3)}$=infant mortality rate lagged by 3 years, HCR(t-6)=head–count ratio lagged by 6 years; u, v and w are the errors terms.

It is hypothesized that fertility, poverty and child labor are jointly determined variables (as outlined in equations (1), (2) and (3); neither can be assumed to be an independent determinant of the other.
In eqn.(1), following Basu and Van(1998), it is assumed that fertility is determined by poverty, female labor force in the unorganized sector(i.e. percentage of female who go outside home for cash in total female labor force), per capita social sector expenditure and female mean age marriage; except poverty(HCR), all are assumed to be exogenous variables. Since our objective is to verify the empirical validity of the Basu-Van (1998) model, we have restricted in incorporating lots of other variables affecting fertility. Since more than 93 percent of our labor force is in unorganized sector, we have chosen objectively the percentage of female workers who go outside home for cash. Under distressed situation, in order to avoid destitute, female generally go outside home for cash and prefer to have fewer number of children.

In equation (2), poverty is determined by per capita social sector expenditure, child labor, past health status of the population measured by lagged values of infant mortality and past period poverty. Social sector expenditure (viz. education and healthcare) is assumed to be an important variable affecting poverty. It helps to augment the human capital formation of the mass.
In equation (3), child labor is caused by fertility, lagged values of poverty, past health status (viz. IMR_3) and per capita social sector expenditure.

2. Data and Methodology:
Since fertility, poverty and child labor are jointly determined variables, we employ 3SLS model to solve the parameters of the simultaneous equations. Both the rank and order conditions are checked and our model as given in equations (1), (2) and (3) do satisfy these conditions and since it is over–identified model, 3SLS is assumed to be appropriate. We use the National Family Health Survey data for three time points (viz. 1992-93, 1998-99 and 2005-06) and 16 major states are considered for the present study. Since, the time points are three and only 16 states, we pool the data in order to carry out the econometric analysis. The Lagrange multiplier test confirms that Classical Linear Regression Model (CLRM) is better than panel[4].

HCR are drawn from Central Statistical Organization and Planning Commission, Govt. of India.
SSE is collected from Ministry of Health and Education, Govt. of India.
CL=percentage of children who are not enrolled in school at the primary level of education are considered as child labor. This is drawn from NFHS Reports, IIPS, Mumbai.
MAM=Mean age at female marriage, drawn from NFHS Findings, IIPS, Mumbai
SP (viz. son preference that is married women who demand more number of sons than daughters)=drawn from NFHS Findings, IIPS, Mumbai
FLC=Female who go outside home for cash in total female labor force, drawn from NFHS Report, IIPS, Mumbai.

3. Results:
Results of the simultaneous equations using 3SLS method:
Before analyzing the simultaneous equation model, let us first examine the descriptive statistics and correlation coefficients of the variables incorporated in our model. It is given in Appendix-A and B. We have observed that except TFR and MAM, almost all the variables show a low mean but high variance. This means that a high degree of dispersion do exist among the states in respect of the selected socio-economic variables used in our simultaneous.

The zero-order correlation matrix (as shown in Appendix-B) does show that all the variables are highly correlated except FLC (percentage of female who go outside home for cash in total female labor force). Multiple regressions generally suffer from multicollinearity problem but in our model, it is not severe.

We have checked the rank and order conditions of the three equations (1), (2) and (3). It is found that the system of equations is over-identified and 3SLS technique is assumed to be appropriate.

Table-1: Solution of Eqn.(1) TFR (Dependent variable.) N=48, RMSE=0.596, R^2=0.55, Chi. Sq.=57.77, P=0.000

Exogenous Var.	Coef	SE	Z	P > IZI
HCR	0.02	.014	1.44	0.149
FLC	-0.019	.006	-3.16	0.002
SSE	-0.0008	.001	-0.85	0.394
MAM	-.198	.096	-2.07	0.039
Cons	7.401	1.637	4.52	0.000

Note: HCR is endogenous var.

Table-2: Solution of Eqn.(2) HCR (Dependent Var.) N=48, RMSE=6.21, R^2=0.74, Chi. Sq.=138.49, P=0.000

Exogenous Var.	Coef	SE	Z	P > IZI
SSE	-0.015	.006	-2.28	0.023
CL	-0.001	.001	-1.01	0.314
IMR_3	0.012	.008	1.57	0.13
HCR_6	0.575	.111	5.15	0.000
Cons	19.421	7.03	2.76	0.006

Note: CL is endogenous var.

Table-3: Solution of Eqn.(3) CL (Dependent Var.) N=48, RMSE=6.39, R^2=0.57, Chi. Sq.=63.97, P=0.000

Exogenous Var.	Coef	SE	Z	P > IZI
TFR	0.238	.392	0.61	0.544
HCR_6	-0.158	259	-0.61	0.541
IMR_3	0.131	.060	2.18	0.029
SSE	-0.027	.009	-2.94	0.003
Cons	28.631	8.09	3.54	0.000

Note: TFR is endogenous var. In this system, endogenous variables are: TFR, HCR and CL; exogenous variables are: FLC, IMR, IMR(t-3), HCR(t-6), MAM, SSE

The solution of the first equation gives us that fertility is not significantly influenced by poverty; it appears as endogenous variable in the simultaneous equation system, though the β coefficient is positive but it is not statistically significant. Fertility is influenced by female labors that go outside home for cash in total female labor force. Since the opportunity cost of time is high among female workers belonging to the unorganized sector, they demand less number of children because child bearing and child rearing activities are time consuming. It supports the demand theory of fertility; even at the lower level of income the substitution effect may take place between number and quality of children. It is to be pointed out that poor families may also demand less number of children if mothers are absorbed in the workforce. Mean age at marriage of the females do have a significant impact on fertility- higher age at marriage reduces the reproductive span of life of the females; it is observed that educated females generally get married at higher age and they prefer to have less and quality children. Per capita social sector expenditure does not appear to be a significant variable in reducing fertility in equation (1).

In eqn.(2), poverty is assumed to be the dependent variable and child labor be the endogenous variable. Social sector expenditure significantly reduces poverty but the child labor does not appear as significant. Past periods poverty significantly aggravates current poverty. Past health status (measured by 3 years lagged IMR) is found to be in expected direction but it does not appear as significant.

In eqn. (3), child labor is the dependent variable and fertility is the endogenous variable. Fertility is found to be positively associated with child labor but the β coefficient is insignificant. Lagged Infant mortality (measured as health status) and social sector expenditure significantly influences child labor. Here, lagged poverty appears to be insignificant.

4. Concluding observations and policy options:

We have empirically examined the relevance of the poverty-fertility-child labor model in Indian context. The model is found to be partially true. The household economic theory of fertility is found to be valid even at the lower level of income where there exist a substantial proportion of people live below the poverty level income. In order to regulate fertility, one can suggest increasing the female employment opportunity even at the informal sector. Age at marriage of the female is directly related to the educational attainment of the female, thus if females are empowered by providing educational opportunities or by giving them access in the job market at the formal or informal sector, the fertility can be reduced at a significant level. Child labor is caused by lower health status (measured by IMR) and social sector expenditure on education and healthcare. Poor health status and insufficient social sector expenditure acts as a barrier to accumulate human capital accumulation. Therefore, if we increase the per capita social sector expenditure, it directly augments enrollment of children in school. Since health and education is treated as complementary to each other, a rise in social sector investment has some spillover benefits to the society.

Notes

[1]In the Syntheses model of fertility(viz. social theory of fertility), the factors most often studied in relation to fertility differential among different societies are education, caste, religion, social norms, son preference, use of contraception, occupation of the mothers, urbanization, pattern of breast feeding, infant mortality rate, female age at marriage, female autonomy [Easterlin, Pollak and Wachter 1980, Bongaarts and Watkins 1996, Caldwell 1977, 1982; Jeffery and Jeffery 1996; Murthi, Guio and Dreze 1995; Murthy and Dreze 2001, McNay, Arokiasamy and Cassen 2003]

[2]In the demand theory of fertility, the household maximizes a utility function which includes both the number and quality of children along with consumption of other goods:

U=U(N,Q,Z)…………….1(A), where N=number of children, Q=per child investment for accumulation of human capital and Z=rate of consumption of other goods.

Parents maximize utility subject to a linearly homogeneous production constraint in which production of children and Z requires inputs not only money but also parent's time:

C=N.Q=f(t_c, x_c)…………2(A), where C=child services, t_c and x_c are vectors of the total amount of time and goods that parents devote to children during parants' life time.
The full income budget constraint is written as:

I=N.Q.$\prod_c$ + N.P_N +Q.P_Q +Z. $\prod_Z$…….3(A), where I=full income of the household, $\prod_I$ are the cost minimizing shadow prices, P_N=fixed price or costs per child which is independent of Q and PQ= fixed price applying to that component of child costs that is independent of the level of N chosen.

Solving the resultant first-order conditions yields a system of simultaneous equations which can be estimated using OLS:

$N=N(I, \prod_c, \prod_Z, P_N, P_Q)$……………………4(A)
$Q=Q(I, \prod_c, \prod_Z, P_N, P_Q)$……………………5(A)
$Z=Z(I, \prod_c, \prod_Z, P_N, P_Q)$……………………6(A)
Here, child quality and child quantity are jointly determined dependent variables, neither can be assumed to be an independent determinant of the other.

[3]Basu and Van (1998) argue that in a less developed economy, poor households demand more number of children because child labor acts as incentive to the parents. This is because children in poor families provide net economic benefits to their families and the choice of fertility of a particular household is influenced by his neighbor i.e., the social environment.

[4]Random Effects Model: v(I,t) = e(I,t) + u(i) |

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| Estimates:  Var[e]          =  .228670D+00  |
|             Var[u]          =  .133070D-01  |
|             Corr[v(I,t),v(I,s)] =  .054993   |
| Lagrange Multiplier Test vs. Panel(FE/RE) =   1.29 |
| ( 1 df, prob value =  .256886)              |
| (High values of LM favor FEM/REM over CR model.) |
| Fixed vs. Random Effects (Hausman)    =  437.70 |
| ( 3 df, prob value =  .000000)              |
| (High (low) values of H favor FEM (REM).) |
| Reestimated using GLS coefficients:         |
| Estimates:  Var[e]          =  .176776D+01  |
|             Var[u]          =  .184230D+01  |
|             Sum of Squares     .142272D+03
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Appendix-A: Descriptive Statistics of the Variables in the SEM Model

Variables	N	Minimum	Maximum	Mean	Std. Deviation
TFR	48	1.70	5.10	3.029	0.898
HCR	48	6.16	54.96	26.761	12.3
FLC	48	5.00	56.30	25.468	14.44
SSE	48	192.00	1088.00	449.604	184.94
MAM	48	17.40	22.80	20.233	1.332
CL	48	5.70	48.70	26.027	9.933
IMR3	48	10.00	122.00	66.000	21.64
HCR6	48	6.16	55.58	30.522	13.014
IMR	48	14.00	103.00	61.583	19.440

Appendix-B: Zero-Order Correlation Matrix of the variables in the SEM Model

		TFR	HCR	FLC	SSE	MAM	CL	IMR	HCR_6	IMR_3
TFR	Pearson Correlation	1.000	0.524	-0.373	-0.631	-0.596	0.669	0.708	0.455	0.716
	Sig. (2-tailed)	.	0.000	0.009	0.000	0.000	0.000	0.000	0.001	0.000
HCR	Pearson Correlation	0.524	1.000	-0.067	-0.701	-0.354	0.572	0.555	0.837	0.524
	Sig. (2-tailed)	.000	.	0.651	0.000	0.013	0.000	0.000	0.000	0.000
FLC	Pearson Correlation	-0.373	-0.067	1.000	0.147	0.153	-0.005	-0.187	-0.246	-0.253
	Sig. (2-tailed)	0.009	0.651	.	0.320	0.298	0.973	0.203	0.093	0.083
SSE	Pearson Correlation	-0.631	-0.701	0.147	1.000	0.696	-0.707	-0.512	-0.671	-0.511
	Sig. (2-tailed)	0.000	0.000	0.320	.	0.000	0.000	0.000	0.000	0.000
MAM	Pearson Correlation	-0.596	-0.354	0.153	0.696	1.000	-0.698	-0.500	-0.335	-0.495
	Sig. (2-tailed)	0.000	0.013	0.298	0.000	.	0.000	0.000	0.020	0.000
CL	Pearson Correlation	0.669	0.572	-0.005	-0.707	-0.698	1.000	0.601	0.500	0.598
	Sig. (2-tailed)	0.000	0.000	0.973	0.000	0.000	.	0.000	0.000	0.000
IMR	Pearson Correlation	0.708	0.555	-0.187	-0.512	-0.500	0.601	1.000	0.505	0.976
	Sig. (2-tailed)	0.000	0.000	0.203	0.000	0.000	0.000	.	0.000	0.000
HCR_6	Pearson Correlation	.455	.837	-.246	-.671	-.335	.500	.505	1.000	.509
	Sig. (2-tailed)	.001	.000	.093	.000	.020	.000	.000	.	.000
IMR_3	Pearson Correlation	.716	.524	-.253	-.511	-.495	.598	.976	.509	1.000
	Sig. (2-tailed)	.000	.000	.083	.000	.000	.000	.000	.000	.

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).