POVERTY, RCH-CARE UTILIZATION AND FERTILITY IN INDIA: A DISTRICT LEVEL ANALYSIS

S.C. GULATI

POPULATION RESEARCH CENTER
INSTITUTE OF ECONOMIC GROWTH
UNIVERSITY ENCLAVE
DELHI-110007
INDIA
FAX: 91-11-2766410
E-MAIL: GULATI@IEG.ERNET.IN
PHONES: 91-11-27667101, 27667288, 27667365

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S.C.GULATI[1]

ABSTRACT: The study highlights interlinkages amongst district level poverty, socioeconomic developmental indices, RCH-care utilization and fertility. Thereby the study formulates a recursive model to highlight the structural linkages between marriage age patterns, contraception, antenatal and delivery care, children's immunization and fertility. The parametric estimates of the recursive structural system are based on data for 504 districts of India on relevant parameters from alternate sources like district level household surveys – reproductive and child health (DLHS-RCH), center for monitoring Indian economy (CMIE), censuses, etc. The elicited parametric estimates are utilized to elicit the partial and total effects of exogenous or predetermined socioeconomic and cultural variables on the endogenous variables in the system. The study highlights strong interlinkages between fertility, contraception, marriage age patterns, antenatal and delivery care, and immunization. The elicited parametric estimates also facilitate prioritization of RCH parameters like contraception, delivery care and immunization towards fertility containment. Furthermore, women's empowerment enabling factors like female education and employment, and socioeconomic infrastructure characteristics like road connectivity, hospital beds and ANMs also depict substantially higher total compared with partial inhibitive effects on fertility. Poverty alleviation can facilitate much stronger impact on fertility reduction and thus quicken the process of population stabilization in India.

Keywords: Poverty, Reproductive and Child Health (RCH), Women's Empowerment, Fertility, Recursive-System-Model.

I. INTRODUCTION

Theoretical and empirical literature highlights strong linkages amongst socioeconomic development, demographic parameters like fertility, mortality, contraception, marriage age patterns, and mother and child health care utilization. The study also highlights such linkages through factor analytical investigations. The factor analysis also facilitates in structural formulation of the recursive model in which fertility and the RCH parameters like fertility, contraception, marriage age patterns, antenatal and delivery care, and immunization are involved as endogenous variables and socioeconomic variables like women's empowerment enabling factors viz. female education, female employment; health and economic infrastructure variables like auxiliary nursing midwives, hospital beds, road connectivity and electrification of villages, etc. as exogenous variables in the system. It has often been argued that poverty, social backwardness and ill health status often trap poorer persons in vicious circle. These aspect of interlinkages would be under the purview of the present study through factorial investigations and structural formulation of the model.

[1] Professor, Population Research Center, Institute of Economic Growth; gulati@ieg.ernet.in

The parametric estimates of the structural model also facilitate highlighting the strength of linkages and also in prioritization of the RCH-care utilization and socioeconomic and cultural factors towards containment of fertility, which is important for quickening the process of population stabilization in the long run. A comprehensive population policy for cost-effective achievement of short, medium and long run policy objectives of provision of quality health-care, informed choice of contraception, fertility reduction and population stabilization ought to have such linkages in sight.

II. OBJECTIVES

This study purports to formulate a recursive model to highlight the structural linkages between key socioeconomic and demographic parameters like poverty/development, fertility, contraception, marriage age patterns, mother and child health care utilization - namely antenatal, delivery care and children's immunization. The parametric estimates of the structural linkages are based on the district level data on relevant parameters from alternate sources like DLHS-RCH (IIPS, 1999), CMIE (2000), Census (2001), and Population Commission (2001). These estimates would be utilized to elicit the direct, indirect and total effects of exogenous or predetermined socioeconomic, health and education infrastructure variables and cultural factors in the structural system. The structural estimates and the effects would facilitate a prioritization of the alternate RCH components and demographic factors to be focused upon towards a cost effective achievement of the population policy objectives.

III. METHODOLOGY

The districtwise development indices, sectoral as well as overall, have been elicited using factor analytical technique, details of which are provided in the Appendices. The interlinkages are highlighted through factor investigations. Formulation of the recursive model and thereby parametric estimates are elicited using multivariate technique.

Poverty being multi-dimensional phenomenon is difficult to be captured by some catch all variables like per capita income The causal factors for poverty in different regions could be different. It could be difficult terrains, adverse soil conditions like deserts or infertile soils, non-conducive agro-climatic factors like scarcity of water, scanty rainfall, non-availability of irrigational sources, inaccessibility to technological innovations, etc. for lack of agricultural development. Similarly for industrial and tertiary level sectors it could be lack of infrastructure facilities like electricity, roads, railways, banking sector network, telecommunications, etc. Even income inequalities in a region could also be causal factor for widespread poverty in the region. Thus, sectoral as well as overall economic development aspects at district level have been elicited using factor analytical technique in the study using these sectoral aspects of development. Furthermore, percent population below poverty level for districts has also been utilized in the study to reflect the economic profiles of the districts.

This recursive model depicts formulation of the structural equations in which endogenous variables are ordered in such a way that the first endogenous variable has only predetermined or exogenous variables on the right hand side; the second equation contains predetermined variables and the first endogenous variable in the right-hand side; and so on. The special feature of the recursive system facilitates an estimation of equations one at a time by OLS without simultaneous-equation bias. Furthermore, the OLS estimates of the structural coefficients are unbiased and consistent.

The structural relations in the recursive system can be formulated as follows:

$Y_1 = f(X_1, X_2, X_3, \ldots X_k; u_1)$
$Y_2 = f(X_1, X_2, X_3, \ldots X_k; Y_1; u_2)$
$Y_3 = f(X_1, X_2, X_3, \ldots X_k; Y_1, Y_2; u_3)$
……
……

and so on.

The random variables are assumed to be independent. The special features of a recursive model are that its equations may be estimated one at a time by OLS estimation technique obviating the simultaneous-equations bias. Assuming that there are G-endogenous variables and k-exogenous variables in the model the structural form of the recursive model would be as follows:

Recursive Structural Model

$Y_1 = \Upsilon_{11} X_1 + \Upsilon_{12} X_2 + \ldots + \Upsilon_{1k} X_k + u_1$
$Y_2 = \Upsilon_{21} X_1 + \Upsilon_{22} X_2 + \ldots + \Upsilon_{2k} X_k + \beta_{21} Y_1 + u_2$
$Y_3 = \Upsilon_{31} X_1 + \Upsilon_{32} X_2 + \ldots + \Upsilon_{3k} X_k + \beta_{31} Y_1 + \beta_{32} Y_2 + u_3$
.
.
$Y_G = \Upsilon_{G1} X_1 + \Upsilon_{G2} X_2 + \ldots + \Upsilon_{Gk} X_k + \beta_{G1} Y_1 + \beta_{G2} Y_2 + \ldots \beta_{G-1} Y_{G-1} + u_G.$

The recursive system being triangular in the sense that coefficients of the endogenous variables (the β's) form a triangular array; the main diagonal of the array of ß's contains units, and no coefficients appear above the main diagonal. The array of structural parameters can be rewritten in matrix form as follows:

$$ß_{GxG}\, Y_{Gx1} = \Gamma_{Gxk}\, X_{kx1} + U_{Gx1}$$

The estimated structural parameters can be elicited by application of OLS to each equation yielding unbiased and consistent estimates of the structural parameters ß and Γ. The reduced form parameters Й can be elicited using the estimated structural parameters of the recursive system as follows:

$$Й = ß^{-1}_{GxG} * \Gamma_{Gxk.}$$

The reduced-form parameters measure the total effect, direct plus indirect of a change in the predetermined variable on the endogenous variable, after taking account of the interdependence among the jointly dependent endogenous variables, while a structural coefficient indicates only the direct effect (Koutsoyiannis, 1977).

IV. LINKAGES AMONGST POVERTY, RCH-CARE, SOCIOECONOMIC PROFILES AND FERTILITY IN INDIA

The following table provides Varimax rotated structure of the selected variables in the study.

Table-1: Varimax Rotated Factor Structure for the Selected Variables

Variable (abbreviated Name)	Factors					Communality
	F1	**F2**	**F3**	**F4**	**F5**	
PB03P	**-0.886**	**-0.248**	0.101	-0.061	0.054	.863
PGMB18	**-0.447**	**-0.580**	-0.102	-0.102	0.140	.577
CUAM	**0.829**	0.167	-0.151	-0.002	0.140	.757
PPANC	**0.839**	0.192	-0.129	0.099	-0.018	.768
PDHI	**0.739**	**0.425**	-0.145	-0.076	-0.091	.785
PCWCI	**0.826**	0.246	-0.363	0.116	0.011	.758
Q291	**-0.408**	**-0.417**	0.283	0.020	0.356	.548
DDIO	**0.301**	**0.707**	**-0.380**	-0.161	-0.054	.764
PPBPL	**-0.341**	-0.212	**0.514**	0.268	0.228	.549
FLR	**0.640**	**0.553**	0.001	-0.015	-0.019	.716
FWPR	0.010	-0.252	0.308	**0.797**	-0.092	.755
PRMSCL	0.075	-0.252	**0.722**	0.196	0.053	.631
HADBEDS	0.164	**0.708**	-0.095	0.035	0.033	.539
ANMNEW	0.282	**0.686**	0.178	0.198	-0.051	.624
PVNCPR	**-0.380**	-0.241	**-0.392**	**0.317**	0.322	.560
PVE	0.260	0.020	**0.611**	**0.324**	0.122	.561
IWPMW	0.075	0.002	0.012	-0.038	**0.866**	.757
PURB	0.204	**0.657**	-0.288	-0.236	0.079	.618
PMUS	-0.053	-0.069	0.102	**-0.786**	-0.034	.637
Eigen Values	7.03	2.223	1.421	1.085	1.004	

Note: Description of the Variables is provided in Appendices (Annex-1).

Perusal of the table clearly reveals that poverty (PPBPL); fertility (PBO3+), marriage age (PGMB18), contraception usage (PCUAM), antenatal care (PPANC), delivery care (PDHI), immunization (PCWCI), and child mortality (PDBT) are strongly interconnected. The factor loadings on the first factor are relatively much higher. The direction of linkages is also consistent with the general expectations.

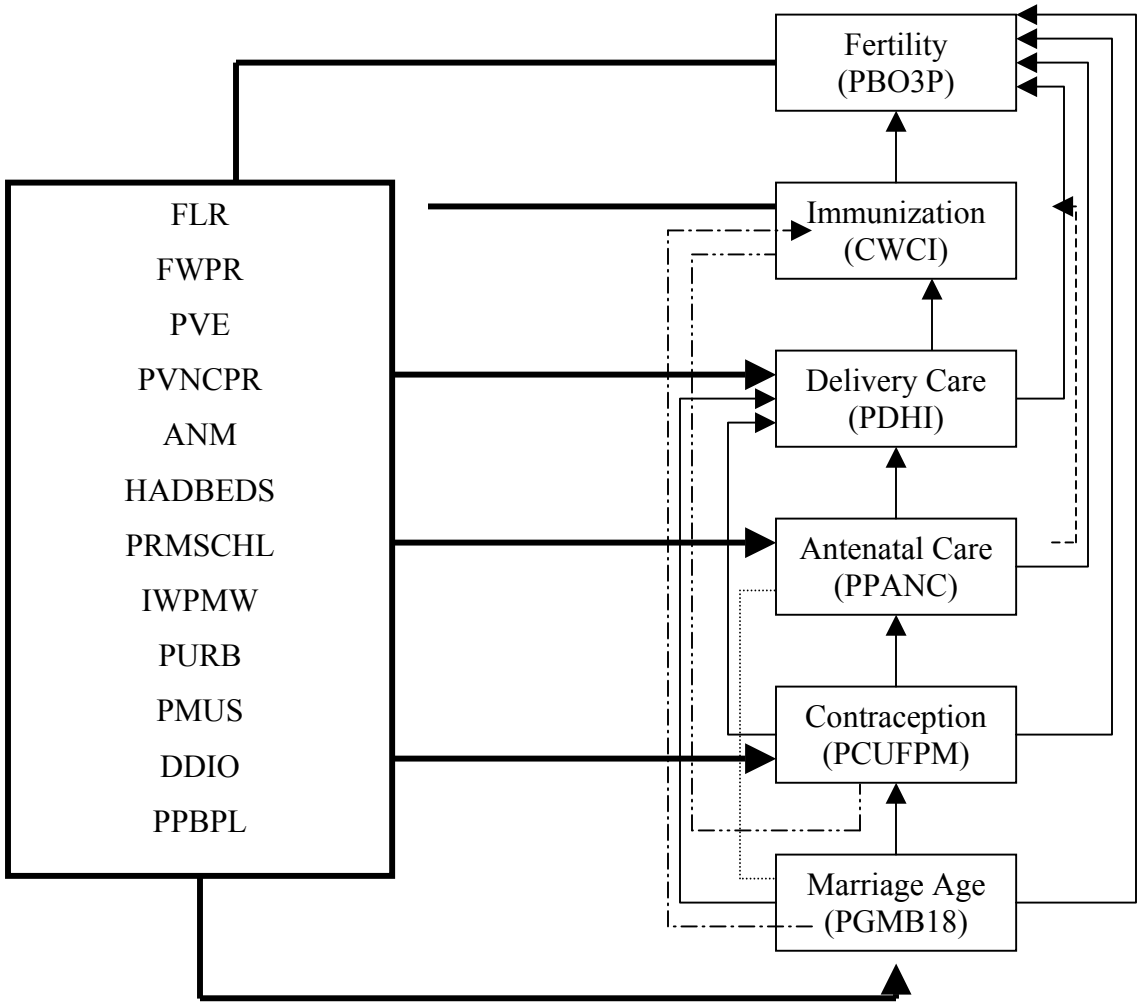
Women' empowerment characteristics like education (FLR) and road connectivity of villages depict strong linkages with the earlier mentioned demographic characteristics. Furthermore, socioeconomic and infrastructure characteristics like primary schools, road connectivity of villages, village electrification, etc. also depict strong and consistent linkages with fertility and RCH parameters.

The semi-quantitative insights into the interlinkages facilitate formulation of the structural model in the following section.

V. STRUCTURAL FORMULATION OF THE MODEL

The functional forms of the six structural relations become clear from the following Flow Diagram 1 as well as Table 1, which provide parametric estimates of the recursive system in the flow diagram.

Fig. 1: FLOW DIAGRAM FOR THE INTEGRATED RCH AND FERTILITY MODEL



The first structural relation depicts that marriage age patterns namely, percent girls married below the age of 18 years (PGMB18) providing extent of girls getting married at younger ages i.e. below 18, the legal age at marriage, is predicted by the eleven socioeconomic and cultural factors under the purview of the present study. The marriage age patterns are presumed to be influenced by women's empowerment enabling factors like women's education and employment viz. female literacy rate (FLR) and female work participation rate (FWPR); percent villages electrified (PVE) and percent villages not connected by *pucca* road (PVNCPR). Other predictors of marriage age patterns are presumed to be infrastructure variables like village electrification (PVE), road connectivity of villages (PVNCPR), health infrastructure variables like number of ANMs and hospital and dispensary beds per lakh population (HADBEDS), number of primary schools per lakh population (PRMSCHL). Other factors presumed to affect marriage age patterns are overall economic development (DDIO)[2], incidence of poverty (PPBPL), and extent of industrialization characterized by industrial workers as percent of main workers (IWPMW). Lastly, proportionate Muslim population (PMUS) has also been inducted as a predictor of marriage age patterns.

The second structural relation depicts that usage of contraception characterized by percent couples using family planning methods (PCUFP) is determined by all the twelve socioeconomic and cultural factors under the purview of the present study alongwith the first endogenous variable namely, PGMB18.

The third structural relation depicts the extent of utilization of antenatal care Characterised by percent pregnancies in which the antenatal care was utilized (PPANC) is determined by all the twelve socioeconomic and cultural variables alongwith marriage age patterns (PGMB18) and usage of contraception (PCUFPM).

The fourth structural relation that depicts the extent of institutional deliveries characterized by percent deliveries in health institutions (PDHI) being determined by all the predetermined variables along with marriage age patterns, contraception usage and extent of utilization of antenatal care.

The fifth structural relation depicts the extent of children's immunization characterized by percent children over age one with complete immunization (PCWCI) as being determined by all the predetermined variables alongwith the four of the endogenous variables viz. PGMB18, PCUFPM, PPANC, and PDHI.

The sixth structural relation depicts that fertility characterized by percent births of order 3+ (PBO3P) as being a function of all the five endogenous variables viz. PGMB18,

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[2] The districtwise overall economic development index (DDIO) based on twelve sectoral developmental indices, was elicited by the author for an earlier study published in Journal of Quantitative Economics and used in the World Bank study jointly with Prof. K.Srinivasan. The details on methodology etc. are available in Gulati (1996), Srinivasan (1998), Harman (1970). Some details of the methodology are also made available in Annex 2.

PCUFPM, PPANC, PDHI, and PCWCI; in the system and all the twelve predetermined variables.

The flow chart clearly reflects that fertility (PBO3+) has five endogenous predictors (five arrows from the five smaller rectangular boxes) and all the twelve exogenous variables (arrow from bigger rectangular box). Furthermore, immunization of children (PCWCI) has four endogenous variables and twelve exogenous variables as predictors. Likewise lowermost small rectangular box depicts that marriage age (PGMB18) has only all the twelve exogenous and none of the endogenous variables as predictors.

VI. PARAMETRIC ESTIMATES OF THE STRUCTURAL MODEL

Perusal of the parametric estimates in Table-2 reveals that women's empowerment enabling factors like female education (FLR) and work participation (FWPR) depict significant by inhibiting effect on lowered marriage age patterns. Alternatively, districts with higher female literacy and work participation depict higher marriage age patterns. Furthermore, infrastructure variables like road connectivity of villages (PVNCPR) and overall economic development (DDIO) characterizing higher standards of living or economic prosperity also depicts significant and positive impact on higher marriage age patterns. Interestingly, health infrastructure variables like number of ANMs and hospital and dispensary beds in districts also depict significant and positive impact on increase in marriage age patterns.

Usage of contraception (PCUFPM) seems to be significantly affected by female literacy (FLR), health infrastructure variables viz. ANMs and HADBEDS; and overall economic development (DDIO). Interestingly, we find that women's education depicts relatively much higher impact on the usage of contraception.

Utilization of antenatal care (PPANC) and contraception (PCUFPM) depict a strong and positive linkage. Alternatively, districts with couples showing a greater use of contraceptive methods also depict a higher usage of antenatal care. Amongst the predetermined variables we find that female education (FLR) and female work participation (FWPR) depict a significant and positive impact on the utilization of antenatal care. Improvement in health infrastructure facilities (HADBEDS) also depicts significant and positive impact on the utilization of antenatal care. Furthermore, we find that districts with higher economic prosperity (DDIO) also depict higher utilization of antenatal care. It is of interest to note that the women's empowerment enabling factors depict relatively stronger impact on antenatal care utilization.

Table 2: Parametric Estimates of the Recursive System's Structural Relations.

Predictor Variable	Dependent Variable					
	PGMB18	**PCUFPM**	**PPANC**	**PDHI**	**PCWCI**	**PB03+**
PGMB18		.046	.033	-.014	**-.181***	**.067***
PCUFPM			**.565***	.001	**.283***	**-.388***
PPANC				**.396***	**.306***	**-.077****
PDHI					**.127***	**-.455***
PCWCI						**-.113***
FLR	**-.449***	**.496***	**.146***	**.215***	**.083****	-.051
FWPR	**-.083***	.026	**.247***	.037	**.095***	**-.046****
PVE	.011	**.164***	-.034	.012	.005	.012
PVNCPR	**.117***	-.035	**-.104***	**-.214***	-.026	**.067***
ANMNEW	**-.122***	.063	.046	**.141***	.046	-.024
HADBEDS	**-.095***	**.125***	**.059****	**.083***	.045	.027
PRMSCHL	**-.079****	**.083***	**.056****	-.009	.042	**-.036****
IWPMW	-.005	**.063****	-.002	.025	.011	.014
PURB	**-.199***	.001	.043	**.164***	.029	**-.072***
PMUS	.015	-.032	-.001	**-.058****	-.028	**.051***
DDIO	**-.291***	**.106****	**.103***	-.055	.027	.009
PPBPL	-.042	**-.150***	**-.069****	**-.069***	-.003	**.044***
R-Square	.517	.454	.620	.729	.669	.836
* & ** Denote Significance at 1% and 5%, respectively.						

Percent deliveries in health institutions (PDHI) seem to be significantly associated with the extent of utilization of antenatal care (PPANC). Also we find that creation of health infrastructure like number of hospital and dispensary beds and number of ANMs also depict promotive impact on the utilization of delivery care from health institutions. Surprisingly, we find that districts with predominantly higher proportions of Muslim population depict significantly lower utilization of health institutions for delivery care.

Extent of children's immunization (PCWCI) seems to be significantly associated with marriage age patterns, usage of contraception, and utilization of antenatal and delivery care. Directions of linkages or effects turn out to be consistent with general expectations. Furthermore, we find that women's empowerment factors like female education (FLR) and female employment (FWPR) also depict significant and positive impact on the extent of children's immunization.

Coming to the fertility (PBO3P) equation we find that all the five endogenous variables viz. PGMB18, PCUFPM, PPANC, PDHI and PCWCI; depict significant and expected directional impacts on fertility. Alternatively, districts with higher usage of contraception, antenatal and delivery care and children's immunization depict lower levels of fertility and districts with higher percent of girls marrying below 18 years of age depict higher fertility. Furthermore, usage of contraception also depicts relatively much

higher and significant and inhibitive impact on fertility. Amongst the predetermined variables we find only extent of urbanization and primary schooling facilities depict significant and inhibitive impacts on fertility. Also we find that districts with higher proportionate population below poverty line also depict significantly higher fertility. Interestingly, we find those districts with predominance of Muslim population, despite controlling all the relevant socioeconomic and infrastructure variables, depict significantly higher fertility compared with other districts.

VII. PARTIAL AND TOTAL EFFECTS OF PREDETERMINED VARIABLES ON ENDGONEOUS VARIABLES

The direct or partial effects of the predetermined variables have been highlighted earlier while discussing the parametric estimate in the earlier section. Furthermore, the total effects of the predetermined variables elicited through estimated reduced form parameters are presented in the following Table-3.

Table 3: Partial and Total Effects of the Predetermined Variables on the Endogenous Variables in the Recursive System Model

Predictor Variable		Partial and Total Effects of Predictor Variables on					
		PGMB18	PCUFPM	PPANC	PDHI	PCWCII	PBO3P
FLR	Direct	-0.449	0.496	0.146	0.215	0.083	-0.051
	Total	**-0.449**	**0.475**	**0.399**	**0.380**	**0.469**	**-0.522**
FWPR	Direct	-0.083	0.026	0.247	0.037	0.095	-0.046
	Total	**-0.083**	0.022	**0.257**	0.140	**0.213**	**-0.168**
PVE	Direct	0.011	0.164	-0.034	0.012	0.005	0.012
	Total	0.011	**0.165**	0.059	0.036	0.072	-0.080
PVNCPR	Direct	0.117	-0.035	-0.104	-0.214	-0.026	0.067
	Total	**0.117**	-0.030	**-0.117**	**-0.262**	-0.125	**0.229**
ANM	Direct	-0.122	0.063	0.046	0.141	0.046	-0.024
	Total	**-0.122**	0.057	-0.074	**0.172**	0.129	**-0.153**
HADBEDS	Direct	-0.095	0.125	0.059	0.083	0.045	0.027
	Total	**-0.095**	**0.121**	**0.124**	**0.134**	0.151	**-0.114**
PRMSCHL	Direct	-0.079	0.083	0.056	-0.009	0.042	-0.036
	Total	**-0.079**	0.079	**0.098**	0.031	0.113	**-0.106**
IWPMW	Direct	-0.005	0.063	-0.002	0.025	0.011	0.014
	Total	-0.005	**0.063**	0.033	0.038	0.045	-0.036
PURB	Direct	-0.199	0.001	0.043	0.164	0.029	-0.072
	Total	**-0.199**	-0.008	0.032	**0.179**	0.095	**-0.177**
PMUS	Direct	0.015	-0.032	-0.001	-0.058	-0.028	0.051
	Total	0.015	-0.031	-0.018	**-0.065**	-0.054	**0.101**
DDIO	Direct	-0.291	0.106	0.103	-0.055	0.027	0.009
	Total	**-0.291**	**0.093**	**0.146**	0.007	0.151	-0.078
PPBPL	Direct	-0.042	-0.150	-0.069	-0.069	--0.003	0.044
	Total	-0.042	**-0.152**	**-0.156**	**-0.130**	-0.103	**0.183**

Marriage age patterns (PGMB18) being the first structural relation in the recursive model, would obviously depict partial and total effects being exactly same. Coming to total effects of predetermined variables on usage of contraception we find that most of the partial effects get compounded as indirect effects routed through marriage age patterns get compounded with the direct effects on usage of contraception. However, the changes are not substantial as marriage age patterns don't depict any significant impact on contraception usage.

Total effect of female literacy on utilization of antenatal care (PPANC) gets compounded and becomes significantly higher (0.399) compared with its partial effect (0.146), as its indirect effects routed through marriage age and especially contraception usage, which bear significant effect on antenatal care. Similarly we find that total impacts of female work participation (FWPR), road connectivity of villages (PVNCPR), hospital and dispensary beds (HADBEDS), and overall economic development (DDIO) turn out to be much higher compared to their direct effects.

Coming to total effects on institutional delivery we find that total impact of female literacy (FLR) turns out to be substantially higher (0.380) compared with its direct effect (0.215). Furthermore significant direct effects of road connectivity, number of ANMs and hospital beds (HADBEDS) and extent of urbanization (PURB) also get compounded because of the indirect effects routed through other endogenous variables. Furthermore, we find that total effects of Muslim predominance in districts also get compounded and thus the total inhibited effect on institutional delivery (-0.065) is much higher than the partial or direct effect (-0.058).

Childcare characterized by percent children with complete immunization (PCWCI) gets significantly affected by female empowerment characteristics like female education (FLR) and female work participation (FWPR). Furthermore, we find that total effects of these variables are much higher compared with their direct effects on children's immunization. Total effect of female literacy (FLR) is substantially higher (.469) compared with its partial effect (.083). Thus, the indirect effects of female literacy on child care routed through other endogenous variables like marriage age patterns, contraception usage, antenatal and delivery care turns out to substantial resulting into much higher total effect on children's immunization.

Coming to fertility (PBO3P) we find that total inhibitive effect of female education (-0.552) is substantially higher than its direct effect (-0.051). Furthermore, women's employment also depicts much higher inhibitive total impact (-0.168) compared with its direct effect (-0.046). Similarly we find that extent of urbanization (PURB) depicts much higher total effect (-0.177) compared with its direct effect (-0.072) on fertility. Interestingly, we find that districts with higher Muslim proportionate populations depict much higher promotive total impact (0.101) compared with the direct effect (0.051) on fertility. Alternatively, the indirect effects of lower marriage age patterns and contraception usage, lower utilization of antenatal and delivery care, and children's immunization amongst the Muslim population also seem to generate a substantial promotive impact on their fertility. Incidence of poverty also depicts substantially higher

inhibitive impacts on antenatal (-0.156) and delivery care (-0.130) and promotive impact on fertility (+0.183) compared with its direct effects on these RCH and fertility characteristics. Similarly we find poverty depicts significant and inhibitive impact on contraception usage (-0.152). It may be of interest to mention that poverty depicts total promotive impact on fertility (0.183) being substantially higher than its direct effect (0.044) as its indirect effects routed through other endogenous variables are substantial. Thus, overall we find that poverty depicts inhibitive effects on contraception usage, antenatal and delivery care and promotive impact on fertility.

VIII. SUMMARY AND CONCLUDING REMARKS

The recursive model comprising six structural linkages integrating the RCH components and fertility as endogenous variables was formulated in the study. The endogenous variables in the recursive structural model comprise marriage age patterns (PGMB18), contraceptive methods usage (PCUFPM), percent pregnancies in which antenatal care was utilized (PPANC), percent deliveries in the health institutions (PDHI), percent children aged one and above who got completely immunized (PCWCI) and percent births of order three and higher (PBO3P). The structural system comprised twelve predetermined variables like women's empowerment enabling factors like female education (FLR) and employment (FWPR), health and educational infrastructure variables like number of hospital and dispensary beds (HADBEDS) and schools (PRMSCL) per *lakh* population, extent of village electrification (PVE) and road connectivity (PVNCPR), overall extent of urbanization (PURB), extent of industrialization (IWPMW), overall economic development (DDIO), and cultural variable like percent Muslim population (PMUS) in the district. The detailed description and descriptive statistics of the district-wise indicators is furnished in the Appendices.

Strong inter-linkages between poverty, fertility, usage of contraception, marriage age patterns, utilization of RCH care viz. antenatal and delivery care, and children's immunization are discerned in the study. Relative significance of usage of contraception, institutional deliveries and children's immunization towards fertility reduction are much higher compared with other endogenous variables. Thus, with twin objectives of improvement in the quality of life and fertility reduction we need simultaneous concerted efforts to promote usage of quality contraceptives, institutional deliveries and children's immunization.

Women's empowerment enabling factors, especially female education and employment, are discerned to play important role towards utilization of RCH quality care package in India as depicted through their all pervasive effects on promotion of higher marriage age patterns, usage of contraception, utilization of antenatal and delivery care. Women's empowerment was also placed in the center stage in the International Conference on Population and Development held in Cairo in 1994, after which paradigm shifts in India's population policy also got documented in the National Population Policy. Thus, women's empowerment can facilitate wider usage of RCH quality care and also fertility reduction.

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APPENDICES

ANNEX-1

Table A-1: Description of Variables in the Structural Model And Sources of Data

Abbreviated Name	Description of the Variable and Source of Data
PGMB18	Percent Girls Married Before 18 Yrs of Age (RCH)
PCUFPM	Percent Couples Using Family Planning Methods (RCH)
PPANC	Percent Pregnancies In Which Antenatal Care Was Used (RCH)
PDHI	Percent Deliveries in Health Institutions (RCH)
PCWCI	Percent Children 12-36 Months Old With Complete Immunization (RCH)
PBO3P	Percent Births During Last 3 Yrs. Of Order 3+ (RCH)
FLR	Female Literacy Rate (Census 2001)
FWPR	Female Work Participation Rate (CMIE)
PVE	Percent Villages Electrified (CMIE)
PVNCPR	Percent Villages Not Connected By Pucca Road (PC, 2001)
ANM	Auxiliary Nurse Midwives Per Lakh Population (CMIE)
HADBEDS	Hospital and Dispensary Beds Per Lakh Population (CMIE)
PRMSCL	Primary Schools Per Lakh Population (CMIE, 2000)
IWPMW	Industrial Workers As Percent of Main Workers (CMIE, 2000)
PURB	Percent Urban (Census)
PMUS	Percent Muslim Population (Census)
DDIO	District's Development Index (Gulati, 1996))
PPBPL	Percent Population Below Poverty Line (Gulati, 1996)

ANNEX 2

METHOD OF COMPUTING DISTRICT DEVELOPMENT INDICES

Development being a multi-dimensional phenomenon is difficult to capture by any single development indicator. Most often, per capita income is suggested as an overall measure of economic development. This measure of development has often been subjected to lot of criticism for its inherent limitations and accounting problems in the Indian context (Gopalaswamy, 1983). Nevertheless, the non-availability of even such a limited measure of development at the district level constrains us in investigating the linkages between development and demographic patterns.

Furthermore, sectoral aspects of economic development may depict varied linkages with the demographic parameters. Thus, a truer nature of linkages between different demographic parameters and varied composition of gross domestic product or labor force would also be worthwhile to investigate. For the purpose, this study has elicited district level economic developmental indicators highlighting sectoral aspects of economic development. The database on developmental indicators is primarily drawn from the Center for Monitoring Indian Economy district level indicators. Data on 14 such

developmental variables for all the districts of India have been drawn from the CMIE reports. Districts in Assam, Arunachal Pradesh, Manipur, Tripura, Sikkim, etc. in the Northeastern region, got excluded because of non-availability of the data.

A vector of fourteen developmental indicators is selected to highlight the aggregate and sectoral aspects of districtwise economic development. Basic indictors are selected to reflect the sectoral aspects of development, viz. agricultural, manufacturing and tertiary, at the district level.

Table A2.1. Description the Variables used in the Development Indices

Abbreviated Name	Description of the Variable
Agricultural Characteristics	
PNASGA	Percent Net Area Sown to Total Geographical Area
PGIAGCA	Percent Gross Irrigated Area to Gross Cropped Area
PHFC	Per Hectare Fertilizer Consumption of Gross Cropped Area
PCFP	Per Capita Food Production (‘000 Kg.)
ANR	Annual Normal Rainfall (Mms)
Industrial Characteristics	
PVE	Percent Villages Electrified
EHHIPLP	Employment in Household Industry per Lakh Population
ADEFPLP	Average Daily Employment in Factories Per Lakh Population
PCBCAI	Per Capita Bank Credit to All Industries
Tertiary Sector Characteristics	
BOPLP	Bank Offices Per Lakh Population
PCBD	Per Capita Bank Deposit
PCBASS	Per Capita Bank Advances to Service Sector
LITPTP	Literate as percent of Total Population
URBPTP	Urban Population as Percent of Total Population

Factor scores are elicited for all the districts depicting underlying sectoral dimensions of development and thereby the factor scores for overall economic development are also elicited by a weighted average of the sectoral aspects of development. A brief description of the Varimax rotated factor structure of the 14 underlying development indicators and weighted index to elicit overall economic development at district level is provided in an earlier study (Gulati, 1996).