FERTILITY, MCH-CARE AND POVERTY IN INDIA: SIMULTANEOUS STRUCTURAL ANALYSIS

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ABSTRACT: The study highlights interlinkages amongst district level fertility, mother and child health care utilization (MCH-care) and poverty and relevant socioeconomic, demographic and cultural factors through factorial investigations Thereby, the study formulates a simultaneous structural model with fertility, mother and child health care utilization and extent of poverty as endogenous variables and nine of the crucial socioeconomic variables and contraception usage as exogenous variables to the system. The parametric estimates by 3SLS estimation procedure of the system model are based on data from 593 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), Census, 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, mother and child health care utilization and poverty levels at the district level. The elicited parametric estimates also facilitate prioritization of some policy variables towards rapid population stabilization process in India.

Keywords: Poverty, Mother and Childcare, Fertility, Contraception, Simultaneous Structure System

I INTRODUCTION

Theoretical and empirical literature highlights linkages amongst fertility, mother and child health care (MCH-Care) utilization, and extent of poverty, usage of contraception, marriage-age patterns, and some selected socioeconomic and cultural factors. The present study highlights such interlinkages through factor analysis. The factor analysis further facilitates formulation of the simultaneous structural system through selection of the interwoven structural variables. The analysis facilitated the formulation of the simultaneous structural system with fertility, MCH-care utilization and poverty as endogenous variables while nine socioeconomic and demographic variables like contraception usage, marriage age patterns, female literacy and employment, availability of health functionaries, extent of rural-road network, 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 a vicious circle. These aspects of interlinkages also get highlighted in the present study through factorial investigations and structural formulation of the model.

The parametric estimates of the structural model also facilitate highlighting the strength of linkages and also facilitate in prioritization of socioeconomic and demographic factors towards containment of fertility and increasing MCH-care

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utilization, which are important for quickening the process of population stabilization in the long run. A comprehensive population policy for cost-effective achievement of the short, medium and long run policy objectives such as 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 highlight interlinkages amongst basic socioeconomic and demographic variables through factorial investigation and thereby formulate a simultaneous structural system to highlight often brought out vicious circles or circular linkages between fertility, MCH-care, poverty, contraception, women's education and empowerment, etc. Thereby the structural estimates by the system method of estimation of three stage least squares (3SLS) would facilitate highlighting the strength of the linkages. 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 partial and total effects of the exogenous or predetermined socioeconomic, contraception usage, marriage age patterns, health and education infrastructure variables, etc. on the endogenous variables in the structural system. The structural estimates and the effects would facilitate prioritization of the alternate socioeconomic and demographic factors to be focused upon towards a cost effective achievement of the population policy objectives.

III METHODOLOGY

The interlinkages amongst selected variables under the purview of the present study are highlighted through factorial investigations. Formulation of the simultaneous structural system and thereby parametric estimates of the structural coefficients are elicited using the 3SLS system method of estimation. Thereby partial and total effects of the predictor or predetermined variables on the endogenous variables are elicited from the reduced form of the structural system.

III.1 SIMULTANEOUS STRUCTURE MODEL

A General Notation for Linear Simultaneous Equations Model is as follows:

$$\gamma_{11} y_{t1} + \gamma_{21} y_{t2} + \cdots + \gamma_{M1} y_{tM} + \beta_{11} x_{t1} + \cdots + \beta_{k1} x_{tk} = \varepsilon_{t1},$$

$$\gamma_{12} y_{t1} + \gamma_{22} y_{t2} + \cdots + \gamma_{M2} y_{tM} + \beta_{12} x_{t1} + \cdots + \beta_{k2} x_{tk} = \varepsilon_{t2},$$

$$\vdots$$

$$\gamma_{1M} y_{t1} + \gamma_{2M} y_{t2} + \cdots + \gamma_{MM} y_{tM} + \beta_{1M} x_{t1} + \cdots + \beta_{kM} x_{tk} = \varepsilon_{tM},$$

There are M equations for M endogenous variables, denoted $y_1, \ldots, y_M$. There are K exogenous variables, $x_1, \ldots, x_K$. The first element of x_t will usually be the constant i.e. 1. Finally, $\varepsilon_{t1}, \ldots, \varepsilon_{tM}$ are the structural disturbances. The subscript t will be used to index observations, $t = 1, \ldots, T$.

In matrix terms, the system may be written

$$\begin{bmatrix} y_1 & y_2 & \cdots & y_M \end{bmatrix}_t \begin{bmatrix} \gamma_{11} & \gamma_{12} & \cdots & \gamma_{1M} \\ \gamma_{21} & \gamma_{22} & \cdots & \gamma_{2M} \\ & & \vdots & \\ \gamma_{M1} & \gamma_{M2} & \cdots & \gamma_{MM} \end{bmatrix}$$

$$+ \begin{bmatrix} x_1 & x_2 & \cdots & x_k \end{bmatrix}_t \begin{bmatrix} \beta_{11} & \beta_{12} & \cdots & \beta_{1M} \\ \beta_{21} & \beta_{22} & \cdots & \beta_{2M} \\ & & \vdots & \\ \beta_{k1} & \beta_{k2} & \cdots & \beta_{kM} \end{bmatrix} = \begin{bmatrix} \varepsilon_1 & \varepsilon_2 & \cdots & \varepsilon_M \end{bmatrix}_t$$

or

$$y_t'\Gamma + x_t'B = \varepsilon_t'.$$

The solution of the system of equations determining y_t in terms of x_t and ε_t is the reduced form of the model would be as follow:

$$y_t' = \begin{bmatrix} x_1 & x_2 & \cdots & x_k \end{bmatrix}_t \begin{bmatrix} \pi_{11} & \pi_{12} & \cdots & \pi_{1M} \\ \pi_{21} & \pi_{22} & \cdots & \pi_{2M} \\ & & \vdots & \\ \pi_{k1} & \pi_{k2} & \cdots & \pi_{kM} \end{bmatrix} = \begin{bmatrix} v_1 & \cdots & v_M \end{bmatrix}_t$$

$$= -x_t'B\Gamma^{-1} + \varepsilon_t'\Gamma^{-1}$$

$$= x_t'\Pi + v_t'.$$

The reduced-form parameters, coefficients of π, 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. DATA BASE OF THE STUDY

District level data base of the study is drawn from alternate sources such as most of the fertility, contraception usage, MCH care indicators, are drawn from the DLHS-RCH surveys conducted by several consulting organizations monitored by the International Institute for Population Sciences. District level data on female literacy and employment, extent of urbanization, percent Muslim population, etc. has been drawn from Census reports of 2001 census. Data on health infrastructure and health functionaries are drawn from CMIE, 2000. District level development and mother and childcare composite indices have been drawn by factor analytical techniques. The details of the selected variables and sources of information are provided in the Appendices.

Development being a multi-dimensional phenomenon is difficult to be captured even by a catchall variable like per capita income, which is also not available at the district level in India. The causal factors for poverty in different regions could be different. Numerous possible factors could be difficult terrain, adverse soil conditions like desert or infertile soil, non-conducive agro-climatic factors like scarcity of water, scanty rainfall, non-availability of irrigational sources, inaccessibility to technological innovation, etc. for lack of agricultural development. Similarly, sectoral aspects of development for agricultural, industrial or tertiary level sectors may also entail factors like lack of infrastructure facilities such as roads, railways, electricity, banking sector network, telecommunications, etc. Even income inequality in a region could also be a causal factor for widespread poverty in the region. Thus, sectoral as well as overall economic developmental aspects at the district level had been elicited using a factor analytical technique in an earlier study using these sectoral aspects of development (Gulati, 1996). Furthermore, the percent population below poverty level for districts has also been utilized in the study to reflect the extent of socioeconomic backwardness at the district level (CMIE, 2000).

V. LINKAGES AMONGST FERTILITY, MCH-CARE, POVERTY AND OTHER SOCIOECONOMIC FACTORS

The following table-1 provides the Varimax rotated factor structure of the selected variables in the study. Perusal of the table 1 reveals that fertility (PBO3+), contraception usage (PCUFPM), marriage age patterns (PGMB18), mother and child health care (MCH3)[2] utilization, female literacy (LITF) and women's empowerment indices (FMLITRAT)[3] are depicted to be strongly interconnected as the factor loadings of all the variables on the first factor are relatively much higher. The direction of linkages is also consistent with the general expectations such as districts with higher utilization of MCH-

[2]The district level MCH3 indices are the factor scores based on the Principal Component Analysis of three RCH indices viz. %women with pregnancies over last three years using antenatal care using antenatal care, percent deliveries over last three years in health institutions and percent children between 1-3 years with complete immunization. The component's weights were .931, .907 and .896 for the three RCH components, respectively.

[3] Ratio of female to male literacy is hypothesized to capture the extent of women empowerment.

care and higher utilization of contraception usage depicts lower fertility. Furthermore districts with lower age at marriage patterns or higher ratios of females marrying less than 18 years of age also depict higher fertility. Female literacy and female empowerment depict negative association with the fertility and marriage age patterns, and positive linkages with contraception usage and mother and child heath care utilization. Overall economic development (DDIO)[4] also depicts relatively stronger linkages with demographic and MCH-care utilization factors.

Table 1: Varimax Rotated Factor Structure of the Selected Variables

Variable	Factors				Communality
	I	II	III	IV	
PBO3PN	**-.865**	-.175	.034	.195	.818
PGMB18	**-.618**	-.235	-.324	-.147	.564
PCUFPM	**.832**	.055	-.092	-.209	.747
MCH3	**.808**	.346	-.025	-.134	.791
PFLIT	**.694**	.492	.088	.055	.734
FMLITRAT	**.653**	.537	.140	.091	.742
PFWMAIN	.251	**.866**	.022	-.164	.841
PFWMAR	-.133	**-.888**	-.020	.162	.840
HADBEDS	**.436**	.350	.124	.318	.429
PHCS	-.018	-.087	.223	**.594**	.411
ANM	.402	**.452**	.440	.132	.577
PVNCPR	**-.510**	-.218	.395	-.147	.486
PVELEC	.276	.286	-.259	-.249	.287
PPBPL	-.287	.029	**.663**	.055	.525
DDIO	**.567**	.429	-.115	.166	.546
PURB	.301	**.669**	-.129	.105	.566
PFSRTI	-.288	.034	**-.696**	.032	.570
PMUS	-.064	-.012	-.364	**.702**	.630
Eigen-value	4.733	3.374	1.713	1.283	

Note: Description of the Variables is provided in Appendices

Second factor structure depicts that female employment viz. percent woman as main workers (FWMAIN) and marginal workers (FWMAR) depict close linkages with female literacy, MCH-care utilization and extent of urbanization at the district level. Furthermore female employment in the category of main workers seems to be higher in urban compared to rural areas. Furthermore, availability of health functionaries (ANM) also depicts positive association with mother and childcare utilization.

Perusals of the third and fourth factor structures reveals that lower age at marriage patterns are positively associated with higher incidence of RTIs/STDs amongst females. Interestingly, districts with better health infrastructure characterized by higher number of

[4] DDIO is an overall economic development index for each district based on 14 sectoral aspects of development viz. agricultural, industrial and tertiary sectors; elicited in an earlier study (Gulati, 1996)

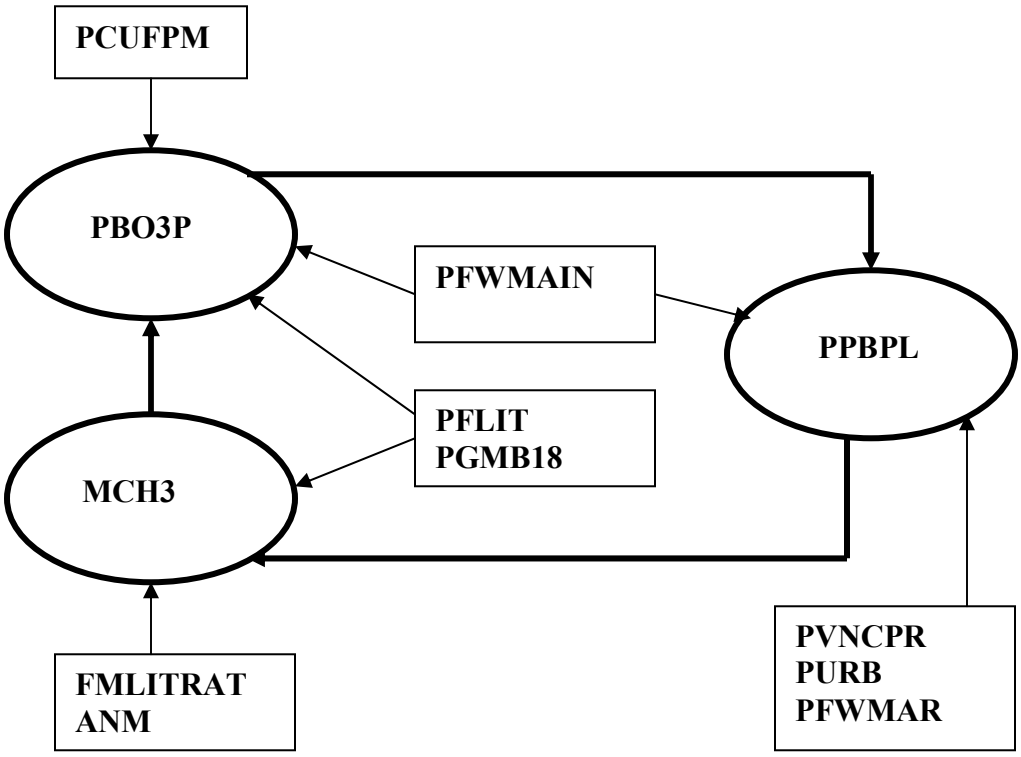
ANMs and better road connectivity (PVNCPR) depict lower incidence of reproductive tract infections amongst women.

The last column of communalities reveals that most of the socioeconomic and demographic variables under the purview of the present study can be well represented by the four factors. Furthermore, the semi-quantitative insights into the interlinkages facilitate formulation of the structural model in the following section.

VI. STRUCTURAL FORMULATION OF THE MODEL

The functional forms of the three structural relations for the three endogenous variables viz. fertility (PBO3), mother and child health care utilization (MCH-3) and extent of poverty (PPBPL); become clear from the following Flow Chart in Fig-1. The nine exogenous variables in the system are usage of contraception (PCUFPM), marriage age (PGMB18), female literacy (LITF), and female employment as main and marginal workers (FWMAIN and FWMAR), number of ANMs per lakh population (ANM), rural-road networking (PVNCPR) and extent of urbanization (URBP).

Fig-1: Flow Chart of the Simultaneous Structural System



The first structural relation depicts that fertility (PBO3P) is affected by the utilization of MCH-care, usage of contraception, marriage age patterns, female literacy and employment.

The second structural relation depicts Utilization of mother and child health care (MCH3) is affected by extent of poverty and availability of health personnel like ANMs. Furthermore, the utilization also depends upon extent female education and empowerment. Still further we expect the marriage age patterns also affect the utilization.

The last structural relation depicts that extent of higher fertility also contributes to higher incidence of poverty. The cause and effect relationship between poverty and fertility has drawn lot of attention over the recent past (Srinivasan, 2006). Furthermore, lack of female employment in the category of main as well as marginal workers also contributes towards lack of economic development or incidence of poverty. Still further, the extent of rural infrastructure development in terms of road connectivity and extent of urbanization also affects the levels of poverty.

VII PARAMETRIC ESTIMATES OF THE STRUCTURAL COEFFICIENTS OF THE MODEL

The parametric estimates of the structural coefficients of the simultaneous equation system by the three stage least squares system method is provided in the following Table-2.

Table 2: The 3SLS Estimates of the Structural Coefficients of the Model

	PBO3P		**MCH3**		**PPBPL**	
Variable	**Structural Coeff.**	**Signifi-cance.**	**Structural Coeff.**	**Signifi-cance.**	**Structural Coeff.**	**Signifi-cance.**
Constant	**50.596**	0.00	**7.454**	.00	**40.346**	.00
PBO3P					**.330**	.00
MCH3	**-9.162**	.00				
PPBPL			**-.145**	.00		
Exogenous						
PGMB18	**.037**	.03	-.001	.22		
PCUFPM	**-.264**	.00				
PFLIT	**-.079**	.02	**.023**	.00		
FMLITRAT			**.015**	.02		
PFWMAIN	-.002	.94			**-.057**	.02
PFWMAR					-.009	.71
ANM			.001	.81		
PVNCPR					**.025**	.02
PURB					.005	.29
N=593						

Perusal of the parametric estimates of the structural coefficients of fertility (PBO3P) in Table 2 reveals that utilization of the MCH-care, which was based on the extent of utilization of antenatal institutional-delivery care and children's immunization; depicts significant inhibitive impact on fertility. Alternatively, the MCH-care obviously affects maternal and child mortality and which in turns has often been viewed to be important determinants of fertility. Thus, accessibility and affordability of MCH-care would certainly facilitate fertility reduction. Furthermore, we find that proximate determinants like higher marriage-age patterns and contraception usage also depict significant inhibitive impact on fertility. Still further we find that female literacy also depicts significant inhibitive impact on fertility.

The parametric estimates of the second structural relation reveals that the extent of poverty (PPBPL) in the region significantly affects utilization of MCH-care (MCH3) in a district. Thus, alleviation of poverty being an ideal goal by itself as a welfare measure for the society also helps in better utilization of MCH-care, which in turn was found to have significant inhibitive impact on fertility. Thus poverty alleviation not only helps towards better health of women and children but also lowers fertility. An interesting document by UNFPA elaborated on the strategy towards alleviation of poverty through utilization of RCH care (UNFPA, 2003). Possibly the cause and effect relation between RCH-care and poverty alleviation would be difficult to establish, but certainly the two; alleviation of poverty and RCH-care or MCH-care utilization; seems to reinforce each other. Furthermore, we find that female literacy (PFLIT) as well as female empowerment (FMLITRAT) depicts significant positive impact on the MCH-care utilization.

The last structural relation estimates reveal that the extent of fertility depicts significant positive impact on the incidence of poverty in a district. Alternatively, fertility reduction in a region indirectly helps people in poverty reduction too. Furthermore, we find that female employment whether in the category of main or marginal workers, helps towards poverty alleviation. However, female employment in the category of main workers is discerned to help significantly in poverty reduction. Still further, we find that rural road no-connectivity (PVNCPR) also enhances the poverty in the region.

VIII PARTIAL AND TOTAL EFFECTS OF PREDETERMINED VARIABLES ON ENDOGENOUS VARIABLES

The direct or partial effects of the predetermined variables have been highlighted earlier while discussing the parametric estimates of the structural coefficients of the Model 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.

It may of interest to mention that total effects elicited out of the reduced form of the model depict that all the total effects of significant exogenous variables in each structural relation has come out to be much more pronounced compared with their partial effects. Such as the total effect of marriage age patterns (PBMB18) on fertility has gone up from .037 to .082, almost more than double. Similarly, we find that total effect of contraception usage on fertility has enhanced to -.470 compared with its partial effect of

-.264. Total inhibitive effect of female literacy on fertility has increased tremendously from just .079 to 1.782. Also we find that the total effects of female education and female empowerment are much higher compared with their partial/direct effects on mother and childcare utilization. Still further, we find that total effect of rural road networking on extent of poverty is also much more pronounced compared with its partial/direct effect. Thus, overall we find that because of the circular linkages amongst the endogenous variables in the system the total effects of almost all the exogenous variables on the endogenous variables have increased substantially.

Table 3: Partial and Total Effects of Exogenous Variables on Endogenous Variables

Exogenous Variable	Endogenous Variable					
	PBO3P		MCH3		PPBPL	
	Partial	Total	Partial	Total	Partial	Total
PGMB18	**.037**	**.082**	-.001	-.005		.027
PCUFPM	**-.264**	**-.470**		.022		**-.155**
LITF	**-.079**	**-1.782**	**.023**	**.108**		**-.588**
FMLITRAT		**-.245**	**.015**	**.027**		-.081
FWMAIN	-.002	**-.138**		.015	**-.057**	**-.103**
FWMAR		-.021		.002	-.009	-.016
ANM		-.016	.001	.002		-.005
PVNCPR		.059		-.006	**.025**	**.045**
URBP		.012		-.001	.005	.009

Interestingly, we find that female literacy seems to have all pervasive effects and turn out to be most important towards fertility containment, mother and childcare utilization and poverty alleviation. Furthermore we find that usage of contraception depicts much stronger impact on fertility reduction compared with female employment or empowerment. Toward prioritization of alternate predictor variables under the purview of the study we find that female education, contraception usage, female employment and then marriage age play important role towards fertility reduction.

Coming to mother and child health care (MCH3) we find that female literacy and female employment empowers them to make decisions towards availing of the MCH care, which certainly helps towards improvement in their well-being and also fertility curtailment.

Towards poverty alleviation we find that female education and employment in the category of main workers helps towards reduction in the extent of poverty. Also we find that improvement in the rural road infrastructure also helps in economic development or poverty alleviation. It may be of interest to mention that even the usage of contraception depicts relatively much higher total effect towards poverty reduction. Possibly, usage of contraception reduces the family size and thus with limited resources better living standards can be provided because of higher allocation towards the welfare of the limited family members and thus poverty alleviation objective can also be met indirectly.

It may be of interest to look into the joint effects of contraception and mother and childcare utilization on fertility reduction as often it is being debated that provision of quality RCH care and its utilization would automatically motivate people to adopt contraception for limiting their family size.

IX INTERACTION EFFECTS OF CONTRACEPTION AND MCH-CARE ON FERTILITY

Possibly it is high time to get into debate over interaction effects of family planning programme efforts and socioeconomic development process towards population control and accelerated population stabilization goals. There are enough theoretical and empirical evidences which depict that informed choice, availability, accessibility and affordability of quality contraception can also lead to improvements in the living standards, education of children and health of all family members and serve as a catalyst to accelerate economic growth and poverty reduction and thus fertility reduction and population stabilization. Success of family planning programs in Thailand, Indonesia, Colombia, and most recently in Bangladesh, the family planning community came to realize that contraception itself might the most effective means of improving maternal and child health (Philip D. Harvey, 1996). One can't deny the benefits of contraceptive usage resulting into limited family and thus substantial reproductive and general health benefits provided to small family size members by head of the household even with limited resources available for the purpose. One can get into the issues of interactions between lower fertility, higher usage of contraception, better health and childcare facilities, lowered infant and maternal mortality and morbidity, higher economic productivity, better standards of living, etc.

Parametric estimates of the multiple regression equation for fertility (PBO3P) on contraception usage, marriage age patterns, mother and childcare utilization and other crucial socioeconomic variables are provided in the following Table 4.

Table 4: Parametric Estimates of Multiple Linear Regression Models for PBO3P

Predictor Variable	Model 1			Model 2		
	Coeff.	Standardized Coeff.	Significance	Coeff.	Standardized Coeff.	Significance
Constant	**52.976**		**.00**	**49.781**		**.00**
PCUFP	**-.276**	**-.348**	**.00**	**-.199**	**-.251**	**.05**
PGMB18	**.042**	**.061**	**.01**	.075	.109	.09
MCH3	**-7.982**	**-.600**	**.00**	**-4.633**	**-.348**	**.00**
PFLIT	**-.112**	**-.130**	**.02**	-.134	-.157	.12
FMLitRatio	-.094	-.090	.09	-.049	-.047	.38
PPBPL	**.053**	**.058**	**.00**	**.043**	**.048**	**.02**
PCUFPM*PGMB18				-.001	-.053	.38
PCUFPM*MCH3				**-.071**	**-.251**	**.01**
PCUFP*PFLIT				.001	-.138	.41
R-Square	**.793**			**.801**		

Perusal of parametric estimates of Model 1 in Table 4 reveals that almost all the coefficients pertaining to contraception usage, marriage age patterns, mother and childcare utilization, female literacy, and percent population below poverty line depict significant effects on fertility and in expected directions. In order of priority of the significant variables towards their impact on fertility we can observe from the standardized coefficients that utilization of MCH-care (MCH3) and contraception usage play most roles towards fertility curtailment. Next in terms of priority we find that female education and marriage age play important roles in fertility reduction.

Coming to Model 2 in Table 4 we find that interaction effects of contraception together with utilization of mother and childcare depict much stronger inhibitive impact on fertility. The magnitudes of the standardized regression coefficients reveal that apart from significant inhibitive effects of contraception usage and mother and childcare utilization we find that their joint/interaction effect (PCUFPM*MCH3) turns out to be highly significant. Clearly the joint effect of MCH quality care and usage of contraception would bring about faster pace of decline in fertility and thus would accelerate the process of population stabilization in India. Thus, relegating contraception to the back burner compared with RCH-care would slow down the process of fertility reduction and population stabilization in India.

National and international situations provide sufficient evidence to such interactions where contraception coupled with alternate socioeconomic factors have played crucial role toward fertility regulation. Hitherto, the usage of contraception along with alternate combinations of socioeconomic and political factors like health and education, women empowerment, political commitment, better governance, etc. have played important role towards fertility reduction and population stabilization process in different regions/states of India. Thus, we need to adopt a holistic approach on according equal importance to contraception together with other socioeconomic and RCH care utilization programme efforts for accelerating the population stabilization process in India.

X SUMMARY AND CONCLUDING REMARKS

The simultaneous structural model comprising three structures pertaining to three endogenous variables viz. fertility (PBO3P), MCH-care (MCH3) and poverty (PPBPL); together with nine exogenous variables viz. contraception usage, marriage age patterns, female literacy and empowerment, extent of female employment in the categories of main and marginal workers, availability of health functionaries, no rural road connectivity and extent of urbanization; has been formulated based on the semi-quantitative insights drawn from the factor analysis of much larger set of variables under the purview of the present study. The parametric estimates of the structural coefficients are elicited by system method of estimation of 3SLS based on data for 593 districts of India from alternate sources like DLHS-RCH, CMIE, Planning Commission, author's earlier studies.

Strong inter-linkages between fertility, MCH-care utilization and poverty got reflected in the factorial investigation and linkages with other crucial variables like contraception usage, marriage age patterns, female literacy and employment, availability of health functionaries like ANMs, rural road infrastructure, etc. also got discerned. Thereby formulation and estimation of simultaneous structural system facilitated highlighting partial and total effects of the exogenous variables on the endogenous variables of the system and thus facilitated prioritization of alternate factors towards fertility reduction, MCH-care utilization and poverty alleviation.

It may of interest to mention that total effects elicited out of the reduced form of the model depict that all the total effects of significant exogenous variables in each structural relation has come out to be much more pronounced compared with their partial effects.

Towards fertility reduction we find female literacy and contraception usage depict much stronger impact compared with other variables under the purview of the study. Thereby we find female employment and empowerment also play crucial role towards fertility reduction. Coming to mother and child health care (MCH3) we find that female literacy and female employment empowers them to make decisions towards availing of the MCH care, which certainly helps towards improvement in their well-being and also fertility curtailment. Female education and employment in the category of main workers reduce the extent of poverty in a district again. Also we find that usage of contraception also helps indirectly towards poverty alleviation due to reduced fertility. Alternatively, usage of contraception reduces the family size and thus with limited resources better living standards can be provided because of higher allocation towards the welfare of the limited family members. Better road connectivity of villages in India also helps towards poverty alleviation objectives.

The joint effects of contraception together with utilization of mother and childcare depict much stronger inhibitive impact on fertility. Clearly the interaction effect of MCH quality care and usage of contraception would bring about faster pace of decline in fertility and thus accelerate the process of population stabilization in India**.**

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APPENDICES

Table A-1. Description of the Variables under Study

Variable's Abbreviation	Description of the Variable and Source of Data
PBO3PN	Percent Births of Order 3 plus (DLHS- RCH, 2002)
PGMB18	Percent Girls Married Before Age 18 (DLHS- RCH, 2002)
PCUFPM	Percent couples using family planning method (DLHS- RCH, 2002)
MCH3	Mother and Childcare index based on 3 indicators (Gulati, 2005)
LITF	Percent Females Literate (Census 2001)
FMLITRAT	Female to male literacy ratio (Census 2001)
FWMAIN	Female Main Workers (Census 2001)
FWMAR	Female Marginal Workers (Census 2001)
HADBEDS	Hospital Beds Per Lakh population (CMIE, 2002)
PHCS	Primary Health Centers (CMIE)
ANM	Auxiliary Nursing Midwives (CMIE)
PVNCPR	Percent Villages not connected by pucca road (CMIE, 2002)
PVELEC	Percent Villages Electrified (CMIE, 2002)
PPBPL	Percent Population Below Poverty Line (Gulati, 1998)
DDIO	District's Overall Development Index (Gulati, 1996)
URBP	Percent Urban Population (Census 2001)
PFSRTI	Percent Female Suffering from RTIs/STDs (DLHS-RCH, 2002)
PMUS	Percent Muslim Population (Census 2001)

Table A-2: Descriptive Statistics of the Selected Variables.

Variable	Minimum	Maximum	Mean	Std. Deviation
PBO3PN	1.90	73.7	44.25	13.31
PGMB18	0.00	84.00	35.60	19.25
PCUFPM	1.70	83.70	44.78	16.79
MCH3	-1.74	2.19	0.00	1.00
LITF	18.49	96.06	53.14	15.53
FMLITRAT	39.49	109.94	69.47	12.63
FWMAIN	13.22	94.79	55.20	16.78
FWMAR	5.21	89.25	46.30	17.06
HADBEDS	7.66	366.98	74.50	50.75
PHCS	0.52	34.91	2.84	1.58
ANM	3.37	456.53	101.84	63.35
PVNCPR	0.00	89.62	36.75	27.21
PVELEC	10.57	156.96	87.51	13.59
PPBPL	7.00	99.00	32.15	14.65
DDIO	-1.10	4.00	0.01	0.59
URBP	1.20	100.00	24.21	19.47
PFSRTI	0.10	86.50	28.45	12.50
PMUS	0.04	94.31	10.74	10.92
N=593				