

EFFECTS OF SOCIO – ECONOMIC FACTORS ON CHILDREN EVER BORN USING PATH ANALYSIS

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1. Introduction

Indian population is rich and diverse in nature. The population strength of our country is the backbone of our country. India's population is growing at a rate of 1.2% and expected to surpass China by 2025. To find out the true demographic change it is necessary to study the macroeconomic determinants of all its factors like population, size, density, fertility growth, mortality, age, sex, income, household size, urbanization and religion. Demographic analysis relies on large data sets over long periods of time and is required to develop trends in demographic indicators. Most of the countries show rapid population growth and some of the countries are facing the problems of negative growth. The mechanism of factors affecting fertility is that intermediate variables influence fertility directly, while socio-economic & environmental variables, macro-economic variables affect fertility indirectly through intermediate variable. (Davis & Blake, 1956, Bongarts al 1978). This study seeks to examine the direct, indirect and joint effects of selected macro-economic variables on fertility through the technique of path analysis.

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2. Data and Methodology

2.1 Variables and their measure:

In this study the dependent variable is the number of children ever born (CEB) to women reaching the end of their reproductive period between 15 to 49 years. The independent variables considered are percentage of population living in urban areas, Average household size, per capita income (in rupees), population density per square kilometre, Female literacy rate defined as the percentage of females aged less than 15 years and more than 60 years who knows how to read and write proportion of people living below poverty line and work participation rate which is the percentage of total workers (main and marginal) to total population..

2.2 Data Source: The data on the explanatory variables are obtained from census 2011 on Indian states and union territories. From the census 2011 it is found that Delhi has the highest percentage of urban population while it is lowest in Himachal Pradesh. Per capita income across the state varies from Rs 22890 to Rs 1, 73,686. Also Delhi has the highest population density and Arunachal Pradesh has the lowest population density. The percentage of dependent population is more in Bihar (85.54%) and it is less in Daman & Diu (35.14%). Proportion of people living below poverty line is higher in Himachal Pradesh is 51.9 % and lower in Lakshadweep at 29.1%. Chhattisgarh has the highest percentage of work participation rate while it is lowest in Chandigarh. Average house hold size across the states varies from 4 to 6. Percentage of females aged 7 and above who knows how to read and write in Bihar is 51.5% while in Kerala it is 92.1%. All the Union territories like Andaman & Nicobar, Pondicherry, and Daman & Diu are within the top ten literate states in India. Mean number of Children ever born which is an indicator of cumulative fertility is higher in Nagaland (3.66) and lower in Tamil Nadu (2.38). Table 1 presents the values of top and bottom 5 states of the variables included in this study.

Table 1: Top and Bottom States of Variables:

Selected variables	Top five states	Bottom five states
Urban Population (in percent)	Delhi(97.5)	Himachal Pradesh(10)
	Punjab(97.3)	Bihar(11.3)
	Lakshadweep(78.1)	Assam(14.1)

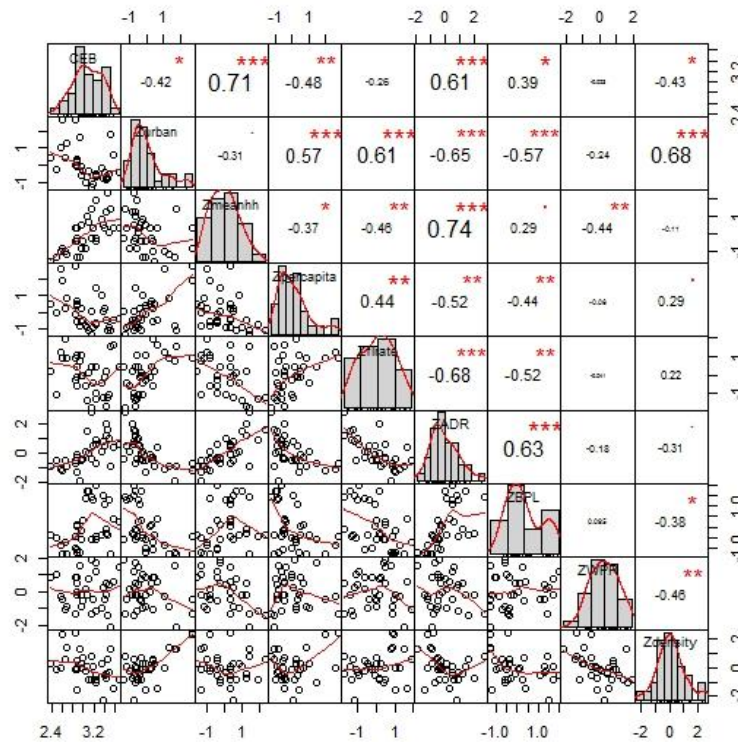
	Daman& Diu(75.2)	Orissa(16.7)
	Pondicherry(68.3)	Meghalaya(20.1)
Per capita income (in rupees)	Delhi(1,73,686)	Bihar(22,890)
	Goa(1,67,838)	Uttar Pradesh(29,785)
	Chandigarh(1,42,869)	Lakshadweep(32,205)
	Sikkim(1,24,791)	Manipur(32,865)
	Haryana(1,08,345)	Assam(37,250)
Population density (per sqkm)	Delhi(11320)	Arunachal Pradesh(17)
	Chandigarh(9258)	Andaman & Nicobar(46)
	Pondicherry(2547)	Mizoram(52)
	Daman &Diu(2191)	Sikkim(52)
	Lakshadweep(2149)	Manipur(115)
Age dependency ratio	Bihar(85.54)	Daman& Diu(35.14)
	Meghalaya(77)	Andaman &Nicobar(41.1)
	Uttar Pradesh(72.72)	Chandigarh(42.66)
	Jharkhand(71.36)	Goa(43.14)
	Rajasthan(68.63)	Pondicherry(45.29)
Below poverty line	Himachal Pradesh(51.9)	Lakshadweep(29.1)
	Sikkim(50.5)	Uttar Pradesh(32.9)
	Daman& Diu(49.9)	Delhi(33.3)
	Chhattisgarh(47.7)	Bihar(33.4)
	Andhra Pradesh(46.6)	Kerala(34.8)
Work participation rate	Chhattisgarh(39.93)	Chandigarh(0)
	Jharkhand(36.96)	Pondicherry(0.02)
	Manipur(36.89)	Lakshadweep(0.26)
	Arunachal Pradesh(34.67)	Daman & Diu(0.28)
	Bihar(33.74)	Andaman &Nicobar(0.55)
Mean household size	Uttar Pradesh(6)	Tamil Nadu(3.9)

	Jammu & Kashmir(5.8)	Andaman & Nicobar, Andhra Pradesh, Daman & Diu(4)
	Bihar, Lakshadweep(5.5)	Pondicherry(4.1)
	Meghalaya, Rajasthan(5.4)	Kerala, Goa (4.2)
	Jharkhand(5.3)	Chandigarh(4.3)
Female literacy rate	Kerala(92.1)	Bihar(51.5)
	Mizoram(89.3)	Rajasthan(52.1)
	Lakshadweep(87.9)	Jharkhand(55.4)
	Goa(84.7)	Jammu & Kashmir(56.4)
	Andaman & Nicobar(82.4)	Uttar Pradesh(57.2)
Mean children ever born	Nagaland(3.7)	Tamil Nadu(2.4)
	Mizoram(3.6)	Andhra Pradesh(2.5)
	Lakshadweep(3.5)	Goa(2.6)
	Madhya Pradesh(3.5)	Chandigarh(2.6)
	Uttar Pradesh(3.6)	Kerala(2.7)

2.3 Correlation Analysis:

The zero order correlation coefficients between socio economic variables and cumulative fertility (CEB) is depicted by the correlation matrix in Table 2

Table 2: Zero order correlation coefficients among the selected variables of CEB.



According to Table2, it is observed that CEB has the strongest significant relationship with Mean household size(meanhh) and Age dependency ratio(ADR); urban population with per capita income, female literacy rate and population density; Mean household size(meanhh) with Age dependency ratio(ADR); Below poverty line(BPL) with Age dependency ratio (ADR). The urban population has strong significant negative association with ADR and BPL; female literacy rate with ADR. Stronger significant negative association exists between CEB & percapita income; meanhh with female literacy rate withwork participation rate(WPR); percapita income with female literacy rate(FLR),Age dependency ratio(ADR) with Below poverty line(BPL); female literacy rate(FLR) with Below poverty line(BPL); work participation rate (WPR) with Population density.

The presence of multicollinearity among variables used in this study is tested using the Variance Inflation Factor(VIF) which is given by $1/(1-R_i^2)$ where R_i^2 is the square of the multiple correlation coefficient obtained from the regression of the i^{th} explanatory variable on all other explanatory variables. Usually, a VIF in excess of 10 is considered as an indication that

multicollinearity may cause problems in estimating the parameters. A small value of the ratio $Q = \frac{\sum VIF}{p}$ where p is the number of regressors indicates that interdependence among explanatory variables is not a problem.

Table 3: Variance Inflation Factors (VIF)

X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈
5.901	3.485	6.18	2.63	4.055	2.444	1.639	5.23

From Table 3 all variance inflation factors are less than 10 as well as the value of Q (=3.2129) are less than 5.

3. Path Analysis

Path analysis enables us to hypothesize a complex causal structure between linear interrelated variables through path diagram. Path analysis is a statistical technique which is used to decompose the correlation coefficient into direct effects, indirect effects and total effects. It is an extension of the multiple regression models and helps in understanding the effect of one variable on another variable. The entire factors which are involved in path diagram is divided into three groups namely exogenous variable which is defined by a variable whose variation is explained by factors outside the model and which also explains other variables within the model, Endogenous variables which is defined by a variable whose variation is explained by one or more variables within the model and dependent variables. In the path diagram the variables are arranged from left to right in such way that all the endogenous variables are to the right of the exogenous variables. The unidirectional straight paths from left to right represent the direct effect between the exogenous and endogenous variable. The direction of the arrow shows the importance of path diagram. The value written on the straight arrows shows the path coefficients. A path coefficient represents the numerical strength of each path. The variables used in the path analysis are listed in Table 4.

Table 4: The variables used in Path Analysis:

Exogenous	Urban Population(X ₁)
Variables	Per capita income(X ₂)

	Population density(X_3)
	Age dependency ratio(X_4)
	Below poverty line (X_5)
	Work participation rate(X_6)
Endogenous Variables	Mean house hold size(X_7)
	Female literacy rate(X_8)
Dependent Variable	Children ever born(X_9)

The relationship between causal and non-causal effects among the variables can be represented by a set of structural equations. The system of equation with two endogenous variables X_7 and X_8 for the path model is expressed as follows.

$$X_7 = A_{76}X_6 + A_{75}X_5 + A_{74}X_4 + A_{73}X_3 + A_{72}X_2 + A_{71}X_1 + A_{7u}E_u$$

$$X_8 = A_{87}X_7 + A_{86}X_6 + A_{85}X_5 + A_{84}X_4 + A_{83}X_3 + A_{82}X_2 + A_{81}X_1 + A_{8v}E_v$$

$$X_9 = A_{98}X_8 + A_{97}X_7 + A_{96}X_6 + A_{95}X_5 + A_{94}X_4 + A_{93}X_3 + A_{92}X_2 + A_{91}X_1 + A_{9w}E_w$$

Where A_{ij} are the path coefficients and E_u , E_v , and E_w are the random disturbance terms. All variables are standardized and logarithmic transformation is taken for the population density. All the random disturbance terms are mutually independent of their corresponding dependent variables. The path coefficients are equivalent to standardized regression coefficients. Each of the residual path coefficients can be estimated with the regression equation as square root of $(1 - R^2)$, where R^2 is the multiple correlation coefficient of the regression equation. From the path analysis the direct, indirect, implied and total effects of each selected explanatory variables on CEB are calculated. All variables are standardized and logarithmic transformation is taken for the population density. Fig 1 shows a systematic representation of the path diagram.

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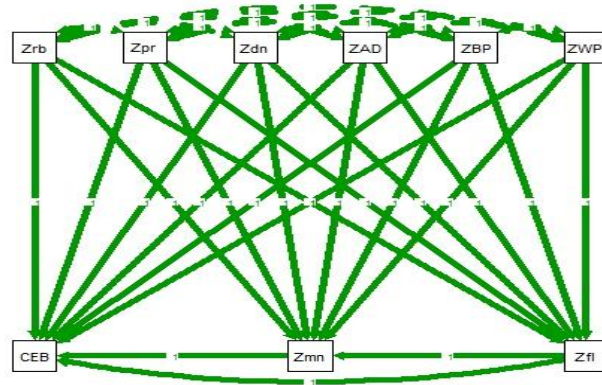


Fig 1.Path diagram of the selected explanatory variables.

4. Results and discussion of the path model

The systems of fitted equations are as follows:

$$X_7 = -.174X_6 - .083X_5 - .494X_4 - .337X_3 - .009X_2 + .429X_1$$

$$X_8 = -.130X_7 - .328X_6 - .202X_5 + .795X_4 - .26X_3 - .28X_2 + .342X_1$$

$$X_9 = .114X_8 + .261X_7 + .084X_6 + .043X_5 + .034X_4 - .067X_3 - .061X_2 + .021X_1$$

It is important to note that all the above hypothesized models are significant. ($p < .05$)

Table 5 presents the results of path analysis.

Table 5: Effects of Socio Demographic factors on CEB

Dependent variable	Selected variable	Total association	Non – causal effect	Total effect	Indirect effect Via		Other variables	Direct effect
					X ₇	X ₈		
	X ₁ - Zurban	-0.42	-0.457	0.037	0.009	0.007	0.021	
	X ₂ – Zpercapita	-0.48	-0.427	-0.053	0.001	0.008	-0.061	
X ₉ – CEB	X ₃ – Zdensitylog	-0.43	-0.403	-0.027	0.023	0.017	-0.067	
	X ₄ – ZADR	0.61	0.566	0.044	-0.017	0.027	0.034	

	X₅- ZBPL	0.39	0.359	0.031	-0.004	-0.009	0.043	
	X₆-ZWPR	-0.02	-0.062	0.042	-0.015	-0.028	0.084	
	X₇ - Zmeanhhsiz	0.71	0.541	0.169	0.000	-0.092		0.261
	X₈-Zflrate	-0.26	-0.374	0.114	0.000			0.114

Table 6 shows the percentage analysis of the direct and indirect effects on CEB.

Table 6: Percentage of the Total Absolute effect on CEB through Endogenous and Exogenous variables.

Dependent variable	Selected variable	Percentage of Indirect Effect		Other variables (Implied Effect)	Direct effect
		X ₇	X ₈		
	X₁-Zurban	24.22	19.31	56.47	
	X₂ - Zpercapita	0.79	11.26	87.95	
	X₃- Zdensitylog	21.10	16.28	62.62	
	X₄- ZADR	21.58	34.73	43.69	
X₉ - CEB	X₅- ZBPL	6.46	15.72	77.82	
	X₆-ZWPR	11.58	21.84	66.58	
	X₇ - Zmeanhhsiz	0.00	26.06	0.00	73.94
	X₈-Zflrate	0.00	0.00	0.00	100.00

From tables 5 and 6, we find that total effects of Urban population on CEB is .037 of which indirect effect about 24.22% acts through Mean House Hold Size and 19.31% is transmitted through female literacy rate in the same direction. Also it shows that the total effects of Per Capita income on CEB is -.053 of which indirect effect about 0.79% acts through Mean house

hold size and 11.26% is transmitted through Female Literacy Rate in the same direction. Total effects of Population Density on CEB are -0.027 of which indirect effect about 21.10% acts through Mean House Hold Size and 16.28% are transmitted through Female literacy rate in the same direction. The total effects of Age dependency ratio on CEB is $.044$ of which indirect effect about 21.58% acts through mean household size and 34.73% is transmitted through Female Literacy rate in the same direction. Total effects of Below poverty line on CEB is $.031$ of which indirect effect about 6.46% acts through Mean house hold size and 15.72% is transmitted through Female literacy rate in the same direction. Total effects of Work participation rate on CEB is $.042$ of which indirect effect about 11.58% acts through Mean house hold size and 21.84% is transmitted through Female literacy rate in the same direction. Direct effect endogenous variables Mean house hold size and female literacy rate on CEB are found to be from the Table III is 0.261 and 0.114 respectively. We find that mean house hold size is directly affected by 74% of children ever born and also it shows that female literacy rate is directly affected by 100% of the children ever born.

5. Conclusion:

In this study we find that from the selected exogenous variables per capita income and population density are observed in the negative direction on CEB and their correlation is significant. CEB is positively associated with mean house hold size, age dependency ratio and below poverty line also the correlation is significant. Mean household size has significant positive association with age dependency ratio and significant negative association with per capita income, female literacy rate and work participation rate. Female literacy rate is negatively associated with age dependency ratio and below poverty line and also the correlation is significant. Implied effect of CEB through per capita income is the highest at 87.95% followed by below poverty line at 77.82%, work participation rate at 66.58% and population density at 62.62%, urban population at 56.47% and also we find that implied effect on CEB for age dependency ratio is 43.69%. Female literacy rate and mean household size significantly contributes to children ever born.

6. References:

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