DETERMINANTS OF POPULATION GROWTH IN RAJASTHAN: AN ANALYSIS

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Abstract

Rajasthan is the biggest State of India and is currently in the second phase of demographic transition and is moving towards the third phase of demographic transition with very slow pace. However, state's population will continue to grow for a time period. Rajasthan's performance in the social and economic sector has been poor in past. The poor performance is the outcome of poverty, illiteracy and poor development, which co-exist and reinforce each other. There are many demographic and socio-economic factors responsible for population growth. This paper attempts to identify the demographic and socio-economic variables, which are responsible for population growth in Rajasthan with the help of multivariate analysis.

1. Introduction:

Prof. Stephan Hawking (Cambridge University) was on Larry King Live. Larry King called him the "most intelligent person in the world". King asked some very key questions, one of them was: "what worries you the most?" Hawking said, "My biggest worry is population growth, and if it continues at the current rate, we will be standing shoulder to shoulder in 2600. Something has to happen, and I don't want it to be a disaster".

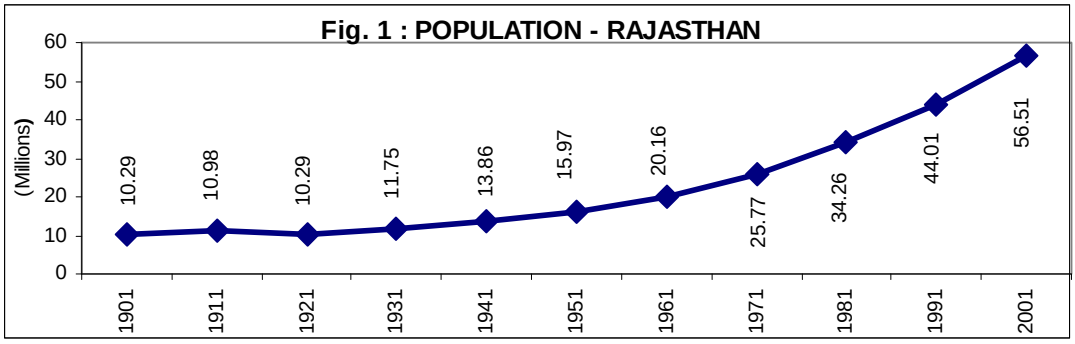
The importance of population studies in India has been recognized since very ancient times. The 'Arthashastra' of Kautilya gives a detailed description of how to conduct a population, economic and agricultural census. During the reign of Akbar, Abul Fazal compiled the Ain-E-Akbari containing comprehensive data on population, industry, wealth and characteristics of population. During the British period, system of decennial census started with the first census in 1872.

The population growth of a region and its economic development are closely linked. India has been a victim of population growth. Although the country has achieved progress in the economic field, the population growth has wrinkled the growth potential. The need to check the population growth was realized by a section of the intellectual elite even before independence. Birth control was accepted by this group but implementation was restricted to the westernized minority in the cities. When the country attained independence and planning was launched, population control became one of the important items on the agenda of development. The draft outline of the First Five Year Plan said, "the increasing pressure of population on natural resources retards economic progress and limits seriously the rate of extension of social services, so essential to civilized existence."

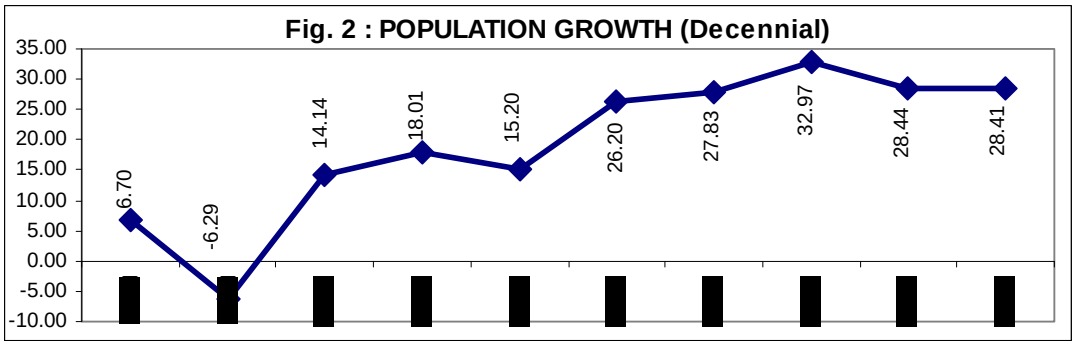
India was one of the pioneers in health service planning with a focus on primary health care. Improvement in the health status of the population has been one of the major thrust areas for the social development programs of the country in the five year plans. India is a signatory to the Alma

Ata Declaration (1978) whereby a commitment was made to achieve 'Health for All' by 2000 AD. We are in the end of the first decade of the 21st century but still have to go a long way to achieve this target. Rajasthan is lagging behind the all India average in the key parameters i.e. CBR, CDR, IMR, TFR & CPR. The state has made consistent efforts to improve quality of its people through improvement in coverage & quality of health care and implementation of disease control programs but the goals remain elusive due to high levels of fertility and mortality. According to the Report of the Technical Group on Population Projections, India will achieve the target of TFR = 2.1 (Net Reproduction Rate = 1) in 2026. Kerala & Tamilnadu had already achieved it in 1988 & 1993 respectively but Rajasthan will achieve it in 2048 & Uttar Pradesh in 2100.

Rajasthan is the largest state of the country with its area of 342239 sq. kms., which constitutes about 10.41% of the total area of the country. According to 2001 census, its population is 56.51 million. It consist 5.5 % population and ranks eighth in the country. In 1901, population of Rajasthan was 10.29 millions. In 1951, it reached to 15.97 millions with its slow growth during 1901-1951. Figure 1 shows that it increased rapidly after 1951. It reached to 34.26 million in 1981 and to 56.51 million in 2001. It has multiplied 5.5 times since 1901 and 3.5 times since 1951. Figure 2 shows decennial growth in population of the state. Before 1951, it increased by less than 20% growth per decade. In 1971-81, it shows the maximum growth rate of 32.97%. In 1981-91, it decreased by 4.53 percentage points and grew by 28.44%. The decade of 1991-2001 shows growth of 28.41%.

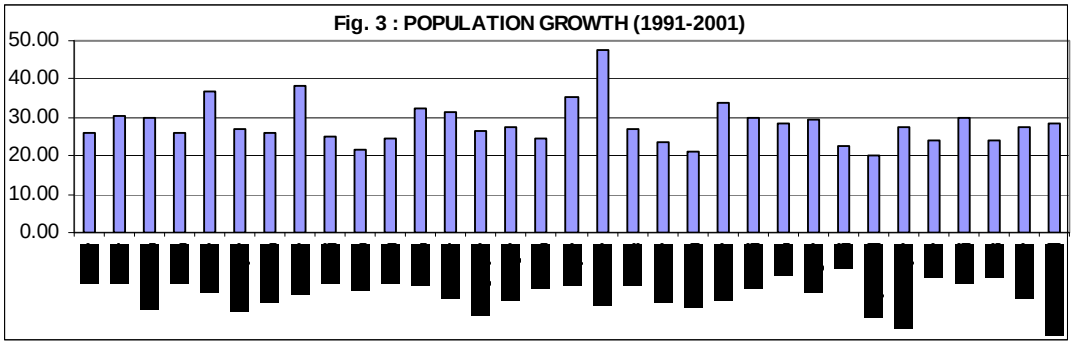


Source: Government of India, Registrar General, India, see the website www.censusindia.net



Source: Government of India, Registrar General, India, see the website www.censusindia.net

The rapid population growth in a already populated state like Rajasthan could lead to many problems i.e. pressure on land, environmental deterioration, fragmentation of land holding, shrinking forests, rising temperatures, pressure on health & educational infrastructure, on availability of food grains & on employment. Figure 3 shows the decennial growth of district-wise population during 1991-2001. Jaisalmer shows the maximum growth of 47.45% followed by Bikaner (38.18%), Barmer (36.83%), Jaipur (35.10%) and Jodhpur (33.77%). Rajasamand shows minimum growth of 19.88% followed by Jhunjhunu (20.90%), Chittorgarh (21.46%), Pali (22.39%) and Jhalawar (23.34%).



Source: Government of India, Registrar General, India, see the website www.censusindia.net

Rajasthan is currently in the second phase and is moving towards the third phase of demographic transition with very slow pace. The changes in the population growth rates in Rajasthan have been relatively slow, but the change has been steady and sustained. We are aware of the need for birth control, but too many remain ignorant of contraception methods or are unwilling to discuss them. There is considerable pressure to produce a son. However, the state's population will continue to grow for a time period.

Rajasthan is the second state in the country to formulate and adopt its own Population Policy in January 2000. State Population Policy[5] has envisaged strategies for population stabilization and improving health conditions of people specially women and children. The policy document has clearly presented role and responsibilities of different departments actively contributing in implementation of population policy. Family Welfare Program was linked with other sectors and demands intervention and efficient policies in these sectors so that changes can be brought in the social, economic, cultural & political environment. The State Population Policy envisages time bound objectives as mentioned in table 1:

Table 1: Objectives of Population Policy of Rajasthan

Indicators	1997	2001	2004	2007	2011	2013	2016
Total Fertility Rate	4.11	3.74	3.41	3.09	2.65	2.43	2.10
Birth Rate	32.1	29.2	27.5	25.6	22.6	20.9	18.4
Contraceptive Prevalence Rate	38.5	42.2	48.2	52.7	58.8	61.8	68.0
Death Rate	8.9	8.7	8.4	7.9	7.5	7.2	7.0
Infant Mortality Rate	85.0	77.4	72.7	68.1	62.2	60.1	56.8

Rajasthan's performance in the social and economic sector has been poor in past. The poor performance is the outcome of poverty, illiteracy and poor development which co-exist and reinforce each other. State Government has taken energetic steps in last few years to assess and fully meet the unmet needs for maternal & child health care and contraception through improvement in availability and access to family welfare services but still remains a long path. The progress in these indicators would determine the year and size of the population at which the state achieves population stabilization.

2. Objectives and Methodology:

There is a major data difficulty regarding availability of annual statistics, calculations & comparisons of Crude Birth Rate (CBR), Total Fertility Rate (TFR) and Females' Mean Age at Gauna (FMAG) over time for district level study of any state and which is applied to Rajasthan also. This data problem distorts the calculations and negates the usefulness of making comparisons over time. Due to this data information problem, we use the information for different years (as per the availability of latest data, taking 2000-01 as base year) in this paper. This data problem at district level is a constraint

[5] Government of Rajsthan (1999), "Population Policy of Rajasthan", Department of Family Welfare, Jaipur.

that creates a limitation in the selection of study objectives and hypotheses. This paper attempts to identify the demographic and socio-economic variables, which are responsible for population growth in Rajasthan. The main objectives of the study are:

- To observe the characteristics of indicators of population growth in Rajasthan.
- To identify the various demographic & socio-economic variables which have causal relationship with population growth.
- To analyze the inter-relationship between the indicators of population growth and demographic & socio-economic variables.

For achieving the above objectives, the *a priori* hypotheses are as follows:

- Positive impact of infant mortality & total fertility rate and negative impact of income equality on population growth.
- Positive impact of infant mortality and negative impact of female's age at gauna and female literacy on crude birth rate.
- Negative impact of couple protection rate, income equality, female literacy and positive impact of infant mortality on total fertility rate.
- Positive impact of female literacy & income equality on female's age at gauna.
- Positive impact of female literacy, females age at gauna and income equality on couple protection rate.

To rummage the inter-relationship between indicators of population growth and demographic & socio-economic variables, a social sector model is proposed. The model is estimated by the use of Multiple Regression Analysis (Method of Ordinary Least Squares). The general form of the Multiple Regression Equation Model is as follows:

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots + \beta_k X_{ki} + u_i$$

where i = 1, 2, 3, … , n.

In this multiple regression equation model, Y_i is dependent variable and X_2, X_3, … , X_k are independent explanatory variables. β_1 is the intercept, shows the average value of Y, when X_2, X_3, … , X_k are set equal to zero; β_2, β_3, …, β_k are partial regression/slope coefficients; u_i is the stochastic disturbance term; i is the i^{th} observation and n is the size of population.

The model is estimated by using cross-sectional data of all 32 districts of the state (at that time, the no. of districts was 32). In this paper, we also calculated the Mean, Standard Deviation and Coefficient of Variation of the variables. The variables used in this paper, their reference year and abbreviations/identification code are given in the Appendix I (Table 9). Firstly, we regress the dependent variables with all the variables, which have theoretical relationship and then choose the appropriate variables for multiple regressions. The dependent and independent variables for the model are as follows:

Table 2: Functional Form of the Model

Dependent Variable	Independent Variables
POPGWR	CBR, TFR, FMAG, CDR, CPR, IMR, CIMM, MRANC, PWRSAP, PWETVR, MIPLP, BPGH, PCEMPH, LIT, LIT_m, LIT_f, PCEEE, PCNDDP, PPBPL, ROADSK, PHDW, PCEWS
CBR	POPGWR, FMR, $FMR_{(0-6)}$, PURPOP, FMAG, CPR, IMR, PWETVR, PCEMPH, PCEFW, LIT, LIT_m, LIT_f, PCEEE, PCNDDP, PPBPL
TFR	PURPOP, FMAG, CPR, CDR, IMR, MRANC, PWRSAP, PWETVR, PCEMPH, LIT, LIT_m, LIT_f, PCEEE, PCNDDP, PPBPL, PCESCS
FMAG	PURPOP, PWETVR, LIT, LIT_m, LIT_f, PSER, $PSER_m$ $PSER_f$, DORPS, $DORPS_m$, $DORPS_f$, PCEEE, PCNDDP, PPBPL

Dependent Variable	Independent Variables
CPR	PURPOP, FMAG, IMR, PWETVR, MIPLP, PCEMPH, PCEFW, LIT, LIT_m, LIT_f, PCEEE, PCNDDP, PPBPL, IDI, PCESCS

In this paper, we have taken 32 variables (appendix-I). All the 32 variables are relating to Population; Fertility, Reproductive Health and Mortality; Public Health and Health Infrastructure; Education and Educational Infrastructure; and Economic Growth and Infrastructure. Data used in this paper have taken from website of Census Department, State Human Development Report (Rajasthan), Various Administrative Reports of Medical, Health & Family Welfare Department, Government of Rajasthan and Plan Documents of Planning Department, Government of Rajasthan.

3. Multivariate Analysis

3.1 Mean, Standard Deviation & Coefficient of Variation

Mean, standard deviation and coefficient of variation of all the 32 variables for all 32 districts along with the figures of all Rajasthan are at appendix I (table 9). The Mean, measures the average value of the variables for all 32 districts. The Standard Deviation, measures the absolute variation in the mean and the Coefficient of Variation, measures the percentage variation in mean. The variables are divided in to five categories according to the range of Coefficient of Variation for the analysis of Standard Deviation and Coefficient of Variation.

Table 3: Range-wise Variables according to the Coefficient of Variation

Range	Variables
Less than 25%	POPGWR (19.92), FMR (5.28), $FMR_{(0-6)}$(3.26), CBR (7.02), TFR (10.20), FMAG (3.66), CPR (14.73), CDR (10.44), IMR (20.60), MIPLP (18.59), LIT (12.64), LIT_m (8.31), LIT_f (21.19), PSER (9.39), $PSER_m$ (11.17), $PSER_f$ (14.27), DORPS (12.94), $DORPS_m$ (12.89), $DORPS_f$ (17.01), PCNDDP (24.34), PHDW (21.33)
25% to 50%	MRANC (38.95), BPGH (30.61), PCEFW (38.55), PCEEE (44.54), PPBPL (46.88), PCESCS (48.75)
50% to 75%	PURPOP (53.79), PWETVR (66.94), PCEMPH (58.63), IDI (55.05)
75% to 100%	-
More than 100%	PCEWS (158.62)

Table 3 shows that variability is higher in the variables of public health & health infrastructure and economic growth & infrastructure head. There is need to reduce disparities on this front.

3.2 Regression analysis

To rummage the interrelationship between indicators of population growth and various demographic and socio-economic variables, we regress the dependent variable with the independent variables individually (independent variables are those variable which have causal relationship with dependent variable in theoretical and behavioral terms) and then pick the most influential variables and regress with the help of step-wise method and get best fitted multiple regression equation of them. Some variables with insignificant coefficients have also been kept in the model because theoretically their importance has been proved. Figures below the coefficients are 't' values. Significance of variables with the level of significance is denoted as follows:

***** Significant at 1% level of significance
****** Significant at 2% level of significance
******* Significant at 5% level of significance
******** Significant at 10% level of significance

Efforts have been made to avoid the problem of multicollinearity (as it presents commonly in the analysis of cross-sectional data) but at some places, it is difficult to avoid it.

3.2.1 Population Growth (Decennial)

Population Growth (POPGWR) is regressed with different variables such as CBR, TFR, FMAG, CDR, CPR, IMR, CIMM, MRANC, PWRSAP, PWETVR, MIPLP, BPGH, PCEMPH, LIT, LIT_m, LIT_f, PCNDDP, PPBPL, ROADSK, PHDW, PCEWS.

Table 4: Regression Equations of Population Growth (Decennial)

S.No.	Intercept	Coefficient			R^2	d. f.
1.	10.0934	+	0.5643	CBR	0.0514	31
			1.2745			
2.	8.1549	+	4.1092	TFR***	0.1325	31
			2.1408			
3.	49.0047	-	1.1555	FMAG	0.0156	31
			0.6903			
4.	50.0223	-	0.5750	CPR*	0.3245	31
			3.7963			
5.	46.2904	-	2.0212	CDR****	0.1119	31
			1.9442			
6.	36.6587	-	0.0979	IMR****	0.0946	31
			1.7709			
7.	34.4649	-	0.1670	CIMM***	0.1413	31
			2.2217			
8.	278632	+	0.0061	MRANC	0.0007	31
			0.1473			
9.	13.8825	+	0.1462	PWRSAP	0.0497	31
			1.2532			
10.	30.8793	-	0.1961	PWETVR****	0.097	31
			1.8019			
11.	24.9574	+	0.1171	MIPLP	0.0118	31
			0.5995			
12.	21.9702	+	0.0768	BPGH****	0.1167	31
			1.9906			
13.	29.1035	-	0.0453	PCEMPH	0.0079	31
			0.4881			
14.	32.8303	-	0.0768	LIT	0.0106	31
			0.5664			
15.	40.5194	-	0.1629	LIT_m	0.0328	31
			1.0084			
16.	31.2097	-	0.0696	LIT_f	0.0124	31
			0.6137			
17.	26.7674	+	0.0346	PCEEE	0.0138	31
			0.6478			
18.	32.6477	-	0.0003	PCNDDP	0.0361	31
			1.0604			
19.	27.1559	+	0.0285	PPBPL	0.0057	31
			0.4138			
20.	35.2376	-	0.2308	ROADSK***	0.1539	31
			2.3363			
21.	31.0646	-	0.0465	PHDW	0.0114	31
			0.5872			
22.	28.6427	-	0.0134	PCEWS	0.0122	31
			0.6075			

Fit of the equations is with the expected signs. TFR, CPR, CDR, IMR, CIMM, PWETVR, BPGH and ROADSK have significant coefficients. PCEEE appears with opposite sign as of expected sign. In the step-wise regression, PPBPL is found more relevant in spite of PCNDDP for multiple regression.

$$\text{POPGWR} = 12.5485 + \underset{(3.0425)}{5.6405\ \text{TFR}^*} - \underset{(2.7565)}{0.1477\ \text{IMR}^*} + \underset{(0.4075)}{0.0246\ \text{PPBPL}}$$

$$R^2 = 0.3196 \qquad \text{d.f.} = 29$$

In the multiple regression analysis the coefficients of TFR and IMR are significant at 1% level of significance. This indicates that TFR influences POPGWR positively. IMR shows negative influence to POPGWR in mathematical/statistical terms but in actual terms this leads to birth to more children due to less survival. The variable PPBPL does not affect POPGWR significantly.

3.2.2 Crude Birth Rate

Crude Birth Rate (CBR) is regressed with different variables such as POPGWR, FMR, $FMR_{(0-6)}$, PURPOP, FMAG, CPR, IMR, PWETVR, PCEMPH, PCEFW, LIT, LIT_m, LIT_f, PCEEE, PCNDDP, PPBPL.

Table 5: Regression Equations of Crude Birth Rate

S.No.	Intercept	Coefficient			R^2	d. f.
1.	29.6053	+	0.0910	POPGWR	0.0514	31
			1.2745			
2.	39.4165	-	0.0079	FMR	0.0286	31
			0.9391			
3.	25.6612	-	0.0072	FMR(0-6)	0.0088	31
			0.5163			
4.	32.1109	+	0.0032	PURPOP	0.0002	31
			0.0856			
5.	50.5045	-	1.1004	FMAG****	0.0879	31
			1.7004			
6.	38.4234	-	0.1650	CPR***	0.1657	31
			2.4406			
7.	30.0598	+	0.0247	IMR	0.0372	31
			1.0766			
8.	32.2562	-	0.0059	PWETVR	0.0006	31
			0.1291			
9.	31.1170	+	0.0563	PCEMPH	0.0755	31
			1.5657			
10.	32.3631	-	0.1645	PCEFW	0.0010	31
			0.1744			
11.	32.4349	-	0.0043	LIT	0.0002	31
			0.0792			
12.	30.2455	+	0.0256	LIT_m	0.0050	31
			0.3897			
13.	32.9059	-	0.0172	LIT_f	0.0047	31
			0.3753			
14.	32.2458	-	0.0016	PCEEE	0.0002	31
			0.0748			
15.	34.6147	-	0.0002	PCNDDP	0.0689	31
			1.4901			
16.	31.1572	+	0.0321	PPBPL	0.0447	31
			1.1847			

FMAG and CPR have significant coefficients. PURPOP, PCEMPH and LIT_m are with opposite signs as of expected signs.

$$CBR = 50.2161 - 1.0819\ FMAG^{****} + 0.0114\ IMR - 0.0234\ LIT_f$$
$$(1.7123) \qquad (0.4421) \qquad (0.4701)$$
$$R^2 = 0.1099 \qquad d.f. = 29$$

Fit of the multiple regression equation is with the expected signs Coefficient of FMAG is significant at 10% level of significance. This indicates that FMAG influences CBR negatively. The coefficients of IMR and LIT_f are insignificant but included due to their importance in the determination of CBR.

3.2.3 Total Fertility Rate

Total Fertility Rate (TFR) is regressed with different variables such as PURPOP, FMAG, CPR, CDR, IMR, MRANC, PWRSAP, PWETVR, PCEMPH, LIT, LIT_m, LIT_f, PCEEE, PCNDDP, PPBPL, PCESCS.

Table 6: Regression Equations of Total Fertility Rate

S.No.	Intercept	Coefficient			R^2	d. f.
1.	4.9033	-	0.0006	PURPOP	0.0002	31
			0.0744			
2.	9.2697	-	0.2629	FMAG****	1.1031	31
			1.8573			
3.	6.5736	-	0.0445	CPR*	0.2471	31
			3.1379			
4.	3.6639	+	0.1375	CDR	0.0659	31
			1.7123			
5.	4.2069	+	0.0079	IMR	0.0797	31
			1.6123			
6.	5.2989	-	0.0064	MRANC****	0.1017	31
			1.8431			
7.	5.0179	-	0.0033	PWRSAP	0.0032	31
			0.3124			
8.	51792	-	0.0073	PWETVR	0.0175	31
			0.7304			
9.	4.9694	-	0.0011	PCEMPH	0.0006	31
			0.1367			
10.	4.9951	-	0.0033	LIT	0.0025	31
			0.2719			
11.	5.4818	-	0.0139	LIT_m	0.0305	31
			0.9720			
12.	5.0591	-	0.0039	LIT_f	0.0051	31
			0.3932			
13.	4.9577	-	0.0016	PCEEE	0.0036	31
			0.3288			
14.	5.6749	-	0.00006	PCNDDP***	0.1465	31
			2.2693			
15.	4.9662	+	0.0023	PPBPL	0.0051	31
			0.3906			
16.	5.1543	-	0.0014	PCESCS	0.0664	31
			1.4618			

FMAG, CPR, MRANC and PCNDDP are with significant coefficients. All the variables show the expected signs.

$$TFR = 5.9697 - \underset{(2.9361)}{0.0412\ CPR^{*}} + \underset{(2.3704)}{0.0104\ IMR^{***}} - \underset{(0.3446)}{0.0031\ LIT_f} - \underset{(1.8641)}{0.00004\ PCNDDP^{****}}$$

$$R^2 = 0.4305 \qquad d.f. = 28$$

Coefficient of CPR is significant at 1% level of significance, IMR at 2% and PCNDDP at 10%. This indicates that CPR & PCNDDP influence TFR positively and IMR influences TFR negatively. LIT_f appears with insignificant coefficient but it has major influential role in the determination of TFR.

3.2.4 Females' Mean Age at Gauna

Females' Mean Age at Gauna (FMAG) is regressed with different variables such as PURPOP, PWETVR, LIT, LIT_m, LIT_f, PSER, $PSER_m$ $PSER_f$, DORPS, $DORPS_m$, $DORPS_f$, PCEEE, PCNDDP, PPBPL.

Table 7: Regression Equations of Females' Mean Age at Gauna

S.No.	Intercept	Coefficient			R^2	d. f.
1.	16.1794	+	0.0060	PURPOP	0.0118	31
			0.5994			
2.	15.0223	+	0.0273	PWETVR***	0.1619	31
			2.4070			
3.	15.7873	+	0.0190	LIT	0.051	31
			1.3231			
4.	14.9522	+	0.0305	LIT_m****	0.0981	31
			1.8061			
5.	151910	+	0.0126	LIT_f	0.0346	31
			1.0371			
6.	16.0412	+	0.0160	PSER	0.0456	31
			1.1974			
7.	16.9408	-	0.0028	$PSER_m$	0.0027	31
			0.2861			
8.	15.8440	+	0.0166	$PSER_f$	0.0775	31
			1.5871			
9.	17.3288	-	0.0225	DORPS	0.0796	31
			1.6104			
10.	18.1252	-	0.0268	$DORPS_m$****	0.1050	31
			1.8765			
11.	17.2214	-	0.0099	$DORPS_f$	0.0147	31
			0.6701			
12.	16.7143	+	0.0014	PCEEE	0.0018	31
			0.2328			
13.	16.4417	+	0.00002	PCNDDP	0.0074	31
			0.4713			
14.	16.6888	-	0.0010	PPBPL	0.0006	31
			0.1374			

PWETVR, LIT_m and $DORPS_m$ are with significant coefficients. Except $PSER_m$, coefficients of all are with expected Signs.

FMAG=13.7224 +0.0279 PWETVR*** +0.0039 LIT_f**** +0.00003 PCNDDP
(2.1774) (1.8126) (1.0034)
R^2 = 0.1912 d.f. = 29

All the variables are with expected signs. Coefficient of PWETVR is significant at 5% level of significance & coefficient of LIT_f is significant at 10% level of significance. This indicates that PWETVR & LIT_f influence FMAG positively. Coefficient of PCNDDP is insignificant means the variable PCNDDP does not affect FMAG significantly.

3.2.5 Couple Protection Rate

Couple Protection Rate (CPR) is regressed on different variables such as PURPOP, FMAG, IMR, PWETVR, MIPLP, PCEMPH, PCEFW, LIT, LIT_m, LIT_f, PCEEE, PCNDDP, PPBPL, IDI, PCESCS.

Table 8: Regression Equations of Couple Protection Rate

S.No.	Intercept	Coefficient			R^2	d. f.
1.	40.2031	-	0.1133	PURPOP	0.0511	31
			1.2713			
2.	18.8647	+	1.1404	FMAG	0.0155	31
			0.6876			
3.	34.1252	+	0.0435	IMR	0.0190	31
			0.7628			
4.	35.2834	+	0.1922	PWETVR****	0.0956	31
			1.7811			
5.	35.3518	+	0.0892	MIPLP	0.0069	31

S.No.	Intercept	Coefficient			R^2	d. f.
			0.4596			
6.	36.7349	+	0.0597	PCEMPH	0.0139	31
			0.6522			
7.	33.9617	+	3.4369	PCEFW	0.0726	31
			1.5325			
8.	35.5692	+	0.1294	LIT	0.0306	31
			0.9726			
9.	29.9513	+	0.1606	LIT_m	0.0325	31
			1.0032			
10.	36.5518	+	0.0869	LIT_f	0.0197	31
			0.7762			
11.	39.5813	+	0.0402	PCEEE****	0.0189	31
			1.7607			
12.	31.0288	+	0.0005	PCNDDP****	0.0889	31
			1.7108			
13.	39.0037	-	0.1215	PPBPL****	0.1051	31
			1.8769			
14.	38.5776	+	0.0077	IDI	0.0050	31
			0.3894			
15.	36.6705	+	0.0093	PCESCS	0.0250	31
			0.8785			

PWETVR, PCEEE, PCNDDP and PPBPL are with significant coefficients and expected signs. Sign of coefficient of PURPOP is opposite of the expected.

$$CPR = 20.6541 + 0.4813\ FMAG + 0.1388\ LIT_f^{****} + 0.0006\ PCNDDP^{****}$$
$$(0.2922) \qquad (1.8065) \qquad (1.9266)$$
$$R^2 = 0.1433 \qquad d.f. = 29$$

All the variables are with expected signs of coefficients. Coefficients of LIT_f and PCNDDP are significant at 10% level of significance. This indicates that LIT_f and PCNDDP influence CPR positively. Coefficient of FMAG is insignificant means the variable FMAG does not affect CPR significantly.

4. Conclusion

The model is fit good with the expected signs. Estimated equations confirm the *a priori* hypotheses of positive impact of infant mortality & total fertility rate and negative impact of income equality on population growth; positive impact of female literacy & income equality on female's age at gauna; positive impact of infant mortality and negative impact of female's age at gauna and female literacy on crude birth rate; negative impact of couple protection rate, income equality, female literacy and positive impact of infant mortality on total fertility rate, positive impact of female literacy, females age at gauna and income equality on couple protection rate. Literacy, especially female literacy and per-capita income appeared as most influential variables to attack the poor status of socio-economic & demographic variables. There is need to emphasize on the improvement of these two variables.

Rapid population growth retards the economic, social and human development. Enhancement of women's status and autonomy has been conclusively established to have a direct bearing on fertility and mortality decline, which indirectly affects the population growth. More specifically, inter-relationships between women's characteristics and access to resources are the mechanisms through which human fertility is determined. Education is highly correlated with age at the marriage of the females and thus helps in the reduction of the reproductive life, on an average, and helps in the conscious efforts to limit the family size. The early marriage of the daughter in rural areas is an expected rational behavior, as long as there is mass illiteracy and poverty. The age at marriage for females cannot be raised by mere, legislation unless the socio-economic conditions of the rural people is improved and better educational facilities and occupational alternatives for the teenage girls are provided near their homes.

Reproductive and public health have their importance in determination of population stabilization. National Rural Health Mission (NRHM) and Rajasthan Health System Development Project (RHSDP) are ongoing programs which can improve the situation. There is need of effective monitoring of activities under these programs. Effective implementation of family welfare program will create opportunities for better education and improvement in nutritional status of family through check on population growth, which will turn in better health of mother and child and there will be less infant and maternal mortality.

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Appendix - I

Table 9: All Rajasthan Figures, Mean, Standard Deviation & Coefficient of Variation of Variables

S. No.	Variable & Year	Code	Unit	All Rajasthan	Mean	S. D.	CoV
1.	Population Growth (Decennial) 1991-2001	POPGWR	Per cent	28.33	28.25	5.63	19.92
2.	Female-Male Ratio 2001	FMR	Nos.	921	922.03	48.65	5.28
3.	Female-Male Ratio (0-6 years) 2001	$FMR_{(0-6)}$	Nos.	909	909.00	29.59	3.26
4.	Percentage of Urban Population to Total Population 2001	PURPOP	Per cent	23.38	20.69	11.13	53.79
5.	Crude Birth Rate 1997	CBR	Per '000	32.90	32.18	2.26	7.02
6.	Total Fertility Rate 1997	TFR	Nos.	4.9	4.89	0.50	10.20
7.	Females Mean Age at Gauna1996-97	FMAG	Years	17.7	16.66	0.61	3.66
8.	Couple Protection Rate 2001	CPR	Per cent	37.00	37.86	5.58	14.73
9.	Crude Death Rate 1997	CDR	Per '000	8.9	8.93	0.93	10.44
10.	Infant Mortality Rate 1997	IMR	Per '000	87	85.81	17.67	20.60
11.	Percentage of Mothers Receiving Total Ante-Natal Care 1996-97	MRANC	Per cent	72.3	63.38	24.69	38.95
12.	Percentage of Women having Exposure to TV & Radio 1996-97	PWETVR	Per cent	13.1	13.40	8.97	66.94
13.	Medical Institutions Per-Lakh of Population 1997-98	MIPLP	Nos.	27	28.13	5.23	18.59
14.	Beds Per-Lakh Population in Govt. Hospitals 1997-98	BPGH	Nos.	85	81.81	25.04	30.61
15.	Per-Capita Expenditure on Medical & Public Health 2000-01	PCEMPH	`	19.00	18.82	11.04	58.63
16.	Per-Capita Expenditure on Family Welfare 2000-01	PCEFW	`	0.97	1.13	0.44	38.55
17.	Literacy Rate 2001	LIT	Per cent	60.41	59.58	7.53	12.64
18.	Literacy Rate (Male) 2001	LIT_m	Per cent	75.70	75.31	6.26	8.31
19.	Literacy Rate (Female) 2001	LIT_f	Per cent	43.85	42.51	9.01	21.19
20.	Primary School Enrolment Ratio 1997-98	PSER	Per cent	86.50	86.75	8.15	9.39
21.	Primary School Enrolment Ratio (Male) 1997-98	$PSER_m$	Per cent	99.78	100.51	11.22	11.17
22.	Primary School Enrolment Ratio (Female) 1997-98	$PSER_f$	Per cent	71.91	71.65	10.22	14.27
23.	Drop-Out Rates at Primary Level 1996-97	DORPS	Per cent	56.60	59.13	7.65	12.94
24.	Drop-Out Rates at Primary Level (Male) 1996-97	$DORPS_m$	Per cent	54.72	57.07	7.36	12.89
25.	Drop-Out Rates at Primary Level (Female) 1996-97	$DORPS_f$	Per cent	56.96	62.68	10.66	17.01
26.	Per-Capita Expenditure on Elementary Education 2000-01	PCEPEE	`	47.00	42.86	19.09	44.54
27.	Per-Capita Net District Domestic Product 1999-2000	PCNDDP	`	12752	12831.88	3122.80	24.34
28.	Population Below Poverty Line 1999-2000	PPBPL	Per cent	30.99	31.74	14.88	46.88
29.	Infrastructure Development Index 1994-95	IDI	Nos.	100.00	93.46	51.45	55.05
30.	Percentage of Villages with Safe Drinking Water 1998-99	PHDW	Per cent	64.30	60.54	12.91	21.33
31.	Per-Capita Expenditure on Social & Community Services 2000-01	PCESCS	`	245.62	194.69	94.92	48.75
32.	Per-Capita Expenditure on Water Supply 2000-01	PCEWS	`	39.95	29.19	46.30	158.62