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Socio-Economic Determinants of Family Planning Acceptance in Madhya Pradesh*

THE primary purpose of this study is to find out socio-economic determinants of family planning acceptance in Madhya Pradesh as reflected in the acceptance of sterilisation and IUD programmes. For the purposes of the study, hypotheses on the role of selected socio-economic variables in influencing family planning acceptance in the State have been tested with the help of the technique of linear multiple regression analysis of the cross-sectional data on family planning acceptance. The nine socio-economic variables pertaining to 43 districts taken up for analysis are : percent total literate, percent female literate, percent urban, per capita income, percent non-agricultural workers, percent female workers, percent female non-agricultural workers, hospital bed rate and percent tribal population. Percent non-agricultural workers and hospital bed rate have been taken as proxy for industrialization and the development of medical facilities respectively. In conformity with the available evidence in literature (Srivastava, 1977, pp. 49-62) hypotheses of positive influence of the first eight variables on family planning acceptance have been formulated and the last variable,

*The paper is based on a study conducted by the author as a part of the programme of the Demographic Research Centre, Lucknow. He acknowledges his indebtedness to Mr. D. N. Saksena, Assistant Chief of the Centre for his helpful suggestions on an earlier draft of the paper and to Mr. Ram Karan Singh, Lecturer, Department of Statistics, Lucknow University for providing necessary guidance for the statistical techniques employed in this study.

namely, 'percent tribal population' is hypothesized to exert negative influence on the acceptance.

Data

Family planning acceptance data used here pertain to the pre-mass vasectomy camp era. The practice of holding mass camps, which involved selectivity in terms of districts, started, in general, in late 1971. So, the post 1970-71 year period has been excluded from the purview of our study for avoiding the above problem of non-comparability.

In view of the fact that the family planning campaign was launched in all districts of the State simultaneously and that the annual district-wise achievements are likely to be influenced by more temporary factors, the data on cumulative achievements since inception of the two programmes (sterilisation in 1957 and IUD in 1965) have been utilised for the analysis. As about 87 percent of the cumulative achievement in family planning acceptance upto March 1971 was made after the year 1965-66; the achievement data used here, in effect, pertain to the five year period of April 1966 to March 1971.

Since the primary interest of the study is in determinants of programme acceptance as such rather than its demographic impact, the district-wise acceptance figures have been converted into rates per thousand 1971 population without making any adjustments. For the same reason, the rates for the two programmes have been added to form a combined index of acceptance.

Data on all the explanatory variables, barring per capita income and hospital bed rate, have been taken from the 1971 census of India. For the want of an alternative source, district level per capita income estimates prepared by the National Council of Applied Economic Research, New Delhi for the year 1955-56 have been utilised. The 'hospital bed rate' per 10,000 population at the end of the year 1970-71 has been computed from the data supplied by the Directorate of Public Health and Family Planning, Government of Madhya Pradesh. Table 1 gives relevant data on the inter-district variations in family planning acceptance rates and the selected explanatory variables.

Hypothesis Testing

Linear multiple regression analysis of the cross sectional data on family plan-

TABLE 1—INTER-DISTRICT VARIATIONS IN FAMILY PLANNING ACCEPTANCE RATES AND SELECTED SOCIO-ECONOMIC VARIABLES

Variable	*District Mean*	*Standard Deviation*	*Coefficient of Variation (Percent)*
1. Family Planning Acceptance Rates	20.80	7.10	34.11
2. Percent Total Literate	21.57	6.93	32.12
3. Percent Female Literate	10.58	5.44	51.47
4. Percent Urban	15.77	12.87	81.62
5. Per Capita Income (1955-56) in Rs.	216.56	44.16	20.39
6. Percent Non-Agricultural Workers	6.75	3.22	47.76
7. Percent Female Workers	16.56	7.48	45.19
8. Percent Female Non-agricultural Workers	1.66	0.99	59.80
9. Hospital Bed Rate	3.89	3.02	77.61
10. Percent Tribal Population	18.63	21.35	114.63

ning acceptance and the above nine explanatory variables pertaining to forty-three districts of Madhya Pradesh state has been attempted to test the following two sets of hypotheses : (1) that family planning acceptance rates are determined to a significant extent by the combined influence of the explanatory variables, and (2) that each of the explanatory variable exerts influence on family planning acceptance rates after controlling for the influence of the rest. The results of the analysis are given in two parts (i) selection of the 'best' regression model and (ii) fitting of the regression equation and discussion of results.

(*i*) *Selection of the 'Best' Regression Equation.* As a first step in the analysis, Pearson's Product Moment Coefficients of correlation of each of the above nine explanatory variables with family planning acceptance rates and among them-

selves have been computed. The coefficients are given in the following Zero Order Coefficients of Correlation matrix.

TABLE 2—ZERO ORDER CORRELATION COEFFICIENT MATRIX : FAMILY PLANNING ACCEPTANCE AND SOCIO-ECONOMIC VARIABLES— MADHYA PRADESH

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1 Family Planning Acceptance Rates	1.00									
X_2 Percent Total Literate	.38	1.00								
X_3 Percent Female Literate	.50	.96	1.00							
X_4 Percent Urban	.47	.84	.89	1.00						
X_5 Per Capita Income	.34	.84	.85	.79	1.00					
X_6 Percent Non-agricultural Workers	.42	.85	.93	.94	.86	1.00				
X_7 Percent Female Workers	.07	−.01	−.06	−.29	−.16	−.15	1.00			
X_8 Percent Female Non-agricultural Workers	.19	.68	.62	.45	.61	.68	.21	1.00		
X_9 Hospital Beds Rates	.47	.62	.70	.87	.62	.79	−.35	.25	1.00	
X_{10} Percent Tribal Population	.24	−.55	−.40	−.40	−.48	−.47	.18	−.33	−.29	1.00

The correlation matrix gives zero order correlation coefficients of the explanatory variables (X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}) with dependent variable (X_1). However, these coefficients do not reveal independent influence of explanatory variables but reflect joint influence of other correlated explanatory

variables. Because of inter-correlations among the explanatory variables, even large and significant simple correlations of some of the explanatory variables become small and insignificant in a multiple regression model wherein the influence of other variables is controlled, while others with small and less significant correlations may turn out to be having larger explanatory power in such a model. The inclusion of highly insignificant variables in the regression model may vitiate the regression coefficients of other significant variables.

In order to overcome the above problem, a forward selection procedure (Draper and Smith, 1966) with a modification in its stopping rule, has been adopted for selecting relatively more important variables for inclusion in the regression model. The procedure in essence consists of inclusion of variables one by one in order of their explanatory power in the model till the remaining variables are left with very little explanatory power. In other words, we stop the process of inclusion of variables in the regression model when we know that the inclusion of any additional variable will not increase explanatory power of the model (R^2) to any significant extent. An arbitrary criterion regarding the magnitude of increase in R^2 value below which an additional variable is not included in the model, is its failure to increase value of R^2 by atleast .005 or by 0.5 percentage points.

The adoption of the above procedure of selection reduces severity of multicollinearity by excluding from the model variables having high intercorrelations. It is not claimed, however, that the problem of multicollinearity has been completely overcome. The best that could be done in the situation is the computation of confidence levels of the regression co-efficients and interpretation of regression results in their light.

According to the above procedure of selection, percent female literate, percent non-agricultural workers, percent female workers, hospital beds per ten thousand population, and percent tribal population could be selected for the model. The variable percent total literate was dropped after the inclusion of percent female literate for the latter is a component of the former and was found to be having larger explanatory power. The remaining three variables failed to qualify for inclusion in the model on the criterion mentioned above.

Table 3 gives step-wise results regarding explanatory power of the model using the forward selection procedure. Table 4 gives the sixth order partial

correlation coefficients of the excluded variables and their potential explanatory power in the event of their inclusion. It reveals that none of the remaining variables (X_4, X_5, and X_8) is left with enough explanatory power to increase R^2 value by the minimum acceptable amount of .005 according to criterion adopted after the inclusion of the other five variables. Therefore, they have been dropped from the regression model fitted below.

TABLE 3—RESULTS OF THE FORWARD SELECTION PROCEDURE : FAMILY PLANNING ACCEPTANCE RATES AND SELECTED SOCIO-ECONOMIC VARIABLES

Explanatory Variables	*Multiple Correlation Coefficient (R)*	*Coefficient of Multiple Determination (R^2)*
X_3 Percent Female Literate	.498	.248
+ X_{10} Percent Tribal Population	.689	.475
+ X_9 Hospital Beds Rate	.710	.504
+ X_7 Percent Female Workers	.718	.516
+ X_6 Percent Non-agricultural Workers	.724	.524

TABLE 4—EXPLANATORY POWER OF THE EXCLUDED VARIABLES

Explanatory Variable	*Partial Correlation with X_1, holding X_3 X_6, X_7, X_9, X_{10} constant*	*Square of Partial Correlation*	*Potential Increase in R^2 if included*
X_4 Percent Urban	.090	.008	.004
X_5 Per Capita Income	—.001	.000	.000
X_8 Percent Non-agricultural Females	—.009	.000	.000

(ii) *Fitting of the Selected Model and Discussion of Results.* Now taking family planning acceptance rates (X_1) as dependent variable and the five variables (X_3, X_6, X_7, X_9, X_{10}) as explanatory variables, we have fitted the following linear multiple regression model :

$$X_{1.367910} = \alpha + \beta_{13.67910}X_3 + \beta_{16.37910}X_6 + \beta_{17.36910}X_7 + \beta_{19.36710}X_9 + \beta_{110.3679}X_{10}.$$

Where

X_1 = Family planning acceptance rates.
X_3 = Percent Female Literate.
X_6 = Percent Non-agricultural Workers.
X_7 = Percent Female Workers.
X_9 = Hospital Beds rate
X_{10} = Percent Tribal population, and

α is an unknown constant and β_s are unknown coefficients.

Results and Discussion

The least square estimates of the parameters in the regression equation are as follows :

$$a = 7.203$$
$$b_{13.67910} = 0.894$$
$$b_{16.37910} = -0.646$$
$$b_{17.36910} = 0.118$$
$$b_{19.36710} = 0.935$$
$$b_{110.3679} = 0.156$$

(where 'a' is the estimated constant and b_s are estimated coefficients).

Hence the estimated regression equation is as follows :

$$X_{1.367910} = 7.203 + \underset{(2.214)}{0.894}X_3 - \underset{(-0.787)}{0.646}X_6 + \underset{(0.971)}{0.118}X_7 + \underset{(1.933)}{0.935}X_9 + \underset{(3.527)}{0.156}X_{10} \ldots$$

$$R^2_{1.367910} = 0.524$$

$$S_{1.367910} = 4.897$$

$$N = 43$$

('t' values of regression coefficients are given in parantheses).

(*A*) In order to test the first hypothesis i.e. family planning acceptance rates are determined to a significant extent by the above five explanatory variables, we have tested the significance of multiple correlation coefficient (where $H_0 = \eta_{1.367910} = 0$, Vs, $H_A = \eta_{1.367910} > 0$). It comes out to be highly significant as value of F is 10.557 in the model, which is far beyond the upper 0.001 limit. It means that the combined influence of the explanatory variables on the dependent variable (X_1) is highly significant. They together explain 52.4 percent of variation in family planning acceptance rates. Since the standard error of the estimate from the regression equation is 4.897, the regression estimate is within tolerable limits of the errors of the estimate.

Although the proportion of inter-district variation in family planning acceptance rates explained by the above model is significant and substantial, a little less than half of the variation still remains to be explained. Several non-quantifiable variables might be responsible for this, the most important of which may be 'administration and management' of the programme itself (Agarwala, 1974). Streamlining of the programme machinery at the district level, better implementation of various schemes by the district officers of the dynamic type, offering of various incentives—monetary and non-monetary, and exercise of pressures by several governmental departments in varying measures in different districts and other such factors might account for most of the unexplained variation.

(*B*) For the second set of hypotheses regarding individual influence of explanatory variables, we have tested the significance of regression coefficients by means of "t" test.[1]

Percent Female Literate. The estimated regression coefficient of this explanatory variable ($b_{13.67910}$) is 0.894 in the first model with standard error of 4.404. The estimate suggests that holding the remaining four variables constant, one percentage point larger female literacy in a district is responsible for higher achievement of family planning acceptance rate by about 0.89 points per thousand population. In conformity with our hypothesis of positive influence

1. We have used right tailed test for positive coefficients and left tailed test for negative coefficients where

$$H_0 = \eta 1m.23 \ldots m - 1 = 0$$
$$Vs\ H_A = \eta 1m.23 \ldots m - 1 > 0$$
$$e1m.23 \ldots m - < 0$$

of female literacy level on family planning acceptance rates, the estimated regression coefficient is positive and statistically significant as "t" ratio is 2.214, which is far above its critical value at 5 percent level.

Comparing the relative explanatory power of 'percent total literate' and 'percent female literate' revealed by the analysis, it may be observed that female literacy level is found to exercise larger influence on family planning acceptance rates than the total literacy level. In the forward selection analysis, 'percent total literate' dropped out in the first step itself after inclusion of 'percent female literate', as the latter is only a component of the former. It suggests that female literacy exercises larger influence in decision making process relating to family planning acceptance.

Percent Non-agricultural Workers. The estimated regression coefficient of this variable ($b_{16 \cdot 37910}$) is —0.646 with standard error of 0.821 in the model. Contrary to our hypothesis of positive influence of non-agricultural employment on family planning acceptance, a negative influence is revealed by the analysis. However, taking an alternative hypothesis of negative influence and testing it for significance reveals that the regression coefficient is not significant at 5 percent level, as "t" ratio is —0.787 in the model, while the critical value of "t" at 5 percent level is —1.679. It means, the negative relationship could have been obtained by chance also. The only valid conclusion would be that non-agricultural employment in Madhya Pradesh does not influence family planning acceptance in either way.

We hypothesized positive influence of non-agricultural employment mainly on the consideration that this type of employment by making child bearing and rearing costly and by modernising workers' attitudes tend to reduce preference for additional children and exercises positive influence on family planning acceptance. However, in Madhya Pradesh, the type of non-agricultural employment appears to be such that it does not exercise any significant influence on family planning acceptance. Positive influence of this variable on family planning acceptance is likely to materialise with a rise in the level of development of the State and the growth of factory employment in the process.

Percent Female Workers. The estimated regression coefficient of this variable ($b_{17 \cdot 36910}$) is 0.118 with standard error of 0.122 in the model. In conformity with our hypothesis this variable is found to have positive influence on family planning acceptance rates. However, testing for significance, the coefficient is

not found to be significant as "t" ratio is 0.971 in the model, quite below the critical value of "t" at 5 percent level. Thus, this finding of positive influence could be due to chance also.

Female employment was hypothesized to exert a positive influence on family planning acceptance rates on the consideration that employment of females leaves less time for child rearing, raises opportunity cost of additional children and depresses their family size goal. It appears that the type of female employment in Madhya Pradesh—mainly in agriculture and household industries, is such that it is not much of an obstacle to child bearing and rearing. It is expected that with a rise in level of development and diversification of employment opportunities for women in the State, female employment may start exerting positive influence on family planning acceptance.

Hospital Bed Rate. The estimated regression coefficient of this variable ($b_{10 \cdot 36710}$) is 0.935 with standard error of 0.484 in the regression model. In accordance with our hypothesis, this variable is found to have positive influence on family planning acceptance rates. Testing for significance, the coefficient is found to be significant as "t" value is 1.933 in the model—quite above the critical value of "t" at 5 percent level. It suggests that development of medical facilities, of which the 'hospital bed rate' is a proxy variable, exercises a significant positive influence on family planning acceptance. As hypothesized, the development of medical facilities might be promoting family planning acceptance in several ways, viz. by improving health standards and lowering mortality, particularly child mortality and by providing facilities for offering family planning devices and their follow-up.

Percent Tribal Population. The estimated value of the regression coefficient of this explanatory variable ($b_{110 \cdot 3679}$) is 0.156 with standard error of 0.044 in the model. Contrary to our hypothesis of negative influence of this variable on family planning acceptance rates, the coefficient is positive. Taking an alternative hypothesis of positive influence and testing it for significance, the coefficient is found to be highly significant as "t" value in the model is 3.527, which indicates significance level of even .005. The positive influence of this variable can only be interpreted to mean that tribal population with its poverty, illiteracy and backwardness gives better response to various incentives and disincentives introduced by the administration.

Summary of Findings and Suggestions

Among the explanatory variables included in the regression model, 'percent female literate', 'hospital bed rate' and 'percent tribal population' are found to exercise significant positive influence on family planning acceptance in Madhya Pradesh. The former two variables may be considered as indices of socio-economic development and the third one may be taken to be indicative of backwardness of Madhya Pradesh districts. Taken together, these findings suggest that two contrasting forces, that of development and of backwardness, are responsible for programme achievements in the State in their own way. The other five explanatory variables—two included in the regression function and three left out of it after initial scrutiny, are not found to have significant influence on family planning acceptance. Possibly in the present level of development of the State, the nature of these five variables is such that they do not exercise depressing influence on family size goals and are not conducive to family planning acceptance.

The long run solution of the population problem of the State of Madhya Pradesh appears to lie in raising the level of its development to a stage, where the above indicators of development, which have no significant impact on programme acceptance in their present form start exerting positive influence. For a relatively shorter-run impact, a two-way approach is suggested. On one hand, the spread of literacy with special emphasis on female literacy should be accelerated and higher priority be given to the development of medical and health care as a part of the strategy of family planning programme implementation. On the other hand, adoption of a more imaginative incentive-disincentive policy aiming at a mild turning of cost-benefit scales against child bearing coupled with streamlining of the programme management at all levels is likely to yield better results in Madhya Pradesh.

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