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Female Literacy, Internet Use, and Marriage in Predicting Total Fertility Rate: An Inter-State Analysis

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Abstract: This paper aims to analyse the total fertility rate of different states in India and to find the contributing role of Female literacy, internet use, and marriage in determining it. The major research questions are: What is the relationship between Female literacy, internet use, and marriage with the total fertility rate? What is their contribution to determining the total fertility rate? Data has been taken from the National Family Health Survey-5. Multiple regression analysis was performed to find the contributory role. Results show that the total fertility rate has a negative relationship with Female literacy and internet use and a positive relationship with Females' marriage (percentage of women aged 20-24 married before 18 years). Female literacy, internet use and marriage contribute 5.31, 17.90 and 4.84 per cent, respectively, in total fertility rate. In comparison, the total contribution of these three variables to the total fertility rate is 28 per cent.

Keywords: National Family Health Survey-5, female literacy, internet use, marriage, multiple regression

The total fertility rate (TFR) rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children per age-specific fertility rates of the specified year. It is expressed as live births per woman. (United Nations, 2019; The World Bank, 2022). TFR is an indicator of several socio-economic and demographic characteristics of a population.

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High TFR indicates that the population has a low income, low literacy, and low socio-economic status in general and specifically in the women category. A decrease in TFR indicates that the socio-economic characteristics of that population in general and women in specific are improving. Low TFR also indicates that the population is literate, marriages are done late, income is improving, and women are becoming more empowered.

A TFR of 2.1 is required to replace the population. When TFR goes below 2.1, that population cannot replace itself. Low TFR is now a new challenge in all developed and developing countries (Nargund, 2009; Eslami, 2016), but many developing countries are still facing the issue of high TFR. The TFR of less developed countries is three times higher than that of more developed countries (El-Ghannam, 2005). According to the data of World Population Review 2022, less developed countries like Niger (6.8), Mali (5.8), Chad (5.6), etc., have very high TFR, whereases developed countries like Hong Kong (1.1), Germany (1.5), Australia (1.7) having low TFR. Three demographic processes may change the size of an area's population: birth, death, and migration. The developed world is now facing the problem of a shrinking population caused by the lowest TFR (ranging from 1.1 to 1.3). The ageing population is a common problem in middle and high-income group countries. TFR can be decreased by improving the population's educational, economic, and health status, but increasing TFR is a much greater challenge than reducing it. Historically, governments have succeeded in slowing fertility declines through various interventions. However, more than a single policy intervention is required to reverse low fertility in all cases (Grant et al., 2004).

India has a diverse population living in different regions or states with different parameters like sex ratio, education, population density, marriage, age of marriage, internet use, literacy, awareness, etc. Due to these diversities, the difference in TFR is found among the states. Now, India has attained a TFR of 2.00, which is below the replacement level of the population. This indicates that India's population explosion is now checked. Now, India should not focus on reducing the fertility rate but on retaining it at its present level to maintain the young dependency ratio at its present levels. TFR is affected by many variables like education, health, income, marriage, awareness, use of contraceptives, women empowerment etc. (Jejeebhoy, 1995; Lutz, 2014; Colleran et al., 2014; Wang & Sun, 2016). The present study is an effort to find the relationship of TFR with Female literacy, internet use, and marriage and the contribution of these factors in determining TFR.

Research Questions

After reviewing international and national research related to TFR, the present research has been taken up to answer the following research questions in the Indian context:

1. What are the regional disparities in TFR in India?

2. What is the relationship of TFR with Female literacy, internet use, and marriage?
3. How do Female literacy, internet use, and marriage determine the TFR?

Objectives of the Study

1. To find the regional disparities in TFR in India.
2. To find the relationship of TFR with Female literacy, internet use, and marriage.
3. To find the contributory role of Female literacy, internet use, and marriage in determining the TFR.

Hypotheses

$H_{\alpha 1}$ There exist regional disparities in TFR.

$H_{\alpha 2}$ TFR, Female literacy, internet use, and marriage are significantly correlated.

$H_{\alpha 3}$ Female Literacy, Internet Use, and Marriage significantly contribute to TFR.

Materials and Methods

Data Collection

Data for the present research has been taken from the National Family Health Survey (NFHS-5), 2019-21 (Phase 1 & Phase 2).

Size of the Sample

All 28 Indian States and 8 Union Territories have been selected as the sample for the analysis.

Variables of the Study

Independent Variables

To find the contributory role, three independent variables, i.e., Percentage of Women aged 15-49 years who are literate* (WL), Percentage of Women aged 15-49 years who have ever used the internet (WI), Percentage of Women aged 20-24 years married before age 18 years (WM).

*Here, the word literate refers to Women who completed standard nine or higher and Women who can read a whole or part of a sentence (NFHS, 2021).

In this paper, the terms Females and Women have been used interchangeably.

Dependent Variable

Total Fertility Rate (TFR).

Statistical Techniques Used

Correlation and multiple regression have been used to analyse the data.

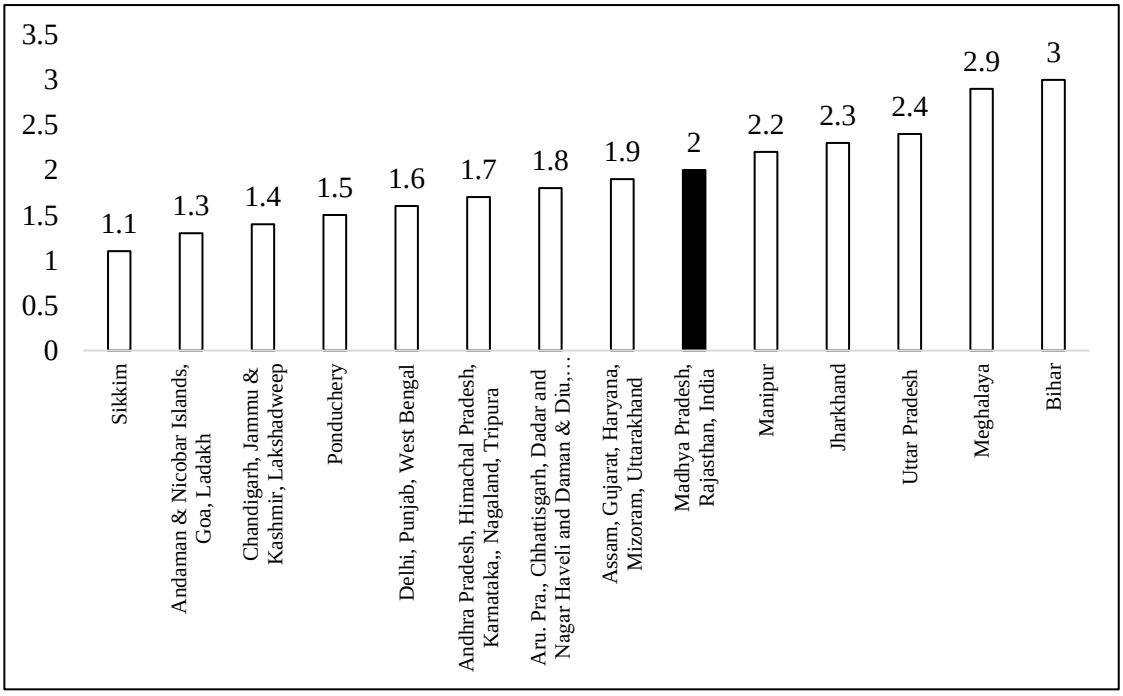
Analysis and Interpretation of Data

Regional Disparities in TFR

India has multiple languages, cultures, climates, lands, and diversities of educational, social, and economic development. All these diversities affect TFR. This can be observed from the data depicted in Figure 1 and Table 1.

Figure 1

Graph Depicting TFR of Indian States and Union Territories (UTs)



From Table 1, it is clear that Bihar has the highest TFR, i.e., 3, whereas Sikkim is the state having the lowest TFR, i.e., 1.1. Out of 36 states and UTs, a total of 31 States or UTs have TFR lesser than the replacement rate, whereas 5 States, namely Manipur, Jharkhand, Uttar Pradesh, Meghalaya, and Bihar, have TFR above the replacement rate. The above data reveals that in Lowest Low or nearby, the TFR category is highly dominated by smaller states and Union Territories like Sikkim, Andaman & Nicobar, Goa, Ladakh, Chandigarh, Jammu & Kashmir, Lakshadweep, and Puducherry. States which are low on economic and educational development indicators have higher replacement rates (2.1) of TFR, like Manipur, Jharkhand, Uttar Pradesh, Meghalaya, and Bihar. The above discussion reveals regional disparities in TFR among various states; therefore, alternative hypothesis Ha1 that *'there exist regional disparities in TFR'* is accepted.

Table 1

TFR in India, States and Union Territories

TFR Level	TFR	States & Union Territories, India
Lowest Low TFR	1.1	Sikkim
	1.3	Andaman & Nicobar Islands, Goa, Ladakh
Lower Than Replacement Rate (1.4 to below 2.1)	1.4	Chandigarh, Jammu & Kashmir, Lakshadweep
	1.5	Pondicherry
	1.6	Delhi, Punjab, West Bengal
	1.7	Andhra Pradesh, Himachal Pradesh, Karnataka, Maharashtra, Nagaland, Tripura
	1.8	Arunachal Pradesh, Chhattisgarh, Dadar and Nagar Haveli and Daman & Diu, Kerala, Odisha, Tamil Nadu, Telangana
	1.9	Assam, Gujarat, Haryana, Mizoram, Uttarakhand
	2	Madhya Pradesh, Rajasthan, **India**
Higher than Replacement Rate (Above 2.1)	2.2	Manipur
	2.3	Jharkhand
	2.4	Uttar Pradesh
	2.9	Meghalaya
	3	Bihar
Source: National Family Health Survey (NFHS-5), 2019-21		

Relationship of TFR with Dependent Variables

Literacy, Internet use, and marriage are closely related to TFR. Literacy and internet use increase awareness, hence helping to reduce the fertility rate. Late marriage reduces the span available for reproduction, reducing the TFR. This can be observed from the correlation values in Table 2 and Figure 2.

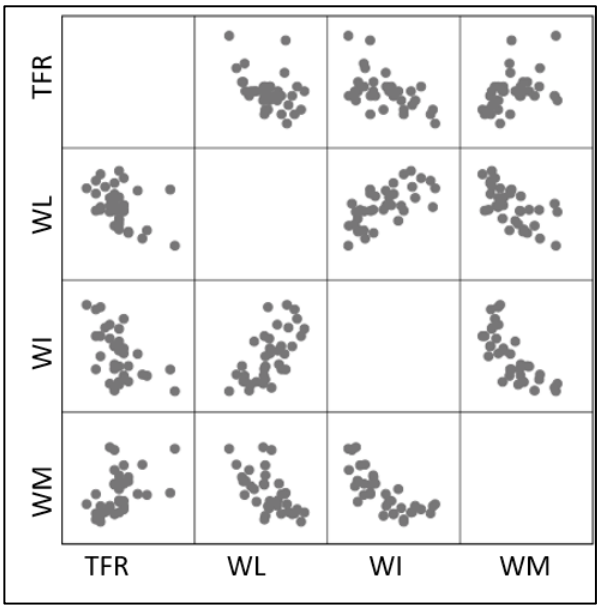
Table 2

Correlation Matrix of TFR with Women Predictive Variables

	TFR	WL	WI	WM
TFR	1.000	-0.425	-0.513	0.448
WL	-0.425	1.000	0.668	-0.625
WI	-0.513	0.668	1.000	-0.751
WM	0.448	-0.625	-0.751	1.000

Figure 2

Relationship of TFR with Women Predictive Variables



The correlation matrices presented in Table 2 reveal that TFR is negatively correlated with literacy (r = -0.425) and internet use (r = -0.513). As the literacy rate and internet use among Females increase, the TFR starts decreasing, whereas TFR and the percentage of Females aged 25-29 married before 18 years have a positive relationship (r = 0.448). It happens because marriage before the age of 18 increases the total span available for reproduction to a couple. A moderate positive correlation is found between literacy and internet use (r = 0.668), as literacy is a prerequisite for internet use. A negative correlation is found between the percentage of Females married before 18, literacy (r = -0.625), and internet use (r = -0.751). It shows that those who are literate and internet users get married late. The correlation values are either moderate or high. It shows that TFR values in India declined with the increment in literacy rate, high internet use, and a decline in the percentage of females getting married before 18. All the correlation values are significant at 0.001 level and df 34; therefore, alternative hypothesis $H_{\alpha 2}$ that '*TFR, Female Literacy, Internet Use, and Marriage are significantly correlated*' is accepted.

To Find the Contribution of Females Literacy, Internet Use, and Marriage in Determining the TFR

Multiple linear regression analysis was carried out to predict the contribution of Female literacy, internet use, and marriage to the prediction of TFR. The purpose of applying multiple regression analysis is to test the following hypothesis:

H_{a3}: Females *literacy, internet use, and marriage significantly contribute to TFR.*

Before the analysis, the prerequisites of applying multiple regression have been checked. It was found that the dependent variable, i.e., TFR, and all three independent variables, i.e., FL, WI, and WM, are on a continuous scale. The independence of residuals was checked using Durbin-Watson statistics. The value of Durbin-Watson statistics is 1.594, which is normal because it comes under the range of 1.5 to 2.5 (Field, 2009). Hence, no autocorrelation has existed. The correlation values between a dependent variable and the independent variables in the model indicate that all model variables have the linearity of correlation. This can easily be seen by the correlation matrix table, i.e., Table 2 and Figure 2. Data from the model shows homoscedasticity; this can be seen in Figure 3. In Figure 3, the dots are evenly distributed, which reveals that data for this regression model shows homoscedasticity. Figure 4 shows the Normal P-P Plot of regression standardised residuals; here, dots are approximately aligned with the line, which shows that residuals (errors) are normally distributed. To check another assumption, i.e., absences of multicollinearity, VIF values and Tolerance values are used. Table 5 shows that tolerance values are greater than 0.2 for each variable, and VIF values are less than 3; hence, data for this regression model did not show multicollinearity.

Figure 3

Scatterplot to Check Homoscedasticity of Data

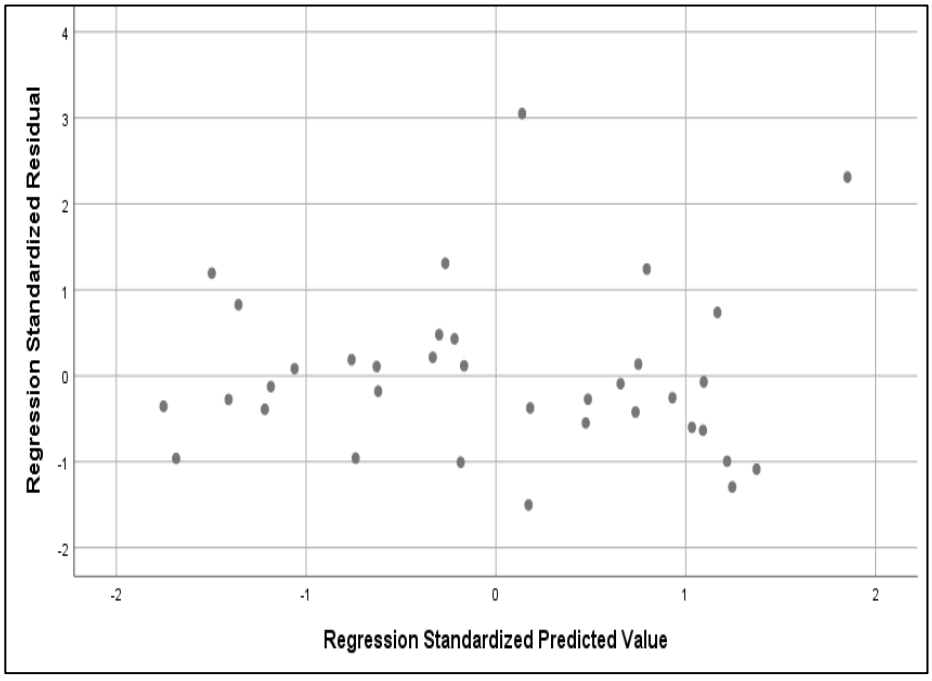
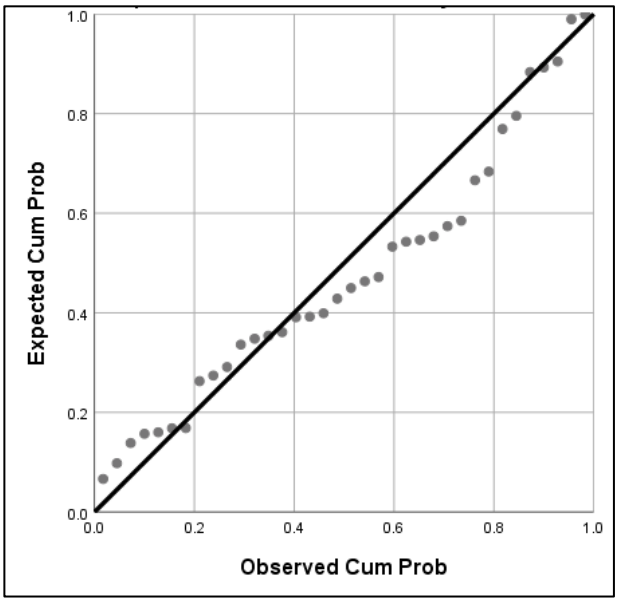


Figure 4

Normal P-P Plot to Check Normality of Data



From the above discussion, the model has fulfilled all the prerequisites and assumptions to apply multiple regression analysis. Following is the description of the multiple regression analysis results.

Table 3

Summary of Multiple Regression Analysis

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.530[a]	0.280	0.213	0.35291
a. Predictors: Constant, WM, WI, and WL b. Dependent Variable: TFR			

It is evident from the Multiple Linear Regression Table 3 that the value of the *Multiple Correlation Coefficient*, R, is 0.53. It indicates a good level of prediction. The Coefficient of Determination, R square (R^2), obtained from Multiple Regression Analysis is 0.28. From this value of R^2, it can be concluded that there is a variation of 28% in the TFR due to the change in WL, WI, and WM Women predicting parameters, i.e., Literacy, Internet use, and Marriage, determine 28% of the criterion variable, i.e., TFR.

Table 4

ANOVA for Multiple Regression

	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.553	3	0.518	4.158	0.014[b]
Residual	3.985	32	0.125		
Total	5.539	35			
a. Dependent Variable: TFR					
b. Predictors: (Constant), WM, WI, and WL					

The *F*-ratio in multiple regression tests, whether the overall regression model is a good fit for the data. The table shows that the independent variables statistically significantly predict the dependent variable, $F(3,32) = 4.158$, $p < 0.05$. Here, the F-ratio is significant at a 0.05 level of significance. This means that the regression model fits the data well or that a linear relationship exists between the predictive variables at a 0.05 significance level.

Table 5

Coefficients for Multiple Regression

	Unstandardised Coefficients		Standardised Coefficients	Correlations	Collinearity Statistics		Contributory percentage	Percentage of Contribution
	B	Std. Error	Beta	Zero-order	Tolerance	VIF	Beta * r	
(Constant)	2.483	0.685						
WL	-0.005	0.008	-0.125	-0.425	0.519	1.926	0.0531	5.31%
WI	-0.008	0.006	-0.349	-0.513	0.372	2.690	0.1790	17.90%
WM	0.004	0.008	0.108	0.448	0.409	2.446	0.0483	4.84%
a. Dependent Variable: Total Fertility Rate								

From the values given in Table 5, it is revealed that the values of unstandardised coefficients corresponding to each predictive variable are used to determine the relative change in TFR by unit change in predictive variables. From this, the general formula to predict TFR can be written as follows:

TFR = 2.483 – 0.005*WL – 0.008*WI + 0.004*WM

Where TFR=Total Fertility Rate, WL is the percentage of women aged 15-49 years who are literate, WI is the percentage of women aged 15-49 years who have ever used the internet, and WM is the percentage of Women aged 20-24 years married before age 18 years.

Unstandardised coefficients indicate how much the TFR varies with an independent variable when all other independent variables are constant. Here, the unstandardised coefficient for WL is equal to -0.005. This means that for each percentage increment in Female literacy, there is a decrease in TFR of 0.005. The unstandardised coefficient for WI is equal to -0.008. This means that for each percentage increment in Female internet use, there is a decrease in TFR of -0.008. Similarly, the unstandardised coefficient for WM is equal to 0.004. This means that for each percentage increment in Female marriage before age 18, there is an increase in TFR of 0.004.

Multiple Regression Analysis also produced individual contributions of predictive variables. The relative contribution of each Female predictive variable in the prediction of TFR is depicted in Table 8. The values obtained by multiplying β (standardised coefficient) and r (correlation coefficient) show the relative contribution of each predicting parameter. For Female literacy, the value is 0.0531, which means Female literacy contributes 5.31 per cent to TFR. Similarly, there is a 17.90 per cent contribution of Female internet use in TFR and a 4.84 per cent contribution of Female marriage in TFR. In contrast, the total contribution of these three variables in TFR is 28%.

From the results obtained, in this model, Female internet use was the most important contributor to predicting TFR. In contrast, the contribution of Female literacy and marriage was found to be comparatively less in predicting TFR.

Findings, Discussion, and Conclusion

It is observed from the above analysis that, at present, a relationship exists between TFR and Female literacy, internet use, and marriage in India. These factors also contribute to determining TFR. It can be said that efforts made by the government to bring women into the mainstream of society are slowly paying off as the determining factors of TFR are high (WL & WI) and low (WM) in the States where the TFR is low, and vice versa. A state like Bihar has TFR 3 and shows 57.8 per cent of Female literacy, 20.6 per cent of Females are using the internet, and 40.8 per cent of Females get married before age 18. This data is much diverted compared to the state Sikkim, which shows 88.9 per cent women literacy, 76.7 per cent of women are using the internet, and only 10.8 per cent of females get married before age 18. This data also supports findings showing that Female literacy, marriage, and internet use contribute to determining TFR. It became increasingly clear that once fertility reaches very low levels, there is greater difficulty in crafting effective policies to reverse the fertility decline (Silva, 2008). Policy reform is needed to retain India's TFR at its current level. The literature suggests that this is less attributable to a single policy mechanism than its ability to create an environment encouraging childbearing. This environment is created by a combination of policies that jointly serve this aim (Grant et al., 2004). Hence, with reforming policies of the states

having high TFR, other stakeholders concerned with this matter should continue to encourage women to get educated and make them aware of the consequences of getting marked early and having more children.

Meanwhile, some incentives should be provided to literate women and their families so that while pursuing their careers and studies, they may easily give birth and care for their children. This may include providing maternity leave for two or three times, childcare leaves to both parents, flexibility in working hours, flexibility for working from home, and opening and maintaining childcare centres and creches near the workplace or childcare facilities within the workplace. These are some suggestions that can be helpful to maintain the TFR without compromising women's education and careers. To provide such incentives, there is a need to reform policies at the national and state levels and at the local and organisational levels, by which flexibility will be provided to the Female workforce in the government and private sectors.

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