Education and Marital Fertility in India : A Panel Study

***Jasmine Brahma, Lwmshaw Sainary, Dr. Konita Basumatary**
Department of Economics, Bodoland University, Assam, India
**Correspondence : E-mail : Jasmine091194@gmail.com*

Abstract

The paper aims to analyze the marital fertility rate and the relationship of marital fertility with education in the states of India. Total Marital Fertility Rate (TMFR) and educational attainment levels were gathered from Sample Registration (SRS), 2011 to 2020, as the basis for this study's secondary data. A panel regression was conducted to investigate the relationship between TMFR and education for 18 states in India using Eviews 12 software. ASMFR peaks in the age range of 15 to 19 and subsequently begins to decline. The trends of the overall marital fertility rate also showed that it climbed from 2011 to 2013, declined in 2014, increased from 2015 to 2016, fell again in 2017 and started increasing once again from 2017 to 2020. In India, the TMFR has increased from 2017 overall. Panel regression analysis reveals the impact of TMFR on educational levels in the Indian states. According to the analysis of ASMFR, it declines with the increase in the age group of married women. Also, the trend of TMFR varies from 2011 to 2020. The empirical panel regression results show that TMFR varied with education levels. As a result, variations in socio-economic development, especially educational attainment, are to blame for the discrepancies in reproduction between Indian states. Rural regions with high marital fertility require more attention. Other aspects also need to be thoroughly examined. Additionally, the government and non-governmental organizations should promote awareness of the value of birth control and enforce laws governing the age of first marriage.

Keywords : *Marital Fertility, Panel Data, Education, India*

Introduction

India has the world's largest population. It accounts for over 20% of births globally, with a population growth rate of 1.74 percent annually. India's unregulated population growth is one of the main threats to its political, economic and social progress. The environment is burdened by rising fertility and population, which also impacts regional livelihoods and health, endangering long-term prospects for sustainable growth. The growth of medical sciences and the implementation of public health measures in developing countries after the 1950s due to Western industrialization, urbanization and socio-economic development led to a fall in mortality rates but not a decrease in fertility rates. Numerous demographers and policy makers now view this rise in fertility as a crucial issue.

In the societies of India, most women give birth only after getting married (Dutt). The marital fertility rate is measured in the following ways-

a. Age-specific Marital Fertility Rate (ASMFR) : Age-Specific Marital Fertility Rate is obtained by dividing the number of live births to only currently married women in a particular age group in the given region by the number of women of the same age group during the given period and multiplying this figure by 1000. Thus, ASMFR = $\frac{n^{B_x}}{n^{W_x^m}} \times k$ $-(1)$ (Registrar General & Census Commissioner of India)

where n^{B_x} = Number of live births in a particular age group in the given region during the given period and usually such age group is taken as 5 years of interval.

$n^{W_x^m}$ = Number of married women of the same age group in the region during the given period.

k = 1000

b. Total Marital Fertility Rate (TMFR) : Total Marital Fertility Rate is the cumulative value of age-specific marital fertility rates at the end of the reproductive period. It indicates the average number of children expected to be born per married woman during the entire span of her reproductive period if the ASMFRs continue to be the same and if there is no mortality.

Thus, TMFR= $5 \sum 5^{i_x}$ - (2)

where 5^{i_x} = $5^{i_x} = \frac{5^{B_x}}{{}_5^{f}P_x}$ × k and k = 1000

Sample Registration System data shows that India's Total Marital Fertility (TMFR)

increased from 4.3 to 4.4 children per woman in 2011, remained stable at 4.4 in 2012, down to 3.9 in 2014 and then increased to 4.6 in 2015. The poor use of contraception among married women in India may be the cause of this. When compared to illiteracy, women with higher levels of education have lower fertility rates (Das, Das and Roy; Mutwiri). Numerous studies also have demonstrated that one key factor influencing fertility is education. More educated women marry at young, use contraceptives more frequently (Ajao and Sanni; Aragaw), are exposed to more information; have greater independence; work outside the home; and are more aware of their health and children.

The objectives of this article are:

1. To analyze the ASMFR and trends of TMFR in India.
2. To determine the relationship between women's educational attainment and marital fertility across Indian states.

Review of Literature

Som and Mishra in their work 'Role of Women Education for Fertility Reduction : A Case Study of Sagar District, India' concentrated on the influence of women's education on fertility from various angles. They assessed the level and trends of mean children ever born (MCEB) and female education, investigated the causes of fertility differences by female educational level and also determined the influence of female educational level on fertility and relationships. The researcher saw a difference in fertility with higher levels of schooling. The results show that as education increases, fewer babies are born. Additionally, it was found that educated women were twice as likely to utilize contraception as uneducated women and illiterate women had shorter breastfeeding periods, which improved fertility. In addition, the study revealed that women with higher education had a 5 times reduced probability of passing away than those without one Female education decreased the impact of son preference and urban areas had greater rates of contraceptive use than rural ones.

Rayhan, Akter and Islam conducted a study entitled, 'Determinants of fertility rate decline in the South Asian Countries: A Panel Data Approach'. It found that the per capita GNI, female labour force participation, education and urbanization were shown to have a negative association with the fertility rate, while the relationship between the fertility rate and the infant mortality rate was found to have a positive relationship.

Mahanta in their work 'Impact of Education on Fertility : Evidence from a Tribal Society in Assam' examined the association between education and fertility in tribal societies, focusing in particular on the Mising women of Assam. The investigators also examined the effect that a wife or husband's education might have on conceiving a child. The findings revealed that when education levels increased, people began to marry at older ages, which reduced fertility. The study also discovered that educated couples were more aware of the use of contraceptive methods for family planning, resulting in fewer live births and educated women may teach their husbands about the risks to their reproductive health and the associated financial costs of having a high fertility rate as well as educate them on fertility management. Thus, it indicated that even in a tribal group of Mising people, education was found to be an essential socio-economic determinant in determining fertility levels.

Materials and Methods

A panel regression was conducted to investigate the relationship between TMFR and education for 18 states in India using Eviews 12 software. The data utilized for the study of TMR trends in India and their relationships to educational attainment in the various Indian states was obtained from the Sample Registration System (SRS), which runs from 2011 to 2020. To ascertain the relationship between TMFR and educational attainment in 18 Indian states from 2011 to 2020, a panel regression was used. In this case, the TMFR is the dependent variable and the educational attainment—which can be classified as illiterate, primary, middle, high school, higher secondary, graduate and above—is the independent variable. The unit root test is done to ensure that each series is stationary before the estimation of regression. In this case, the null hypothesis suggested that the series is non-stationary while the alternate hypothesis assumed that it is stationary. Individual ADF Fisher is used for this test at levels and the first difference for each series.

Descriptive data shows the TMFR and levels of education including illiterate, primary, middle, high school, higher secondary education and graduate and above. The Lagrange multiplier, Likelihood and Hausman tests were conducted through EVIEWS 12 program to see which is an appropriate model for the panel data. The Breusch-Pagan test was used to differentiate between the pooled and random effect models in the Lagrange multiplier test, with the null hypothesis assuming the absence of a random effect and the alternative hypothesis assuming the presence of a random effect. The null hypothesis was rejected for $p < 0.05$ and accepted if $p > 0.05$. Additionally, if the null hypothesis was rejected, further the Chow test (Likelihood Test) was conducted to determine the best model among the pooled least square and fixed effect models. Here, the null hypothesis assumes the absence of a fixed effect while the presence of a random effect in the alternative hypothesis. Furthermore, if the null hypothesis was rejected, the Hausman test was conducted to determine whether to use a random effect model or a fixed effect model.The null hypothesis assumed the presence of a random effect and the absence of a fixed effect in the alternative hypothesis. Here, the null hypothesis was rejected for $p < 0.05$ and accepted if $p > 0.05$. The random effect model was used when the null hypothesis was accepted otherwise the fixed effect model was

recognized as the most appropriate model for the estimation.

The random effect model is given by

$TMFR = \beta_0+\beta_1X_{1it}+\beta_2X_{2it}+\beta_3X_{3it}+ \beta_4X_{4it}+\beta_5X_{5it}+\beta_6X_{6it}+ (\alpha_i - \alpha) + €_{it}$ – (1) where TMFR is the dependent variable.

X_{1it} (Illiterate), X_{2it} (Primary), X_{3it} (Middle), X_{4it} (High school), X_{5it} (Higher secondary), and X_{6it} (Graduate & above) are independent variables.

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ & β_6 are the coefficients of independent variables. α is the value of the specific state i and captures the state effect. ε_{it} is the error term.

Age-specific Marital Fertility Rate by residence of India

The ASMFRs for India by residence in 2020 are presented in Table 1. It was found that ASMFRs decreased as married reproductive women got older. The age range of 15 to 19 had the highest marital fertility and it steadily declined after that. Marital fertility was higher in rural than in urban areas. This may be due to a greater number of women who marry at an early age and have morechildren. Also, they have lower levels of education and use less contraception to achieve their desired number of offspring (Adhikari; Bongaarts; Reddy, Women's education and human fertility in India).

Table 1 : ASMFRs by residence of India, 2020

Age group	Total	Rural	Urban
15-19	353.0	361.2	318.2
20-24	339.1	350.0	306.5
25-29	199.3	206.2	183.9
30-34	95.1	98.4	88.8
35-39	38.1	41.2	32.1
40-44	12.6	14.5	9.2
45-49	5.2	5.6	4.4

Source : Sample Registration System (SRS), 2020.

The ASMFRs for India by place of residence are shown in Figure 1. The highest peak in marital fertility was seen in the age range of 15 to 19 years old and it afterward dropped. It was also noted that marital fertility varied depending on place of residence, with rural areas having greater rates than urban areas. Both the areas have their highest peak in the age range 15-19 and from 20–24 to 45–49, there was a steady fall.

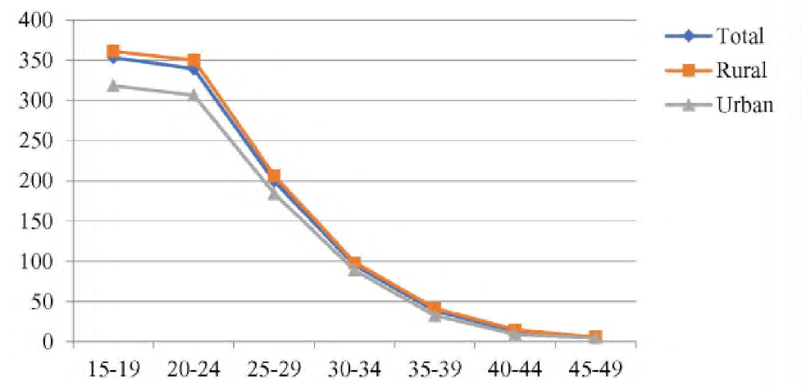

Figure 1: ASMFRs by residence of India, 2020

Trends of Total Marital Fertility Rate by residence of India

The trend in India's total marital fertility (TMFR) from 2011 to 2020 is shown in Table 2. According to the table, the TMFR showed a slight increase from 4.3 births per woman in 2011 to 4.4 births per woman in 2013, following which it remained stable. It fell to 3.9 births per woman in 2014. Again, there was a sharp rise from 3.9 births per woman in 2014 to 4.6 births per woman in 2015 and 4.8 births per woman in 2016. Following that, it began to decline in 2017 before steadily increasing once again beginning in 2018 and reaching 5.2 births per woman in 2020. However, the TMFR was higher in rural areas than in urban ones. Figure 2 additionally displays the TMFR pattern.

Table 2 : Trends of Total Marital Fertility Rate (TMFR) by residence of India, 2011 to 2020

Year	Total	Rural	Urban
2011	4.3	4.4	3.8
2012	4.4	4.5	3.9
2013	4.4	4.5	4.2
2014	3.9	4	3.5
2015	4.6	4.7	4.2
2016	4.8	5	4.1
2017	4.7	4.9	4.1
2018	4.9	5.1	4.4
2019	5.1	5.3	4.7
2020	5.2	5.4	4.7

Source: Sample Registration System Statistical Report, 2011 to 2020

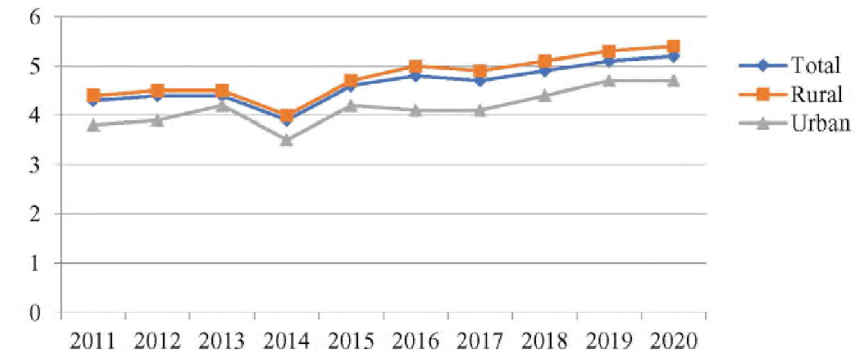

Figure 2 : Pattern of TMFR by residence in India from 2011 to 2020

Panel Unit Root Test

For each series of panel data, stationarity was examined using the ADF Fisher unit root test, as indicated in Table 3.

Table 3 : Results of ADF Fisher Unit root test for variables

Panel Unit Root Test			
Method: ADF Fisher Unit Root Test			
Variables		Stationary at level	
		Statistic	Prob.
TMFR (Total Marital Fertility Rate)		133.1	0.0000
EDUCATIONAL LEVEL	Illiterate	164.5	0.0000
	Primary	177.5	0.0000
	Middle	139.5	0.0000
	High school	116.5	0.0000
	Higher Secondary	148.4	0.0000
	Graduate & above	104.8	0.0000

Source : Calculated by the author

The educational level variable was divided into the following categories in this case: Illiterate, Primary, Middle, High School, Higher Secondary and Graduate & above. When $p > 0.05$, the null hypothesis assumed the series as non-stationary; whereas, when $p < 0.05$, the alternate hypothesis assumed the series to be stationary. Using individual unit root ADF

Fisher, each series was tested at various levels in this context. The results showed that each series was stationary at $p < 0.05$.

Descriptive statistics

The descriptive statistics of the given variables from 2011 to 2020 are presented in Table 4.

Table 4 : Descriptive statistics of variables from 2011 to 2020

Variable	Mean	Std. Dev.	Obs.
TMFR	4.51	0.95	180
Illiterate	2.51	0.99	180
Primary	2.48	0.62	180
Middle	2.23	0.46	180
High school	1.98	0.35	180
Higher Secondary	1.72	0.37	180
Graduate & above	1.61	0.39	180

Source : Calculated by the author. The estimation models

As shown in Table 5, the Lagrange multiplier test, such as the Breusch-Pagan LM test, was carried out. The outcome of the test indicated that the null hypothesis was rejected, indicating that the pooled OLS model was unsuitable. As a result, the random effect was a better model than a pooled OLS model.

Table 5 : Results of Lagrange Multiplier Test for Random Effect

Lagrange Multiplier Tests for Random Effects			
Null hypothesis: No effects			
Alternative hypothesis: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives			
Test hypothesis			
Test	**Cross-section**	**Time**	**Both**
Breusch-Pagan	134.6742 (0.0000)	35.42613 (0.0000)	170.1003 (0.0000)

As revealed in Table 6, the Chow test findings also revealed that the test rejected the null hypothesis and accepted the alternative hypothesis. As a result, the fixed effect was a better model than the pooled effect.

Table 6 : Results of Chow test for Fixed Effects

Redundant Fixed Effects Tests			
Test cross-section fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	10.327480	(9,164)	0.0000

Additionally, the outcome of the Hausman test indicated that the null hypothesis was accepted, indicating that the random effect was preferable to the fixed effect as a model for estimation. This is presented in Table 7.

Table 7: Results of the Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	8.168717	6	0.2260

Relationship between educational level and TMFR

In the estimated model analysis, a relationship between the TMFR and women's educational attainment was found, as shown in Table 8. Illiterate and TMFR were found to be significantly correlated. This suggested that at a 1% level of significance, a 1% rise in illiterate causes a 0.24% increase in the TMFR. Additionally, at the 1% level of significance, the TMFR exhibits a positive and statistically significant connection with graduate and above levels; that is, a 1% rise in graduate and above levels corresponds to a 0.51% increase in the TMFR. Many studies showed that the overall fertility rate decreases with levels of education, including Som and Mishra; Dreze and Murthi; Htun and Ard-am; Adhikari; Bongaarts. However, the current research demonstrates that TMFR rises with increased levels of schooling. This could be because married women may wait to use contraception until they have the desired number of children (Chouhan, Saha and Zaveri; Ajao and Sanni; Adhikari), and they may only breastfeed their infants for a short period if they work outside the home. In addition, moms today supplement or replace other foods for nursing when feeding their children (Reddy).

Table 8 : Results of the Random effect model

RANDOM EFFECT MODEL					
Dependent Variable: TMFR					
Method: Panel Least Squares					
Cross-sections included: 10					
Total panel (balanced) observations: 180					
Variable		**Coefficient**	**Standard Error**	**t-statistic**	**Prob.**
C		1.002720	0.293389	3.417716	0.0008
EDUCATIONAL LEVEL	Illiterate	0.238494	0.075009	3.179537	0.0017*
	Primary	0.424752	0.164056	2.589066	0.0104
	Middle	-0. 351171	0. 217410	-1.615253	0.1081
	High School	0.673370	0.269469	2.498874	0.0134
	Higher Secondary	0.282020	0.200273	1.413221	0.1594
	Graduate & above	0.509339	0.189741	2.684386	0.0080*
R^2		0.604446			
Durbin- Watson stat.		2.321391			

* 1% level of significance. *Source*: Calculated by the author

Conclusion and the way forward

The results of this study showed that married women who were illiterate as well as graduate-level and above had statistically significant TMFR levels. In comparison to illiterate women, educated women were more likely to delay marriage and use contraception (Adhikari; Bongaarts; Som and Mishra; Ajao and Sanni). However, the current data revealed that TMFR changes with educational levels, i.e., high fertility rates are also observed among those with graduate degrees and higher. This could involve breastfeeding for a shorter period or using contraceptives only after having the desired number of children. Governmental and non-governmental organizations should therefore spread the word about the value of birth control. The age of first marriage should also be governed by the government.

ASMFR peaked in the age range of 15 to 19 and subsequently began to decline. The trends of the overall marital fertility rate also showed that it climbed from 2011 to 2013, declined in 2014, increased from 2015 to 2016, fell again in 2017 and started increasing once again from 2017 to 2020. In India, the TMFR had increased from 2017 overall. Panel regression analysis revealed the impact of TMFR on educational levels in the Indian states. According to the analysis of ASMFR, it declined with the increase in the age group of married women. Also, the trend of TMFR varied from 2011 to 2020. The empirical panel regression results

showed that TMFR varied with education levels. As a result, variations in socio-economic development, especially educational attainment, were to blame for the discrepancies in reproduction between Indian states. Rural regions with high marital fertility require more attention. Other aspects also need to be thoroughly examined.

The analysis shows that ASMFR decreases when married women's ages rise. The age group 15 to 19 had the highest marital fertility rate, which then declined across the board. Both rural and urban areas' ASMFRs began to decline from 15-19 to 45-49; however, the rural area's ASMFR was higher than the urban areas.

According to the TMFR trend, 4.3 children were born to every woman in all marriages in 2011. This rate increased from 4.3 children per woman in 2011 to 4.4 children per woman in 2012, according to estimates from the Sample Registration System. India continues to have higher than average marital fertility, notwithstanding variations by region and educational attainment. The trend of marital fertility varied across rural and urban areas between 2011 and 2020.

A panel regression shows a strong positive relationship between female educational achievement and marital fertility as well. The longer reproductive span brought on by better nutrition and health and the non-practice of contraception, along with higher fecundity and less fatal loss, could be the reasons for the rise in marital fertility as education levels rise. As a result, education increasingly influenced fertility. More research is required to fully understand the factors that have contributed to the recent and significant increase in marital fertility. According to the analysis above, variations in socioeconomic development, particularly schooling, are the root cause of reproductive disparities between Indian states. More focus needs to be given to rural areas with high marital fertility if India is to reach below-replacement fertility. It is also necessary to do a more complete investigation of the other elements that have contributed to the sharp rise in marital fertility.

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