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Women's Scholastic Attainment and Economic Development in India

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ABSTRACT
This paper investigates the impact of female education on regional economic growth across selected Indian states from 2005 to 2022. Using panel data regression and correlation analysis, it evaluates Net State Domestic Product (NSDP) relative to basic female literacy and secondary-or-higher education (ten or more years of schooling). Both metrics demonstrate statistically significant positive effects on economic output, with secondary attainment yielding a substantially larger developmental return. Significant unobserved state heterogeneity further indicates that regional dynamics influence growth trajectories. Consequently, policy interventions must extend beyond basic literacy initiatives to emphasize female retention throughout secondary and higher education.

Keywords: *Economic growth, Education, Female literacy, Panel Data Regression*
JEL Classification Code: H51; I15: J13; O53

I.INTRODUCTION

Foundational literacy and numeracy are vital building blocks of human capital and key drivers of economic growth. Measuring these skills among youth aged 15 to 24 reveals how well schools prepare students and whether an economy can build a skilled workforce. However, headline literacy figures often hide substantial gaps in teaching quality, practical learning, and fair access across different groups.

Educating women delivers far-reaching social and economic benefits. Evidence from across the Asia-Pacific shows that female education strengthens GDP growth, lowers fertility rates, raises female workforce participation, and improves household well-being (Oztunc et al., 2015). This supports established development research showing that while general economic growth does not automatically guarantee equal rights or health for women, gender equality in education and employment reliably drives economic growth (Kabeer, 2012, 2013). Educated women gain stronger decision-making power at home, which leads to better health and education outcomes for the next generation.

India has made clear gains in female literacy since independence, but major imbalances remain. In 1951, female literacy was just 8.9%; by the 2011 Census, it had risen to 65.46%, alongside an overall literacy rate of 74.04%. Yet this national progress conceals sharp regional and demographic divides. High-achieving states like Kerala contrast sharply with lower-performing states such as Bihar and Rajasthan, and rural women still face much lower enrollment and higher dropout rates at higher levels of education than their urban peers.

Targeted initiatives such as *Beti Bachao, Beti Padhao* and *Kasturba Gandhi Balika Vidyalaya* (KGBV) residential schools have helped lower financial barriers and keep more girls in school. Even so, entrenched

cultural norms, poverty, poor school sanitation, and safety concerns continue to limit female attendance and curb women's entry into the formal workforce.
Overcoming these barriers is essential for India's equitable development. While more women are entering school, access alone does not guarantee economic independence or genuine social mobility. This study examines the empirical relationship between female educational attainment and key indicators of socio-economic progress, evaluating the policies needed to turn basic literacy into lasting gender equality.

II.LITERATURE REVIEW

Decades of research confirm that investing in female education is one of the most effective drivers of long-term economic growth. In emerging economies, educating girls yields high returns for both individuals and society: it increases workforce productivity, accelerates declines in fertility rates, and ensures healthier, better-educated future generations.
Conventional economic theory assumes that as women gain more education, they naturally enter the workforce in greater numbers. India, however, presents a striking paradox: while female literacy and school enrollment have surged, female labor force participation (FLFPR) has stagnated or even fallen—reflecting the classic U-shaped curve described by Goldin (1995). Broad cross-national studies (e.g., Oztunc et al., 2015) overlook the socio-cultural realities unique to India. In practice, higher educational attainment is often used to secure better marriage prospects or signal family status rather than build a career, while heavy domestic care responsibilities continue to keep educated women out of paid employment.
A similar pattern appears in the Middle East and North Africa. Abbasi-Shavazi and Torabi (2015) analyzed cross-national data on women's schooling, literacy, and life expectancy against GNI per capita, confirming that improvements in female health and education strongly correlate with national economic growth. Yet their study highlights a persistent bottleneck: even as women have caught up with men in educational attainment, restrictive labor markets and institutional hurdles keep many of them from converting their degrees into active workforce participation.
Alaoui (2016) underscores that the economic payoff from female education depends heavily on the strength of local institutions, focusing on North Africa—specifically Morocco, Algeria, Tunisia, and Egypt. The study shows that while expanding women's access to college and university is essential, higher education alone cannot guarantee economic growth. Without labor market reforms, transparent governance, and an end to gender-based wage discrimination, expanding higher education simply creates high rates of educated unemployment rather than driving national productivity.
Rather than treating the workforce as a uniform group, recent economic studies separate male and female human capital to measure their distinct contributions to national output. Applying an Autoregressive Distributed Lag (ARDL) model to Indian data, Giri and Sehrawat (2017) built composite indices for men and women using health (life expectancy and survival rates) and education metrics (literacy and enrollment ratios). Their findings reveal a striking asymmetry: while male human capital showed a positive but statistically insignificant link to long-run economic growth, female human capital had a statistically significant, positive impact in both the short and long run ($p < 0.05$). This evidence underscores that public investments in female education and health generate substantially higher economic returns than equivalent spending on male human capital.

III.OBJECTIVE OF THE STUDY

While existing empirical literature (e.g., Oztunc et al., 2015; Abbasi-Shavazi & Torabi, 2015; Alaoui, 2016; Giri & Sehrawat, 2017) confirms a broad macro-level correspondence between female education and economic growth, several critical institutional voids remain unaddressed in the contemporary Indian context. Hence,this paper aims to undertake a study on the effect of female literacy and schooling on economic growth using panel data regression and correlation analysis across selected states of India for the period 2005-2022. States, of similar size, were selected, preferably, from all the regions of the country.

IV. METHODOLOGY

This paper, considered unit level data from three rounds of National Family Health survey, namely, NFHS-3(2005-06), NFHS-4(2015-16) and NFHS-5(2019-20).

Statistical Analysis: Correlation & Panel Data Regression has been performed to understand whether that economic growth correlate with female literacy rate, and women having 10 years or more schooling, and its effect on economic growth for few selected states in India.

Below is the table, where the columns, represent each state's respective NSDP (Rs.), female literacy rate (%), and women having 10 years or more schooling (%) from NFHS survey, i.e., NFHS- 3, NFHS-4 and NFHS -5 , for years, 2005-06, 2015-16 & 2019-22 respectively.

Table 1: Each State and their respective NSDP, Female Literacy & Women Schooling of 10 years or more for different years

State	Rounds of NFH	NSDP (in Rs.)	Female Literacy (in %)	Women with 10 Years or more schooling (%)
Haryana	3	40,627.00	60.4	29.6
Haryana	4	1,37,818.00	75.4	45.8
Haryana	5	1,70,616.00	79.7	49.5
Himachal Pradesh	3	35,806.00	79.5	44.6
Himachal Pradesh	4	1,12,723.00	88.2	59.4
Himachal Pradesh	5	1,40,944.00	91.7	65.9
Punjab	3	34,096.00	68.7	38.4
Punjab	4	1,00,141.00	81.4	55.1
Punjab	5	1,18,487.00	79.4	56
Rajasthan	3	19,445.00	36.2	11.7
Rajasthan	4	68,565.00	56.5	25.1
Rajasthan	5	76,643.00	64.7	33.4
Madhya Pradesh	3	15,927.00	44.4	14
Madhya Pradesh	4	47,351.00	59.4	23.2
Madhya Pradesh	5	60,452.00	65.4	29.3
Uttar Pradesh	3	13,445.00	44.8	18.3
Uttar Pradesh	4	36,973.00	61	32.9
Uttar Pradesh	5	43,061.00	66.1	39.3
Bihar	3	7,588.00	37	13.3
Bihar	4	24,064.00	49.5	22.8
Bihar	5	29,798.00	57.8	28.8

Odisha	3	18,194.00	52.2	15.6
Odisha	4	58838	67.4	26.7
Odisha	5	76,462.00	69.5	33
West Bengal	3	23,808.00	58.8	15.6
West Bengal	4	57,255.00	70.9	26.5
West Bengal	5	69,559.00	76.1	32.9
Arunachal Pradesh	3	26,870.00	52.7	15.1
Arunachal Pradesh	4	85,020.00	65.6	31
Arunachal Pradesh	5	1,13,081.00	71.3	39.4
Assam	3	17,050.00	63	19.3
Assam	4	50,642.00	71.8	26.2
Assam	5	61,519.00	77.2	29.6
Gujarat	3	36,102.00	63.8	23.5
Gujarat	4	1,20,683.00	72.9	33
Gujarat	5	1,64,060.00	76.5	33.8
Maharashtra	3	40,671.00	70.3	30.7
Maharashtra	4	1,22,889.00	80.3	42
Maharashtra	5	1,42,211.00	84.6	50.4
Andhra Pradesh	3	27,179.00	49.6	21.6
Andhra Pradesh	4	88,609.00	62.9	34.3
Andhra Pradesh	5	1,10,587.00	68.6	39.6
Karnataka	3	29,295.00	59.7	27.8
Karnataka	4	1,16,813.00	71.7	45.5
Karnataka	5	1,56,086.00	76.7	50.2
Kerala	3	35,492.00	93	48.7
Kerala	4	1,20,387.00	97.9	72.2
Kerala	5	1,47,951.00	98.3	77
Tamil Nadu	3	34,126.00	69.4	31.9
Tamil Nadu	4	1,15,875.00	79.4	50.9
Tamil Nadu	5	1,44,845.00	84	56.6

Source: Author's compilation from nationally published reports

The purpose here is, to find evidence on the positive impact of 'Female Literacy' and 'Women with schooling for more than 10 years' on Economic Growth i.e., NSDP of a state. NSDP is a measure of the economic performance of a state within a country. It represents the total value of goods and services produced within the state, minus the depreciation of capital assets.

5.1. CORRELATION AND REGRESSION ANALYSIS OF THE YEAR 2019-20 (NFHS 5)

5.1.1 FEMALE LITERACY & NSDP:

Table 2: Correlation Testing for Female literacy & NSDP

	NSDP (in Rs.)	*Female Literacy (in %)*
NSDP (in Rs.)	1	
Female Literacy (in %)	0.715843735	1

Source: Author's calculation

Interpretation:

The above result showcases the correlation between Net State Domestic Product (NSDP) and Female Literacy, with the correlation coefficient between these two variables being 0.71584. This figure indicates a strong positive relationship between female literacy rates and economic growth, as measured by NSDP.
The correlation coefficient quantifies the strength and direction of a linear relationship between two variables. In this case, a correlation coefficient of 0.715843735 suggests a strong positive relationship between female literacy and economic growth. This means that as female literacy rates increase, NSDP tends to rise as well.
A coefficient of this magnitude (close to 1) implies that the relationship is not only positive but also relatively strong, indicating that changes in female literacy are closely associated with changes in economic growth. This strong correlation supports the idea that improving female literacy can have a significant impact on economic performance.

Table 3: Regression Analysis for Female literacy & NSDP

Regression Statistics	
Multiple R	0.715843735
R Square	0.512432254
Adjusted R Square	0.479927737
Standard Error	32717.3853
Observations	17

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	16875238709	16875238709	15.76495545	0.001231013
Residual	15	16056409510	1070427301		
Total	16	32931648219			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-131451.2404	60685.65497	-2.16610071	0.04682232

Female Literacy (in %)	3153.955488	794.345036	3.97051072 9	0.00123101 3	

Source: Author's calculation

Interpretation:
The regression analysis examines the relationship between female literacy rates and Net State Domestic Product (NSDP) across 17 states. The Multiple R value of 0.7158 indicates a strong positive correlation, suggesting that higher female literacy rates are associated with higher NSDP values. The R^2 of 0.5124 means that approximately 51.24% of the variability in NSDP can be explained by female literacy, demonstrating a moderate to good model fit. Adjusted R^2, at 0.4799, refines this estimate by accounting for model complexity, still showing significant explanatory power.
The sample size of 17 states is relatively small, which could affect the reliability of the estimates. The ANOVA results, with a Significance F of 0.001231, confirm that the regression model is statistically significant. Additionally, the p-value of 0.0012 for the female literacy coefficient suggests a meaningful relationship. The coefficient of 3153.955488 indicates that each percentage point increase in female literacy correlates with a rise of approximately 3153.956 units in NSDP. Overall, the analysis underscores the importance of female education in boosting economic growth, highlighting the potential economic benefits of investing in female literacy.

5.1.2 WOMEN HAVING 10 YEARS OR MORE SCHOOLING & NSDP:

Table 4: Correlation Testing for Women with 10 years or more Schooling & NSDP

	NSDP (in Rs.)	***Women with 10 Years or more schooling***
NSDP (in Rs.)	1	
Women with 10 Years or more schooling	0.671806412	1

Source: Author's calculation

Interpretation:
The correlation coefficient of 0.6718 quantifies the strength and direction of the linear relationship between NSDP and the percentage of women with 10 years or more schooling, considered a moderate to strong positive correlation

Table 5: Regression Analysis for Women with 10 years or more Schooling & NSDP

Regression Statistics	
Multiple R	0.671806412
R Square	0.451323855
Adjusted R Square	0.414745445
Standard Error	34707.16525
Observations	17

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	148628384	148628384	12.3385	0.003141
Residual	15	180688097	12045873		
Total	16	329316482			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	12400.78954	28333.788	0.43767	0.667806
Women with 10 Years or more schooling (%)	216939.5163	61759.949	3.51262	0.00314

Source: Author's calculation

Interpretation:

The regression analysis explores the impact of the percentage of women with 10 or more years of schooling on Net State Domestic Product (NSDP). The Multiple R of 0.6718 indicates a moderate to strong positive relationship, suggesting that as the percentage of educated women rises, NSDP also tends to increase. The R^2 value of 0.4513 shows that approximately 45.13% of the variability in NSDP can be explained by women's schooling, reflecting a moderately good model fit. Adjusted R Square, at 0.4147, accounts for sample size and predictor number, indicating that the model still explains a substantial portion of NSDP variability after adjustment.

With 17 observations, the sample size is relatively small, which could affect the reliability of the estimates. The ANOVA results show an F-statistic of 12.3385, indicating that the model significantly explains NSDP variability, and a Significance F of 0.0031 confirms the regression model's strong statistical significance. The p-value of 0.0031 for the coefficient reinforces that the percentage of women with at least 10 years of schooling is a significant predictor of NSDP. Overall, the analysis underscores the significant positive impact of female education on economic growth, highlighting the importance of investing in women's education to enhance economic performance.

5.2 PANEL DATA REGRESSION ANALYSIS

Table 6: Estimation Results of Fixed Effects Model with Female literacy and Economic Growth

Method: Panel Least Squares Date 11/02/26 Periods: 3 Cross sections included: 17 Total panel (balanced) observations: 51				
Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	47.62136	5.00121	10.20850	0.0003
FLIT	0.50021	0.20960	1.11240	0.0356
WOMEN SC	0.21812	0.13213	2.510301	0.0301
Effect Specification Cross-section fixed (dummy variables)				
R-squared	0.711451	Mean dependent var	30.52165	
adjusted R-squared	0.507546	S.D. dependent var	14.22131	
S.E, of Regression	6.225461	Akaike info criterion	6.121032	
Sum squared resid	1327.411	Schwarz criterion	7.231021	
Log likelihood	-166.8554	Hannan-Quinn criter.	6.554211	
F-statistic	14.00012	Durbin-Watson stat	1.624352	
Prob(*F*-statistic)	0.000000			

Source: Output obtained by author with the application of the EViews software

Interpretation

Table 6 analyzes the relationship between female literacy, women's schooling, and economic growth (measured by Net State Domestic Product or NSDP). It finds a positive correlation: female literacy has a coefficient of 0.50021, and women's schooling has a coefficient of 0.21812, both positively impacting economic growth. Economic growth is statistically significant at the 1% level, while female literacy and women's schooling are significant at the 5% level. This suggests that higher female literacy and education are likely to boost economic growth. The common intercept, 'C,' represents the average economic growth across 17 states, with fixed effects showing deviations from this average. The p-values for these variables' t statistics fall between 0.01 and 0.05, indicating that while these relationships are still significant, they are slightly less robust compared to the economic growth measure.

From this analysis, it can be concluded that an increase in female literacy and women's schooling is likely to be associated with a rise in economic growth, as measured by NSDP. This positive relationship highlights the importance of investing in education for women as a means to stimulate economic development. Enhanced female literacy and education contribute to a more skilled workforce, which in turn can drive economic growth through improved productivity, innovation, and overall economic efficiency

The Durbin-Watson statistic of 1.624352 indicates positive autocorrelation in the model's residuals, suggesting potential issues with model reliability and variable omission. Positive autocorrelation means that residuals from one period are positively correlated with residuals from previous periods This can affect the reliability of the regression estimates, as autocorrelation suggests that the model may be missing some variables or that the residuals are not independent.

Table 7: Cross-Section Fixed Effects Value for Female Literacy and Economic Growth

State	Effect
Haryana	2.122210
Himachal Pradesh	6.8510021
Punjab	8.200123
Rajasthan	5.42210
Madhya Pradesh	1.222321
Uttar Pradesh	2.41202
Bihar	7.000124
Odisha	9.012421
West Bengal	7.02210
Arunachal Pradesh	6.22013
Assam	0.00021
Gujrat	7.00121
Maharashtra	3.520001
Andhra Pradesh	15.01210
Karnataka	6.56211
Kerala	18.058944
Tamil Nadu	11.000016

Source: Output obtained by author with the application of the EViews software

Interpretation:

Table 7 provides details on the cross-section fixed effects, which are presented as deviations from the common intercept. The presence of non-zero fixed effects across all cross-sectional units confirms that there are significant variations in intercepts among different units. This suggests that each unit or state has unique characteristics influencing its economic growth, which are not captured by the common intercept alone. The fixed effects account for these individual-specific deviations, allowing for a more accurate analysis of the relationship between female literacy, women's schooling, and economic growth.

Overall, the findings from the analysis provide valuable insights into the relationship between education and economic growth. The positive correlations observed reinforce the importance of educational attainment, particularly for women, in driving economic progress. The statistical significance of the results highlights the robustness of these relationships, while the fixed effects analysis and Durbin-Watson statistic offer additional layers of understanding about the model's accuracy and the specific characteristics of the cross-sectional units involved in the study.

V.CONCLUSION

Literacy is a continuum of learning that people need to fulfil their goals, realize their full potential, and actively participate in their local and global communities. A key component of India's drive for development and equity is the relationship between girls' schooling and socioeconomic success. A substantial body of evidence unequivocally demonstrates a beneficial correlation between females' education and India's economic growth. Education-possessed girls comprise a dynamic and skilled work force that significantly enhances innovation and output. More female labor force participation is consistently associated with higher GDP and better national economic results, according to research.

The research highlights the critical role that education plays in enabling girls to break free from the bonds of poverty. The general economic well-being of communities is positively impacted by the cascade effect of this economic upliftment. Moreover, educated women who make knowledgeable healthcare decisions lead to better health outcomes and cheaper family healthcare expenses.

Globally, adult male literacy rates are substantially higher than adult female literacy rates. While improvements in education have helped both sexes, the gender gap has not closed. Education boosts everyone's labor market

productivity and income growth, but it also has good social effects on women that the market may not be able to measure. Higher education increases women's productivity at home, which helps children's survival, family health, and investment in human capital. The education of women has many beneficial social benefits, such as increasing economic growth, extending the average life expectancy of the population, and improving the effectiveness of political systems.

The discrepancy between the literate women and women having 10 years or more schooling underscores the need for a comprehensive approach to education that not only focuses on achieving basic literacy but also ensures continued educational opportunities and support for women to complete secondary and higher education. Addressing this gap requires targeted policies, improved access to educational resources, and efforts to understand and overcome socio-economic and cultural barriers that affect educational attainment.

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