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Original Article

Econometric Analysis of Variation in Education Index across Indian States in 2021

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Abstract

Education plays a crucial role in the overall development and prosperity of a nation. It is widely regarded as an essential determination of social, economic, and human development. In a diverse country like India, with its vast population and regional disparities, understanding the variation in education indices across different states is of utmost importance. This paper studies the econometric analysis of the variation in education index across Indian states in 2021. This paper attempts determine if the education infrastructure index and NSDP Per capita can lead to the variations in the education index across Indian states. It also attempts to know whether the nature of the states can influence the variations across the states.

1. Introduction:

Education is the process of acquiring knowledge, skills, values, and attitudes through systematic learning. It is a fundamental right of every individual and plays a crucial role in the development and progress of a country like India. Education is the key to eradicating poverty and inequality. It provides individuals with the necessary skills and knowledge to secure better job opportunities and improve their socioeconomic status. Education enables individuals to break the cycle of poverty and lead a more fulfilling life. Secondly, education is essential for fostering a democratic society. It helps in promoting awareness, critical thinking, and informed decision-making among the citizens. An educated population is more likely to participate in the democratic process, understand their rights and responsibilities, and contribute to the overall development of the nation. Thirdly, education plays a crucial role in promoting gender equality. In many parts of India, girls are still deprived of education due to various cultural and social barriers. However, education empowers women, enabling them to achieve their full potential, challenge gender norms, and become active participants in the workforce, economy, and society.

Furthermore, education is central to economic development. It equips individuals with the necessary skills to contribute to the workforce, fosters innovation and entrepreneurship, and promotes economic growth. A well-educated population is more likely to attract investment, create job opportunities, and improve the overall standard of living. Moreover, education is vital for promoting social cohesion and national integration in a diverse country like India. It fosters understanding, tolerance, and respect for different cultures, religions, and languages. Education helps to bridge the gap between various communities and promotes a sense of unity and harmony among the different sections of society.

Thus, education is of utmost importance in India as it contributes to the individual's growth and

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development, reduction of poverty and inequality, promotion of democracy and gender equality, and overall economic and social progress of the nation. It is crucial for building a prosperous, inclusive, and harmonious society.

In a diverse country like India, with its vast population and regional disparities, understanding the variation in education indices across different states is of utmost importance. In India, every state has its unique challenges when it comes to promoting education. The education index across Indian states is not the same and is dependent on many factors that affect the quality of education provided. The education index is a crucial indicator of the extent of progress a state has made in the education sector. It is essential to recognize the disparities in the education index across various states to understand and address the challenges they face.

With these concerns, the present paper studies the econometric analysis of the variation in education index across Indian states in 2021. This paper attempts to determine if the education infrastructure index and NSDP Per capita can lead to the variations in the education index across Indian states. It also attempts to know whether the nature of the states can influence the variations across the states.

2. Data Sources and Methodology:

2.1 Data Source:

The study is based on the secondary data. The educational index data have been collected from the Global Data Lab[1]. Data regarding Primary school have been collected from the Government of India, Department of Education, Ministry of School Education and Literacy[2]. Area of the states have been collected from the Directorate of Economics and Statistics, Ministry of Statistics and Programme Implementation (MOSPI), Ministry of Agriculture and Farmers Welfare, and the Government of India[3]. NSDP per capita income and population[4] data have been collected from the Handbook of Statistics on Indian States published by the Reserve Bank of India[5].

2.2 Analytical Framework:

2.2.1 Explanatory Factors:

The probable explanatory factor for the variation in education index included in our study is:

i) **Education Infrastructure Index:** The infrastructure available for education plays a vital role in the education index of a state. Good infrastructure ensures that students have access to quality equipment and facilities to aid their learning. States that have better infrastructure for education score higher in the education index. Education infrastructure index is calculated as the geometric mean of the primary school per square kilometre area and the normalise value of the primary

[1]https://globaldatalab.org/shdi/table/2021/shdi+healthindex+edindex+incindex/IND/?levels=1+4&interpolation=0&extrapolation=0

[2] https://dsel.education.gov.in/sites/default/files/statistics/report_in_PDF/udise_21_22.pdf

[3] https://eands.dacnet.nic.in/LUS_2000_2005.htm

[4] Population data have been collected for the year 2011.

[5]https://rbi.org.in/Scripts/AnnualPublications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20States

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school per lakh of population of the respective state. Where the primary school per lakh of population value is normalised by dividing each state's per lakh value by the highest value state.

ii) **NSDP Per Capita:** Net Domestic Product is a critical factor that influences the education index of a state. Higher Net Domestic Product means more resources are available to fund education. These resources can be used to employ qualified teachers and provide vital infrastructure for education. A higher Net State Domestic Product (NSDP) per capita indicates that the state may have better economic development, which could translate to better educational opportunities. NSDP Per capita income in our study have been constructed for the constant prices 2011-12 and collected for the latest available year 2019-20.

iii)**Nature of the States:** The nature of the state can significantly influence the education index. For instance, states with a higher percentage of rural areas may face significant challenges in providing quality education compared to states with a more urban population. On the other hand, access to education in the hilly areas are generally difficult than the plain areas. The policies implemented by the government also play a role in determining the level of education in a state. In the present study Nature of the Indian states has been categorized into four parts[6]:

a) Mountainous States: Under mountainous states we include Andaman and Nickobar Island, Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Manipur, Nagaland, Mizoram, Meghalaya and Uttaranchal.
b) Coastal States: Under coastal states we include Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Pondicherry, Tamil Nadu, Telangana and West Bengal.
c) Small and UTs: Under small and Union Territory we include Chandigarh, Chhattisgarh, Delhi and Goa.
d) Other States: The remaining states are taken as other states, which include Assam, Behar, Haryana, Jharkhand, Punjab, Rajasthan, Tripura and Uttar Pradesh.

2.2.2 Model Specification:

The Model specification of the stated problem can be as follows:
Education Index = F (Education Infrastructure, NSDP Per capita, Nature of the States)
Since nature of the states is categorical, therefore it is used as dummy variable. Let us assume 'Other States' as the base category.
So, the dummy will be three, i.e.
i) S_M → '1' for Mountainous States and '0' for other states.
ii) S_C → '1' for Coastal Sates and '0' for other states.
iii) S_{UT} → '1' for Small and UTs and '0' for other states.

Therefore,
EI = F (EduInfra, PCI, S_M, S_C, S_{UT})
Where,

[6] Some of the UTs such as Dadra and Nagar Haveli, Daman Diu, Ladakh and Lakshadweep have been excluded from our analysis because data regarding NSDP Per capita for these states is not available for these states. However, state Telangana has been excluded since we have taken 2011 population for our analysis.

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EI= Education Index,
EduInfra= Education Infrastructure index
PCI= NSDP Per capita

Since, the dependent variable i.e., education index lies between '0' and '1', we cannot go for linear functioning. Therefore, the functional form will be logistic distribution function i.e.

$EI_t = \frac{1}{1+e^{-Zt}}$ ---------(i)

Where,

$Z_t = \alpha + \beta EduInfra_t + \gamma PCI_t + \delta_1 S_{Mt} + \delta_2 S_{Ct} + \delta_3 S_{UTt} + U_t$

t = 1,2, 3,……,32 states/UTs included in the study

Equation (i) can be written as

$EI_t = \frac{e^{Zt}}{1+e^{Zt}}$ ---------(ii)

Now,

1- $EI_t = 1 - \frac{e^{Zt}}{1+e^{Zt}}$

⇨ $1 - EIt = \frac{1}{1+e^{Zt}}$ -------(iii)

Now, (ii) ÷ (iii) => $\frac{EIt}{1-EIt} = \frac{e^{Zt}}{1+e^{Zt}} \times \frac{1+e^{Zt}}{1}$

=> $\frac{EIt}{1-EIt} = e^{Zt}$ -------(iv)

Now taking the natural log of equation (iv) we obtain,

$\text{In}\left(\frac{EIt}{1-EIt}\right) = Z_t$

∴ $L_t = \alpha + \beta EduInfra_t + \gamma PCI_t + \delta_1 S_{Mt} + \delta_2 S_{Ct} + \delta_3 S_{UTt} + U_t$ ---------- (v)

Thus equation (v) is the log transform model of the equation (i). Here L is not only linear in the explanatory variables but also in the parameters.

Where,

$L_t = \text{In}\left(\frac{EIt}{1-EIt}\right)$ i.e., log-odds of education index.

α = Intercept term

β = the slope coefficient of Education Infrastructure Index which measures on an average the change in log-odds of education index per unit change in the Education infrastructure index, other factor remaining constant.

γ= the slope coefficient of the NSDP per capita, which implies on an average the change in the log-odds of education index per unit change in NSDP Per capita, other factor remaining constant.

δ_1, δ_2, and δ_3 are the slope coefficient of the dummy variables which describe how much the mean log-odds of the education index in the Mountainous, Coastal and Small and UTs differ from the mean log-odds of the education index in the other states.

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The estimation of the functional model given in equation (v) has been performed using the Ordinary Least Squares (OLS) regression analysis for analysing the individual as well as the collective impact of the above-mentioned explanatory variables on the variation in education index.

For the t statistics the Null Hypothesis is that the individual slope has no significant impact on the education index.
For the F statistics the Null Hypothesis is that the entire slope coefficient is equal to zero, i.e. all the explanatory variable has no impact education index.

Table 1: Variables Description

Variable Name	Description	Expected Sign of Coefficient
L_t (Dependent)	Natural Log of $\frac{\text{Education Index}}{1-\text{Education Index}}$	
EduInfra (Independent)	Education Infrastructure Index	+
PCI (Independent)	NSDP Per capita of states	+
S_M (Independent)	Mountainous States	+/-
S_C (Independent)	Coastal States	+/-
S_{UT} (Independent)	Small and UTs	+/-

Data regarding our model is stated in the table-2:

Table 2: Data Table

SL No	Name of the States	Education Index (EI)	L_t= In $(\frac{EIt}{1-EIt})$	Education Infrastructure Index[7]	PCI[8] (Rupees)
(1)	(2)	(3)	(4)	(5)	(6)
1	A&N Island	0.607	0.43	0.07	161564
2	Andhra Pradesh	0.517	0.07	0.19	115344
3	Arunachal Pradesh	0.575	0.30	0.10	113110
4	Assam	0.53	0.12	0.46	61519
5	Bihar	0.48	-0.08	0.24	29794
6	Chandigarh	0.704	0.87	0.03	234350
7	Chhattisgarh	0.528	0.11	0.32	75278
8	Delhi	0.684	0.77	0.30	260541
9	Goa	0.696	0.83	0.22	313973
10	Gujarat	0.519	0.08	0.07	164060
11	Haryana	0.613	0.46	0.16	177507
12	Himachal Pradesh	0.649	0.61	0.32	140048
13	Jammu& Kashmir	0.644	0.59	0.16	68455
14	Jharkhand	0.512	0.05	0.26	55658
15	Karnataka	0.567	0.27	0.13	155869
16	Kerala	0.713	0.91	0.11	149674
17	Madhya Pradesh	0.509	0.04	0.24	61298

[7] Education Infrastructure Index in the present study is the geometric mean of School per km^2 area and normalized value of school per lakh of population.
[8] PCI is the Per capita Net State Domestic Product at Constant Prices.

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18	Maharashtra	0.62	0.49	0.16	145165
19	Manipur	0.656	0.65	0.17	51625
20	Meghalaya	0.572	0.29	0.64	61755
21	Mizoram	0.636	0.56	0.17	108933
22	Nagaland	0.614	0.46	0.11	73361
23	Orissa	0.505	0.02	0.21	76564
24	Pondicherry	0.664	0.68	0.20	154517
25	Punjab	0.598	0.40	0.21	118487
26	Rajasthan	0.543	0.17	0.14	76882
27	Sikkim	0.644	0.59	0.19	248691
28	Tamil Nadu	0.608	0.44	0.21	144845
29	Tripura	0.549	0.20	0.23	83985
30	Uttar Pradesh	0.524	0.10	0.36	43053
31	Uttaranchal	0.609	0.44	0.33	148303
32	West Bengal	0.534	0.14	0.47	71719

Source: Author's construction using secondary data.

3. Results and Discussion:

Descriptive statistics of the variables are given in table 3.

Table- 3: Descriptive Statistics of the Variables[9]

Variable List	Mean	Std. Deviation	Maximum	Minimum	N
Lt	.3769	.27697	.91	-.08	32
Education Infrastructure Index	.2242	.12817	.64	.03	32
PCI	123310.22	68857.828	313973	29794	32

The descriptive statistics shows that the average value of L_t i.e. log of ($\frac{\text{Education Index}}{1-\text{Education Index}}$) is 0.3769 with standard error of 0.27697. The average of education index infrastructure is 0.2242 with standard error of 0.12817. The average value of Per capita Net State Domestic Product is 123310.22 with standard error equal to 123310.22.

Table-4: Results of Regression Analysis of L_t

Variable	Estimated Coefficient Values	Std. Error	t-value	ρ value/ sig value
Infrastructure index (Lt)	-.2224053	0.308579	-0.73	0.474
PCI	2.30e-06	6.8409E-7	3.36	0.002 ***
Mountainous	.2197602	0.094052	2.34	0.027 **
Coastal	.0205656	0.101436	0.20	0.840
Small and UTs	.1333482	0.149933	0.89	0.382
Constant	.0525315	0.133482	0.40	0.695
R^2	0.5783			
F(5,26)	7.13			0.0003***

*** , ** implies significant at 1% and 5% level respectively.

[9] Descriptive Statistics of the dummy variables are ignored here.

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In the Table 4 given above, `R^2' is the coefficient of determination. The R^2 value is found as 0.578 which implies that 57.83 percent variation of L_t is captured by the fitted equation i.e., by the estimator equation.

The `F-ratio' tests the overall significance of the model, indicating whether a statistically significant amount of variance in the dependent variable has been explained by the independent variables. From the above table we can see that the F value is statistically significant at 1% level as the ρ value is sufficiently small i.e., ρ=0.0003. Therefore, we reject the null hypothesis and we can say that overall independent variable has significant impact on the dependent variable L_t.

The coefficient of Education Infrastructure index is β= -.222, which is not significant, since t value is -0.73 (<1.96) and again ρ value is 0.474 (>0.10). Therefore, we accept the null hypothesis that the individual education infrastructure index has no significant impact on the education index.

The coefficient of PCI is γ=2.30e-06, which is positive and highly significant, since t value is 3.36 (>1.96) and it is significant at 1% level. Therefore, we reject the null hypothesis. We can say that the NSDP per capita has significant and positive impact on the education index.

The coefficient of the Mountainous states is δ_1=.220 which is positive. It implies that in comparison to the other states, mean log-odds of education index for the mountainous states is higher by 0.22 and it is statistically significant at 5% level, since ρ value is 0.027 (<0.05).

The coefficient of Coastal states is δ_2=0.021 which is positive. It implies that in comparison to the other states, mean log-odds of education index for the coastal states is higher by 0.021, but it is not statistically significant, since ρ value is 0.840 (>0.10)

The coefficient of the Small and UTs is δ_3=0.133 which is positive. It implies that in comparison to the other states, mean log-odds of education index for the Small and UTs is higher by 0.133, but it is not statistically significant since ρ value is 0.382 (>0.10).

4. Model Diagnostic:

Since our model is based on the cross-section data, therefore we have to check whether the model follow the assumption of homoskedasticity or not. To check heteroskedasticity we have run Breusch-Pagan test, which result is represented by $Chi^2(1)$.

Null hypothesis is that the variances of the residual follow homoskedasticity. Variables included fitted values of **ln** ($\frac{\text{Education Index}}{1-\text{Education Index}}$).

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Lt
chi2(1) = 0.37
Prob > chi2 = 0.5427

Thus at 1 degrees of freedom (df) the chi square test is 0.37 and the associated p value is 0.5427. So,

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from the chi square table we find that for 1 df the 5% critical chi-square value is 3.8414. Thus, the observed chi-square value of 0.37 is insignificant at 5 percent level of significance. It means we accept the null hypothesis that the error variance is constant. It means that there is no heteroskedasticity present in the model.

Since, we are dealing with cross section therefore; the model should be free from multicollinearity. Test of multicollinearity is given bellow:

Table – 5: Multicollinearity Test

Variables	**VIF**	**1/VIF**
Infrastructure index (Lt)	1.24	0.806845
PCI	1.78	0.562913
Mountainous	1.57	0.635476
Coastal	1.71	0.584329
Small and UTs	2.04	0.490577

Again, Since the Variance Inflation Factor (VIF) found is less than 10 for all the variables, therefore, the model does not have multicollinearity problem.

Conclusion:

The present study tries to find out factors behind the variation in Education Index across different Indian states. The study assumes education infrastructure index, NSDP Per capita and the nature of the states as the factor caused to the variation in Education Index. The study found that the education infrastructure index does not have any impact on the Education Index. The NSDP per capita has positive and reliable impact on the Education Index. It means that the states with higher NSDP Per capita will have higher Education Index. Again, we found that Education Index is influenced by nature of the states, where the mountainous states have higher education index compared to the other states.

References:

1. Reddy, V. V., & Sreedhar, M. G. (2019). Education in India: Status and challenges. Sage Open, 9(3), 215824401986987.
2. Martin, C., & Ruby, A. (2018). The Education System in India: Perspectives, Issues, and Challenges. Global Education Review, 5(2), 46-63.
3. Nair, C. S. (2017). Education in India: Challenges and Opportunities. International Journal of Educational Science and Research, 7(2), 1-7.
4. Ministry of Education, Government of India. (2020). Education Statistics at a Glance. Retrieved from https://mhrd.gov.in/statistical-data-education