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Public Education Expenditure and Economic Growth: an Econometric Analysis

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Abstract: ***The study shows the dynamics of expenditure on education and economic growth in all the major Indian states both in the short run and long run though our study that satisfies the long run association by Johansen cointegration. The study is used panel data from 1990 to 2022. The panel error correction supports the long-term Granger causality between expenditure on education and economic growth in all the states. Here the value is negative and significant and the coefficient 0.731 is showing the speed of adjustment towards equilibrium. So, we can state the speed is 7.31% per year adjustment towards equilibrium. However, there is no short-run Granger causality witnessed from educational expenditure to economic growth. It is evident that only in long-run educational expenditure has a significant impact on economic growth. In the short term, expenditure on education does not Granger cause economic growth. Therefore, the study confirms that in short run expenditure on education does not cause economic growth while in the long term it causes economic growth in the major Indian states.***

Keywords: ***Johansen Cointegration, Panel Data Causality, Education Expenditure, Economic Growth.***

1. INTRODUCTION

Human capital cannot be boosted without education**.** So**,** Education is one of the elements of human capital. And it is acting as an efficient contributor to human welfare and most effective means of reducing poverty and uplifting the sustained economic development. It is regarded as a kind of the contributing factors for higher earnings by increasing the productivity, skill and efficiency of educated person which influences overall quality of labour. While measuring the source of rapid economic growth in developed nation with the help of aggregate production function economist had identified both formal and informal education as key components of qualitative factors contributing to it. Education promotes economic development mainly in two ways: by promoting rational attitude relevant for economic development and acting as economic input (Kothari & Panchamuki, 1980).

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Therefore, education directly and indirectly impacted on economic growth by the process of investment which increases nation's as well as individual's income. The association between education expenditure and economic growth has been well dressed in development economic literature. Literature states that there is causal relationship between education expenditure and economic growth, but the question is whether it is bidirectional or unidirectional. It means whether education expenditure leads to economic growth or economic growth leads to better education.

However, over time, there are number of theories on relationship between education expenditure and economic growth. Regarding this Wagnerian and Keynesian approach have received much more attention. Adolph Wagner, the renowned German Political economist (1835-1913) believed that a "cause and effect" relationship exist between Government expenditure and economic growth. He presented his famous "law of ever-increasing state activity" that indicates that the social progress or economic growth was the basic cause of relative growth of state activity and also Keynesian macro-economic theories assume that public expenditure causes growth in national income. From the empirical point of view there are various views that there is a causal relationship between education expenditure and economic growth. It reflects unidirectional relationship i.e education expenditure leads to economic growth but not vice versa. (Kaur, et al (2014) and Pradhan, 2009). Similarly as per Maitra & Mukhopadhyay (2012), Chandra,(2011), bidirectional between two.

On the above background, the present study shows the causal relation between two. But in case of India, a very limited study is done specifically through panel data analysis. And a lot of work is covered on the basis of cross-sectional studies which shows a debate on this matter and this require further investigation. In this context this paper tries to examine the causal relationship between public education expenditure and economic growth by taking major Indian states.

Data source and variable used

Data have been collected on public education expenditure and economic growth for major Indian states for the period 1990 to 2022. 32 years of public expenditure on education (1990-91 to 2021-22) on major Indian states have been analysed. The data have been extracted from the Statistics handbook on Indian Economy, Ministry of human resource development, finance account, Indiastat.com, Economic survey etc.

Model Descriptions

To know the causal relationship between public education expenditure and economic growth in major state in India, the study will use following tests.
Before going to any test, the study will be based on following equations.
GSDP = f (EE)..... (1)
Where GSDP (Gross State Domestic Product) is proxy for Economic growth.
EE (Education Expenditure) which represents in terms of Govt. Expenditure incurred on education overall.
Transferring the equation 1 into a linear format for empirical analysis. In order to have simple analysis, the equation will be framed according to linear panel data format

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$GSDP_{it} = \alpha_i + \beta_{2i} EE_{it} + \varepsilon_{it}$..... (2)

In order to search the causality between education expenditure and growth of the economy the present study will use cointegration technique. One of the pre-conditions for the cointegration technique is that, the series should be stationary in the same order. So the Augmented Dickey-Fuller (ADF) test will be employed in panel format, here to examine the stationarity as this test is more appropriate for this type of data. Therefore, panel Augmented Dickey fuller test requires the estimation of following function,

$\Delta GSDP_{it} = \alpha_i + \beta_i t + \delta GSDP_{i,t-1} + \sum_{j=1}^{n} \gamma_{ij} \Delta GSDP_{i,t-j} + \varepsilon_t$..... (3)

$\Delta EE_{it} = \alpha_i + \beta_i t + \delta EE_{i,t-1} + \sum_{j=1}^{n} \gamma_{ij} \Delta EE_{i,t-j} + v_t$..... (4)

Where $GSDP_{it}$ is the Gross state domestic product, EE_{it} is the Education expenditure of state, Δ indicates first difference operator, α_i, β_i and γ_i are the parameters of the model; and ε_t and v_t are the error terms. The null hypotheses are that $GSDP_t$ and EE_t have unit roots, i.e. $\gamma_{ij} = 0$.Once stationarity is confirmed then we go for cointegration analysis by following equation.

$GSDP_{i,t} = \alpha_0 + \sum_{i=0}^{n} \alpha_{1i}\, GSDP_{t-i} + \sum_{i=0}^{n} \alpha_{2i}\, EE_{t-i} + U_t$..... (5)

Panel Granger Causality

The estimation shows the direction and the speed of adjustment towards the long run. For the estimation, the model will be like,

$$\begin{pmatrix} \Delta GDP_{i,t} \\ \Delta EE_{i,t} \end{pmatrix} = \begin{pmatrix} \emptyset_{i,1} \\ \emptyset_{i,2} \end{pmatrix} + \sum_{i=1}^{m} \begin{pmatrix} \emptyset_{1,2,k} \\ \emptyset_{2,1,k} \end{pmatrix} \begin{pmatrix} \Delta GDP_{i,t} \\ \Delta EE_{i,t} \end{pmatrix} + \begin{pmatrix} \gamma_1 \\ \gamma_2 \end{pmatrix} ECT_{i,t-1} \begin{pmatrix} \varphi_{1,i,t} \\ \varphi_{2,i,t} \end{pmatrix} \text{..... (6)}$$

Econometrics application

Panel unit root model

Here we shall be developing panel unit root model and we have 15 Indian states and data is for 29 years. So we shall detect whether GSDP data and education expenditure data have unit root or not. It means how to detect unit root test in this balanced panel model.

$\Delta Y_{it} = \alpha_i + \beta_i t + \delta Y_{i,t-1} + \sum_{j=1}^{n} \gamma_{ij} \Delta Y_{i,t-j} + \varepsilon_t$..... (7)

Where

Δ is the first difference operator. Y_{it} is independent variable. E_{it} is white noise disturbance term with variance δ^2, i= 1,2,……..N indexes states and t= 1,2,……T indexes Time.

Levin et al. (2002) has proposed the hypothesis to test the stationarity of the panel data are given as

H_0: $\delta = 0$

H_1: $\delta_i < 0$

According to equation 7, study assumed here,

H_0: $\delta_1 = \delta_2 = \ldots\ldots\ldots = \delta_i = 0$

H_1: $\delta_1 = \delta_2 = \ldots\ldots\ldots = \delta_i < 0$

Table1 Panel unit root result 1.1

Variables	**LLC TEST**	
	C	C & T
lnGSDP	4.78(1.00)	0.08(0.53)
LnEE	10.26(0.80)	3.85(0.99)

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ΔlnGSDP	-5.17(0.00)***	-3.75(0.00)***
ΔlnEE	-4.33(0.00)***	-4.01(0.00)***

Notes: The numbers in the parentheses are p values. C refers to specification with intercept. C& T refers to specification with intercept and trend. ***means 1% level of significance.

Table 2 Panel unit root result 1.2

Variables	**IPS TEST**	
	C	C & T
lnGSDP	9.81(1.00)	0.85(0.80)
LnEE	5.93(0.91)	0.72(0.94)
ΔlnGSDP	-6.69(0.00)***	-5.36(0.00)***
ΔlnEE	-5.25(0.00)***	-6.69(0.00)***

Notes: The numbers in the parentheses are p values. C refers to specification with intercept. C& T refers to specification with intercept and trend. *** means 1% level of significance. The result table shows both the test i.e Levin,Lin & Chu t(LLC) and Im,Pesaran and Shin W-stst(IPS) and confirms that the variables are non-stationary in the level form. So cannot reject the null hypothesis of non-stationarity and hence series holds unit root. But after first order differentiation, all the series are stationary i.e, they are I(1) variables. Hence, the variables are integrated of order one, then panel cointegration test will be applied to understand the long run relationship between education expenditure and economic growth.

Panel cointegration test

Here we will be developing panel cointegration model. But there is a precondition for running a panel cointegration model i.e, variables must be stationary and integrated of same order. From the above table 1.1 and 1.2, it is confirmed that both the variables are stationary and integrated of order one,i.e I(1).Then we will be proceeded to find cointegration between education expenditure and economic growth in fifteen major Indian states. Here we have used the Johansen cointegration test to understand the long run relationship. The following equation is to be set for the analysis.

$GSDP_{i,t} = \alpha_0 + \sum_{i=0}^{n} \alpha_{1i}\, GSDP_{t-i} + \sum_{i=0}^{n} \alpha_{2i}\, EE_{t-i} + U_t$ ..... (7)

Considering the equation in mind, the study hypothesized that

H_0: There is no cointegration between Gross State Domestic Product and Education Expenditure.

H_1: There is cointegration between Gross State Domestic Product and Education Expenditure.

Table2 Johansen cointegration result

Table 2.1 Cointegration rank test (Trace)

Trace statistic	**0.05 critical value**	**Prob****
58.93986	15.49471	0.0000
16.00664	3.841465	0.0001

Note: ** means 5% level of significance respectively.

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Table 2.2 Cointegration rank test (Maximum Eigen value)

Maximum Eigen statistic	**0.05 critical value**	**Prob****
42.93323	14.26460	0.0000
16.00664	3.841465	0.0001

Note: ** means 5% level of significance respectively.
In consideration of the variables i.e education expenditure and economic growth (GSDP) are I (1),Johansen cointegration test is employed to investigate the null hypothesis of no cointegrating relationship .

Fully Modified Least Square Method (FMOLS)
The study proceeds to estimate the long-term elasticity, we have employed FMOLS. The FMOLS allows consistent and efficient estimation of cointegrating variable and same time it address the issue of simultaneity biases in the cointegrated panel. OLS estimation is not as suitable here as FMOLS, because it yields biased result of regressor that are endogenously determined in the I(1) cases.
For estimation, the model is,
$GSDP_{i,t} = \alpha_i + \sum_{i=0}^{n} \alpha_{1i}\, GSDP_{t-i} + \sum_{i=0}^{n} \alpha_{2i}\, EE_{i,t} + \sum_{i=0}^{n} \alpha_{3i}\, EE_{t-i} + U_t$ ..... (7)
Where n is the lag length.

Table 3 FMOLS Result

Variable	**Long run coeff.**	**Std. error**	**t- statistic**	**Prob.**
EE	42.20593	6.321562	6.676503	0.0000
C	27041.39	4838.902	5.588331	0.0000

This coefficient is long run coefficient. EE is significant variable to explain GDP, because probability is less than 5%. Here coefficient is positive. The meaning is that 1 unit of EE goes up, then GDP would go up 42.205 units.

Panel Granger causality Test
Granger causality has been developed by Engle and Granger in 1987. It shows the short run and long run relationship between variables. The estimation of Error correction model shows the direction and the speed of adjustment towards the long run. For the estimation, the model will be like,

$$\begin{pmatrix}\Delta GSDP_{i,t}\\ \Delta EE_{i,t}\end{pmatrix} = \begin{pmatrix}\alpha_{i,1}\\ \alpha_{i,2}\end{pmatrix} + \sum_{i=1}^{m} \begin{pmatrix}\alpha_{1,2,k}\\ \alpha_{2,1,k}\end{pmatrix} \begin{pmatrix}\Delta GSDP_{i,t}\\ \Delta EE_{i,t}\end{pmatrix} + \begin{pmatrix}\gamma_1\\ \gamma_2\end{pmatrix} ECT_{i,t-1} \begin{pmatrix}\varphi_{1,i,t}\\ \varphi_{2,i,t}\end{pmatrix} \text{.....(8)}$$

Where $ECT_{i,\,t-1}$ is estimated lag error term derived from one period lagged error term which is to be obtained from long term relationship. The coefficient attached to error correction term ranges 0 to -1. And a negative sign coefficient indicates a short-term adjustment in percentage changes in education expenditure towards long term equilibrium.

Table 4 Panel granger causality test result based on Error correction method(ECM)

Dependent variable		**Independent variables**	
Shortrun		Longrun	
Null hypotheses			ECT

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EE does not granger cause to GDP		0..31791(0.7278)	-0.250975(-2.015098)***
GDP does not granger cause to EE	6.96505(0.001)		-0.73128(-2.54080)***

Note: *** indicates 1% level of significance.

Table 4 shows short run and long run changes though our study satisfies the long run association thorough Johansen cointegration. The panel error correction supports the long-term Granger causality between expenditure on education and economic growth in all the states. Here the value is negative and significant and the coefficient 0.731 is showing the speed of adjustment towards equilibrium. So, we can state the speed is 7.31% per year adjustment towards equilibrium.

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