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GOVERNMENT EXPENDITURE ON EDUCATION AND ECONOMIC GROWTH: A PANEL DATA ANALYSIS

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Abstract: *The fiscal policy of the government determines the long-run economic growth through optimal decisions on government expenses. For robust economic growth and prosperity, efficient allocation of resources is a necessary condition. An efficient labor force will refer to high productivity and high economic growth. The main reason for expecting a link between education and economic growth is straightforward. Education certainly enhances efficiency, which increases productivity and is a precondition for long-run economic growth. This work attempted to find the correlation between public spending on education and economic growth and the magnitude of this relationship. In the analysis, panel data of 63 countries were chosen randomly from each continent from 1981 to 2010. This study also included other variables that impact economic growth, including inflation rate, unemployment rate, Foreign Direct Investment, total export, and capital formation. The study revealed a significant positive correlation between public spending on education and economic development.*

Keywords: *Public Expenditure, Fiscal Policy, Economic Growth, Resource Allocation, Public Policy, Expenditure on Education*

Introduction

Efficient allocation of government expenditure guides a country towards optimal economic prosperity and development (Irmen et al., 2009). Governments worldwide are spending approximately 10-30% of Gross Domestic Product (GDP), which undoubtedly can stimulate economic growth and prosperity if used efficiently (Bruce, 1997). At the policy level, the governmental approach towards allocating its total expenditure should be based on the marginal returns of government expenditure

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(Melody, 1974). Therefore, sectors with higher marginal returns should be given more priority. Owing to the government expenditure multiplier[1], the effect of government expenditure on national income is expansionary. Governments spend their total budget on the consumption of goods and services, investment, and transfer payments. Consumption of goods and services is a short-run demand-side policy that can stimulate the economy in the short run. However, investment for long-run benefit can function as a reliable source for sustainable long-term economic growth. Government spending on education is considered to e an investment in human capital that ensures up-gradation in productivity, stimulating sustainable long-run economic growth. It reduces unemployment and sews up a solid foundation of social equity, awareness, and cultural vitality. Expenditure on education increases efficiency and productivity through creating a pool of skilled human resources, which is a prerequisite for technological improvement and innovation. Thus, government expenditure on education has relatively high marginal returns and should be emphasized accordingly and adequately.

There have been a considerable number of studies to investigate the interrelation of public expenditure on education and economic growth, and significant ones establish a positive relationship between them. However, very few studies have been concentrated on the **per-capita calculation**. If not considered the amount per person, it can never reflect an accurate picture. It is like investing 10 million USD in China and investing the same amount in Australia can never be the same because this will show a massive inequality while calculating the amount per capita. So, this paper is **designed to detect the relationship between expenditure on education and economic growth per capita level.**

The study has been conducted with the comprehensive objective of analysing the interconnection of public spending on education and economic growth at the per capita level and its magnitude, if found any. The scope of this analysis is limited to the optimal allocation of resources to education. This study only concentrates on analysing the association between expenses on education and economic progress rate at the per capita level. It does not include the quality, structure or pattern and effectiveness of the education system. Further and thorough studies should be undertaken to determine how to utilise the allocated resources to provide quality, effective, and knowledge and skill-based education.

Literature Review

Diversified research works have been carried out to establish an association between government expenditure on education and economic growth in the long run. For example, an extended Solow Growth Model was considered to construct a positive association between education and economic growth by Mankiw et al. (1992). In addition, by taking data from 129 countries, Barro and Lee (1993) established a positive and significant link between education and economic growth.

[1] According to Mankiw (2010: 292), "The **government-purchase multiplier** tells us how much income rises in response to a $1 increase in government purchase".

In the context of Bangladesh, Muktadir (2012) investigated to show the functional association between expenses on education and growth, which showed that long-term economic growth was growth positively and remarkably. To investigate how government expenditure on education impacted economic growth in Cameroon, Dounala et al. (2015) used data from 1980 to 2012. They found that there was a significant relationship as the result obtained was positive and statistically significant. After the government of Indonesia decided to spend 20% of the state budget on education, Suwandaru et al. (2021) undertook research to construct the relationship between public expenses in educational sectors and economic development in Indonesia. They studied the data from 1988 to 2018 and used the Cobb-Douglas production function for measurement and observed a positive relationship in the long-term and a negative relationship in short-term estimation.

Odior (2014) established an association of public expenses with Poverty and education in the context of Nigeria. He developed a model named the Dynamic Recursive CGE-MS (Computable General Equilibrium- Micro Simulation) model, which incorporated these links and showed the impact on the Nigerian economy over the period of 2004-2015. Ageli (2013) also found a cointegrated association between education expenses and economic prosperity for the period 1970-2012 in the context of Saudi Arabia.Taking data from 1973 to 2012 of fourteen crucial Asian Countries, Mallick et al. (2016) conducted a study to detect the association between spending on education on education and economic progress and found a direct long-term relationship.

Blankenau et al. (2005) investigated the relationship between spending and economic growth and found out that this association is dependent on government expenses, technological improvement, and taxation systems. Raluca et al. (2010) also detected a similar impact of funding on education on Economic Development in Romania using data from 1991-2009.Rambeli et al. (2021) focused in examining the authentication of education-led economic growth hypothesis. They tested this in case of Malaysia during the recovery period of the recession of 2008. This work suggested that “financial planning as related to national education policies must be carefully and meticulously crafted, to ensure future success”.

Methodology

This study aims to detect if any relationship between expenditure on education and economic growth exists and to what extent if there is any. This study has tried to find the influence of public expenses on education on economic growth. Here government expenditure on education is the independent variable, and economic growth is the dependent variable. Now the classical theory of production function can be used to determine the effect of expenditure on education on economic growth.

$$Q = F(Xi) \qquad (1)$$

Where,

Q = Quantity of output, and

Xi = Quantities of factors of production (i = 1, 2, 3, ………, n)

In this study, expenditure on education (independent variable) were taken on the right side, whereas the explanatory variables were on the left side of the equation (1).

Despite some limitations, Gross Domestic Product (GDP) is regarded as one of the best determinants of economic growth (Mansaray, 2017). This study also used Gross Domestic Product (GDP) as a representative variable for economic growth. If governments spend on education, that in return provides a skilled and efficient pool of human resources. An efficient and skilled pool of human resources promotes the environment for technological improvement and innovation, which in terms increase productivity. There is no doubt that productivity impacts economic growth positively (Fraumeni, 1987). With the purpose of drawing a clearer picture, this study has used per capita government expenditure on education instead of gross government expenditure on education. This study also used some other variables that can impact economic development, i.e., inflation rate, unemployment rate, foreign direct investment, total export, and capital formation.

So, the endogenous growth model takes the form:

$$PCGDP = F\ (PCGEXE, UEM, INF, FDI, EXP, CF) \tag{2}$$

Where,

PCGDP = per capita Gross Domestic Product (GDP)

PCGEXE = per capita government expenditure on education

UEM= Unemployment Rate

INF= Inflation

FDI= Foreign Direct investment

EXP= Total exports

CF= Capital Formulation

This study adopted the following regression equation to estimate the impact of these explanatory variables on GDP per capita.

$$PCGDPit = α\_1+ 〚β\_1\ PCGEXEP〛\_it+ 〚β\_2\ UEM〛\_it+ 〚β\_3\ INF〛\_it + 〚β\_4\ FDI〛\_it+ 〚β\_5\ EXP〛\_it+ 〚β\_6\ CF〛\_it+ε\_t \tag{3}$$

Here,

The subscript i and t denote country and year, respectively.

α_1 is the coefficient term.

β terms indicate the slope coefficients of the respective explanatory variables and

ϵ_t is the error term.

A linear relation between PCGEXE and the explanatory variables has been established in the above equation (equation 3), and the slope coefficients (β terms) depicts the magnitude of the relationships. Therefore, this study will find out the value of slope coefficients using appropriate statistical methods.

In the process of determining the values of slope coefficients, this study first tested the quality of the data set. This study used the Cross-Sectional Dependence (CD) test by Pesaran (2015) to identify cross-sectional dependence. Next, it conducted the test for heteroskedasticity. The study also ran the Wooldridge Test to detect serial correlation in the data set. Then, this work adopted Pesaran's Cross-sectionally Augmented Dickey-Fuller (CADF) and Cross-Sectional Im, Pesaran, and Shin (CIPS) unit root test to check for stationarity. Kao and Pedroni tests for panel cointegration were also carried out. Once the data were tested, this study concentrated on choosing an appropriate estimation model. For this purpose, Hausman Specification Test and F test were undertaken. Firstly, the Hausman test was run to see if panel data was more appropriate for random effect or fixed-effect model. Later, an F test was conducted to choose between Random Effect and pooled OLS (Ordinary Least Squares) model.

The test went for choosing an appropriate Autoregressive Distributive Lag (ARDL) model. Hausman test was used to choose among the ARDL models, Mean Group (M.G.) and Pooled Mean Group (PMG) models. The study finally adopted and Dynamic Fixed-Effect (DFE) regression model to see the short-run and long-run impact and the speed of adjustment to the long-run, in addition to the Random-effects Generalized Least Squares (GLS) model.

Sources of Data

The study utilised time-series data of thirty years from 1981 to 2010 for 63 countries randomly chosen from six different continents. The Source of all the data is the World Development Indicators (WDI) of the World Bank. The study collected data on total government expenditure on education (in current million USD), population (in million) and total GDP (in current million USD). After collecting these three raw data, this study used general mathematical formulas using M.S. Excel to derive per capita GDP and Per capita government expenditure on education. The data of Unemployment Rate (% of labour force), Inflation Rate (Consumer Price Index), Net Foreign Direct Investment inflow (in million US$), Total Export (in million US$) and Gross Capital Formation (in million US$) were also collected from World Development Indicators (WDI) of the World Bank.

The Randomly selected 63 countries from six continents areTunisia, Lesotho, Togo, Eswatini, St. Lucia, Iran Islamic Rep., Thailand, Hong Kong, Malaysia, Mexico, Singapore, South Africa, Cameroon, Saudi Arabia, Panama, Niger, Ethiopia, Jamaica, Madagascar, Switzerland, Cyprus, Argentina, Norway, Estonia, Mauritius, Iceland, Philippines, Denmark, Newzealand, Tajikistan, Australia, Canada, Israel, Bangladesh, Slovenia, Malta, Egypt, Guinea, Ireland, Poland, Finland, Japan, Sweden, Pakistan, Netherlands, Srilanka, Portugal, Bulgaria, France, Spain, Gambia, Hungary, Germany, Slovak Republic, Oman, Greece, Italy, Belgium, Austria, Turkey, Kenya, Seychelles and Syria.

Empirical Results

Test for Cross-Sectional Dependence

Cross-sectional dependence is a general issue for panel data of more extended time frames like over 20-30 years (Baltagi, 2008). As the data this study was dealing with contained data of 30 years, running a test for cross-sectional dependence was a must. Therefore, Pesaran (2015) Cross-Sectional Dependence (CD) test was run under the null hypothesis that the panel data had weak cross-sectional dependence.

H0: Errors have weakly cross-sectional dependent

H1: Errors do not have weakly cross-sectional dependent

Table 1: Pesaran Cross-Sectional Dependence (CD) test

Variable	CD	P-Value
PCGDP	182.15	0.0000***
PCGEXE	124.407	0.0000***
UEM	12.416	0.0000***
INF	64.671	0.0000***
FDI	120.424	0.0000***
EXP	203.77	0.0000***
CF	174.677	0.0000***

Note:***, ** and * indicate 1%, 5% and 10% significance level

Test for Heteroskedasticity

Modified Wald test for Heteroskedasticity was conducted to test for Heteroskedasticity. The presence of no heteroskedasticity is considered under the null hypothesis of this test.

H0: Heteroskedasticity is not present ($\sigma_i^2=\sigma^2$ for all i)

H1: Heteroskedasticity is present ($\sigma_i^2\neq\sigma^2$ for all i)

Table 2: Modified Wald test

Chi^2	1.9e+06
P value	**0.0000*** **

Note:***, ** and * indicate 1%, 5% and 10% level of significance

This study rejected the null hypothesis as per the result obtained. This established the decision in favour of the presence of Heteroskedasticity.

Test for Serial Correlation

This test is applied to Macro panels, which contain data of more than 20-30 years (Torres-Reyna, 2007). The standard error of the coefficients become smaller if a serial correlation exists. This also leads to a higher R-squared value. Hence, the Wooldridge test for autocorrelation was adopted under the null hypothesis that no first-order correlation was present.

H0: First-order correlation is absent.

H1: First-order correlation is not absent.

Table 3: Wooldridge test for autocorrelation

F (1, 47)	30.027
P-value	**0.0000*** **

Note: ***, ** and * indicate 1%, 5% and 10% level of significance

Serial correlation in the studied panel data is detected as the test result rejects the null hypothesis.

Panel Unit Root Test

Testing for unit roots is the preliminary move to investigate panel integration among variables. This study adopted Pesaran's (2007) second generation panel unit root test because of the presence of cross-sectional dependence. This work adopted both Cross-sectionally Augmented Dickey-Fuller (CADF) and Cross-Sectional Im, Pesaran, and Shin (CIPS) tests to check the variables' stationarity.

The Pesaran Test considers the following hypotheses:

H0: Unit roots are present in all panels.

H1: At least one of the panels is stationary.

The following table consists of the result for the Panel Root Test:

Table 4: Panel Unit Root Test by Pesaran (CIPS and CADF)

Variables	CIPS		CADF	
	I(0)	I(1)	I(0)	I(1)
PCGDP	-1.584	**-3.765*** **	**-1.945***	**-3.148*** **
PCGEXE	-1.801	**-3.998*** **	**-1.916***	**-3.065*** **
UEM	- -	**-3.177*** **	- -	**-2.753*** **
INF	**-3.419*** **	- -	**-3.072*** **	- -
FDI	**-3.637*** **	- -	**-2.313*** **	- -
EXP	1.390	**-4.048*** **	-1.440	**-3.597*** **
CF	-1.085	**-3.382*** **	-1.555	**-2.892*** **

Note:***, ** and * indicate 1%, 5% and 10% level of significance

The table shows that both INF and FDI are stationary at level. In contrast, others are not. However, after taking first-order differentiation, all other variables show significant results indicating that PCGDP, PCGEXE, UEM, EXP, and C.F. are stationary.

Panel Cointegration Tests

Kao Test for Panel Cointegration

With all variables at their stationary level, the presence of cointegration in the panel data was tested by adopting Kao (1999) test for cointegration. The speciality of the Kao test is that it identifies homogenous coefficients and cross-sectional intercepts for regressors of the initial stage.

This analysis used the Kao (1999) test for cointegration given I(1) variables.

H0: No cointegration

H1: All panels are cointegrated

The result obtained is shown in the following table.

Table 5: Kao Test for Panel Cointegration

	Statistic	**P-value**
DF (Modified)	-42.9804	**0.0000*** **
DF	-30.0078	**0.0000*** **
ADF	-20.8214	**0.0000*** **
Unadjusted DF (Modified)	-54.7223	**0.0000*** **
Unadjusted DF	-30.9877	**0.0000*** **

Note: ***, ** and * indicate 1%, 5% and 10% level of significance.

The result indicates rejection of the null hypothesis at 1% significance level, which provided the decision that there is cointegration in the panel.

Pedroni Test for Panel Cointegration

This study also adopted the Pedroni panel cointegration test. For both short-run and long-run dynamics, this test permits a higher level of heterogeneity.

H0: No cointegration

H1: Some panels (not necessarily all) have cointegration

The result obtained in this test is mentioned in the following table:

Table 6: Pedroni Test for Panel Cointegration

	Statistic	**P-value**
Phillips- Perron t (Modified)	**1.9937**	**0.0231****
Phillips- Perron t	**-19.6242**	**0.0000*****
Dickey-Fuller t (Augmented)	**-18.4508**	**0.0000*****

Note: ***, ** and * indicate 1%, 5% and 10% level of significance.

Just like the Kao Test, the null hypothesis in Westerlund Test is rejected too. This implies that there is an existence of cointegration in some panels.

Selection of Estimation Model

Determination of Random or Fixed Effect Model

Hausman Specification Test

This study ran Hausman Specification Test to select between the fixed and random effect models. The Hausman Specification Test considers the null hypothesis of individual effects not correlated with any regressor in the model (Hausman, 1978). The hypotheses of the test were set for this study as:

H0: Random Effect Model is appropriate

H1: Random Effect Model is not appropriate

The following table shows the result obtained from the Hausman Specification Test.

Table 7: Hausman Specification Test for FE and RE Models

	Fixed Effect(fe)	**Random Effect (re)**	**Difference (re-fe)**	**Standard Error**
PCGEXE	12.37444	12.43599	-0.0615477	0.1385842
UEM	-276.3903	-270.1707	-6.219597	10.4194
INF	4.659431	2.840315	1.819116	2.385287
FDI	0.0009405	0.0001639	0.0007766	0.00082921
EXP	0.0225211	0.0216853	0.0008959	0.0006705
CF	0.0115472	0.106801	0.0008671	0.0007524
	P-Value		**0.8914**	

Here, in the Hausman Specification test, the P-value obtained is insignificant at 10% significance level. This led to the non-rejection of the null hypothesis, indicating the appropriateness of a random effect model.

F Test

This study used the F test to see if Pooled Ordinary Least Squares (OLS) model or Random effect model is appropriate for the studied data set.

H0: Pooled OLS Model is appropriate

H1: Pooled OLS Model is not appropriate

Table 8: F Test

F (28,645)	4.15
P- Value	0.0000***

Note: ***, ** and * indicate 1%, 5% and 10% level of significance.

The result suggests the null hypothesis's rejection, leading to the decision that the pooled OLS model is not suitable for this panel data set.

Selection of Autoregressive Distributive Lag (ARDL) Model

ARDL models are helpful in forecasting long-run interdependence from short-run dynamics. It uses an error correction term to represent how the adjustment takes place towards the long run. Dynamic models like MG (Mean Group), PMG (Pooled Mean Group) and Dynamic Fixed Effect (DFE) were considered in this study to achieve accurate estimation. This study used the Hausman test to choose among the models. Firstly, the test was run between MG and PMG models, and the result obtained indicated that the PMG model was suitable. Then, this study ran the test between PMG and DFE model, and the result went in favour of the DFE model. Therefore, this study chose the DFE model for the estimation of the studied panel data set.

Estimation of Model

Finally, this study estimated Random Effect Model and Dynamic Fixed Effect (DFE) Model as the Hausman Specification test suggested. The random effect model is estimated solving for the presence of serial correlation. The result obtained is summarised in the following table:

Table 9: Estimation Results of Random Effects GLS Regression

ΔPCGDP	Coefficient
ΔPCGEXE	11.54431 **(0.0000)*** **
ΔUEM	-118.3492 **(0.0000)*** **
INF	-0.9892712 **(0.038)** **
FDI	-0.0007705 (0.530)
ΔCF	0.0185855 **(0.0000)*** **
ΔEXP	0.0193855 **(0.0000)*** **
Constant	73.9113 **(0.071)* **
R-Square	**0.6491**

Note: Values in the parenthesis indicate the p-value, and ***, ** and * indicate 1%, 5% and 10%

Estimation of the random effect regression model establishes a positive correlation of ΔPCGDP with ΔPCGEXE, ΔCF, and ΔEXP. In contrast, the correlations are negative with ΔUEM, INF, and FDI. All of the relationships obtained in the estimation are significant, other than the correlation between ΔPCGDP and FDI.The correlation coefficient of ΔPCGEXEis approximately 11.54, indicating that a 1% change in ΔPCGEXE causes a change of 11.54% in ΔPCGDP. The estimation shows that the value of the R-square is 0.6491, indicating that the explanatory variables cause a 64.91% variance of ΔPCGDP.

This study estimated Causality DFE regression to see the short-run relationship, long-run relationship, and the adjustment rate (ECT) towards the long run. The result obtained is shown in Table 10.

Table 10: Causality DFE (Dynamic Fixed-Effect) Regression

		ΔPCGDP	ΔPCGEXE	ΔUNE	INF	FDI	ΔCF	ΔEXP
ΔPCGDP	**Coefficient (Short-Run)**	**- -**	**12.71554 (.00)******	**-265.682 (.00)*****	**2.56792 (.528)**	**.0035666 (.083)***	**.0103008 (.001)*****	**.023226 (.00)*****
	Coefficient (Long-Run)	**- -**	13.31038 (.000)***	**-243.798 (.146)**	**2.13669 (.942)**	-.020042 (.196)	**.0108248 (.167)**	**.0102911 (.114)**
	Long Run (ECT)	**-.1373724 (0.0000)*****						
ΔPCGEXE	Coefficient (Short-Run)	.048700 (.00)***	- -	9.181201 (.001)***	-.19393 (.441)	-.000212 (.096)*	-.000041 (.827)	-.001037 (.00)****
	Coefficient (Long-Run)	.733777 (.00)***	- -	-3.05372 (.794)	.031477 (.987)	.001899 (.073)*	-000557 (.292)	-.000759 (.092)*
	Long Run (ECT)	-0.1271041 (0.0000)***						
ΔUNE	Coefficient (Short-Run)	-.00021 (.00)***	.0019288 (.00)***	- -	.01711 (.00)***	-1.59e-06 (.352)	-5.99e-06 (.017)**	2.52e-06 (.266)
	Coefficient (Long-Run)	-.00019 (.180)	.0050503 (.022)**	- -	.05669 (.03)**	-1.01e-06 (.941)	.000017 (.073)*	-.000016 (.035)**
	Long Run (ECT)	-0.124839 (0.00000)***						
INF	Coefficient (Short-Run)	.00016 (.619)	-.00407 (.450)	1.878838 (.000)***	- -	1.34e-06 (.940)	-7.81e-06 (0.767)	.000021 (0.379)
	Coefficient (Long-Run)	0.0006 (0.355)	-0.003745 (0.705)	1.454198 (0.011)**	- -	-4.57e-06 (0.940)	.000015 (.634)	-6.50e-06 (.816)
	Long Run (ECT)	0.2961883 (0.0000)***						
FDI	Coefficient (Short-Run)	1.26634 (0.083)*	-19.68132 (0.096)*	-592.2763 (0.470)	1.2129 (0.987)	- -	0.00520 (0.928)	.104111 (0.044)**
	Coefficient (Long-Run)	-.25007 (0.788)	-2.572956 (0.851)	6065.9492 (0.482)	-2.5430 (0.987)	- -	.059747 (.183)	-.1174546 (.003)***
	Long Run (ECT)	.473457 (.00)***						
ΔCF	Coefficient (Short-Run)	1.67425(.001)***	-1.74973 (0.827)	-1291.247 (.019)**	-14.699 (0.777)	.002381 (0.928)	- -	.5153671 (.000)***
	Coefficient (Long-Run)	21.8011 (0.840)	5.9527 (0.798)	196242.7 (0.811)	-7850.2 (0.827)	1.61779 (0.877)	- -	5.952754 (0.798)
	Long Run (ECT)	0.0034169 (0.810)						
ΔEXP	Coefficient (Short-Run)	4.65806 .(00)***	-54.31039 (.00)***	699.5673 (0.255)	49.5051 (0.390)	.058807 (.044)**	.635912 (.00)***	- -
	Coefficient (Long-Run)	41.6549 (0.119)	-477.5035 (0.173)	38184.19 (0.187)	-2265.8 (0.462)	1.61021 (0.303)	-.44966 (0.629)	- -
	Long Run (ECT)	-.02083 (0.113)						

Note: Values in the parenthesis indicate the p-value, and ***, ** and * indicate 1%, 5% and 10% significance level.

While observing the causality between ΔPCGDP and ΔPCGEXE, taking the first one as the dependent variable, the correlation coefficient values are 12.72 and 13.31 in the short and long run, respectively. Therefore, this result recommends that in the short run, a 1% change in ΔPCGEXE causes a change of approximately 12.7% change in the short run in ΔPCGDP. In the contrary, the change in ΔPCGDP is 13.3% in the long run. Furthermore, from the value of Error Correction Term (ECT), this is indicated that the adjustment to the long run is 13.73%. Thus, the coefficient of ECT indicates that the deviation of ΔPCGDP to long-run from short-run is adjusted by 13.73% each year. Therefore, this convergence to equilibrium takes about 7.28 years after a shock in ΔPCGDP.

The short-run estimations obtained from the DFE model can be plotted in Equation 3 to get the desired regression equation.

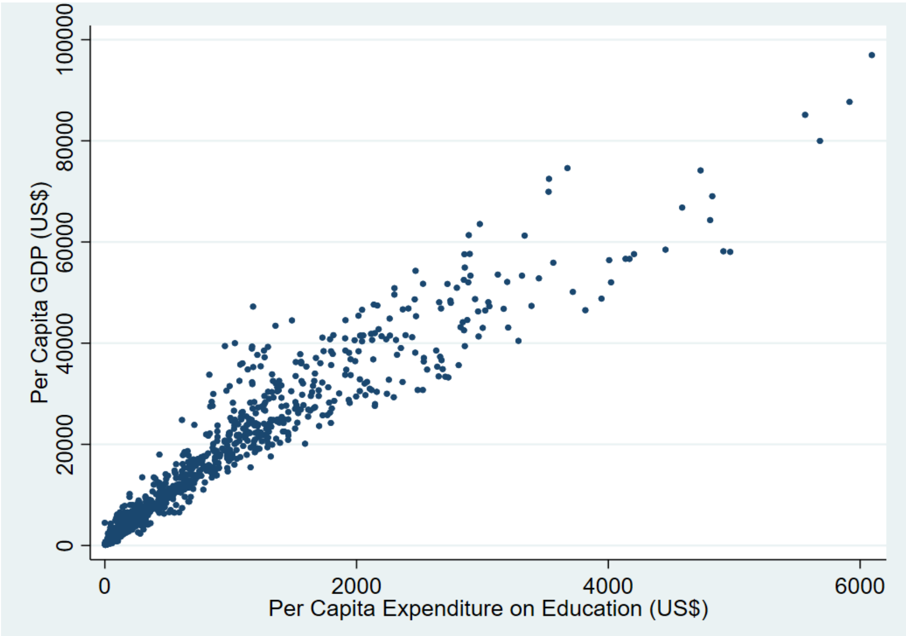
$$PCGDP_{it} = 699.75 + 12.72PCGEXE_{it} - 265.687UEM_{it} + 2.57INF_{it} + 0.004FDIit + 0.023EXP_{it} + 0.01CF_{it} + \varepsilon_t \quad (4)$$

The regression equation establishes a positive relationship with all of the explanatory variables but the unemployment rate.

While examining the authentication of education-led economic growth hypothesisduring the recovery period of the recession of 2008 in case of Malaysia, Rambeli et al. (2021) got validation of bidirectional causality from education to economic growth and vice versa. Dounala et al. (2015) estimated the error correction model and found that a 1% growth rate of government education spending led to 10.145% long run economic growth. A case study was done in case of Turkey by Mercan et al. (2014) To establish this relationship. The long term ARDL model found that A 1% of increase in education expenses increases the economic growth in 0.30% rates. Mallick et al. (2016) tested this impact on major Asian countries and found that a 1% increase in educational expenditure causes economic growth by 1.26%, 0.45%, 0.39%, 0.32%, 0.63%, 0.65%, 0.55% and 0.40% respectively in case of Nepal, Pakistan, Philippines, Saudi Arabia, Singapore, Sri Lanka, Thailand, and Turkey. Ojo et al. (2022) tried to establish this correlation in case of Japan and found that "a 1% increase in present education spending will result in a 6.80% rise in economic development, implying that education investment can boost economic growth in Nigeria". In comparison to other similar studies, this study found a stronger correlation between public expenditure on education and economic growth. This work incorporated this correlation at per capita level which led to this stronger correlation.

The following figure (figure 1) plots the data of 63 studied countries of thirty years (1981 to 2010), taking per capita expenditure on education in the horizontal axis while per capita GDP in the vertical axis. The figure shows a strictly upward sloping correlation between PCGDP and PCGEXE, indicating the rise in PCGDP with the increase in PCGEXE. This correlation has been validated in the previous analysis.

Figure 1. **Correlation between PCGDP and PCGEXE**



Source: own representation

Conclusions

Economic development is the most desired achievement for any nation in this era, and education has always been considered one of the most significant catalysts for that. This study wanted to examine the relationship between economic growth and expenditure on education, keeping that idea in mind and seeing the strength of this relationship, using data of 63 countries from different continents for 1981-2010. Some other important factors related to economic growth were also taken into consideration in this study. The finding of this study supports the literature that economic growth is impacted by expenditure on education as the results suggested that per capita expenditure on education positively impacts per capita GDP. The impact of per capita expenditure was proved for both the short and long run. The finding of this study suggests that the policymakers should concentrate on whether they are expending enough on education. Finally, while deciding the optimal amount of public expenditure on education, policymakers should always consider per capita expenditure on education instead of the percentage of total expenditure or GDP as they can not reflect the accurate picture. The main difference of this study from similar previous literatures is that considering per capita level created stronger correlation between public expenditure on education and long term economic growth. Investment at per capita level can bring returns at much higher rates. It is better if the budget allocation for education is done at per capita level instead of as the percentage of the total GDP. There can be many further research works on how much amount should be invested per capita. This policy implication is more suitable and can bring more efficient results for densely populated countries.

List of Abbreviations

DFE	-	Dynamic Fixed Effect
GDP	-	Gross Domestic Product
LDC	-	Least Developed Countries
USD	-	United States Dollar
CGE-MS	-	Computable General Equilibrium- Micro Simulation
GEXE	-	Government Expenditure on Education
PCGDP	-	Per Capita Gross Domestic Product
PCGEXE	-	Per Capita Government Expenditure on Education
OLS	-	Ordinary Least Squares
LM	-	Lagrange Multiplier
CD	-	Cross-sectional Dependence
ADF	-	Augmented Dickey-Fullar
PP	-	Phillip-Peron
MG	-	Mean Group
PMG	-	Pooled Mean Group
GLS	-	Generalized Least Squares
WDI	-	World Development Indicators
DF	-	Dickey-Fullar
GMM	-	Generalized Method of Moments
ECT	-	Error Correction Ter

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The authors declare that they have no financial or non-financial competing interests.

Author Contributions

MMR designed this study and set the methodology, while TBA reviewed the existing literature and prepared data for the study. MMR and TBA worked together to analyze the data. Both authors read and approved the final manuscript.

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