Government Spending on Education and Economic Growth: A Case Study of West African Countries.

By

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Abstract
The study investigated government spending on education and economic growth in West African countries. Data for the study covers the period 1990 to 2016 for 15 selected ECOWAS countries. Unit root, cointegration analysis and casualty test was done. The study findings include that government spending on education and economic growth in West African countries are positively and significantly related. Long-term Granger causality exits while there is no evidence of short-run Granger causality from government educational expenditure to economic growth. This indicates that in the long run, government educational expenditure, through its impact on human capital, significantly and positively influence economic growth. Thus, in the West African region, such spending on education should be encouraged in the public sector. One way to encourage this is to allow and encourage regional collaboration amongst the countries as this will allow resources to be concentrated, and knowledge to be shared across the countries in the region and subsequently boost economic growth.
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1.0: Introduction

Endogenous growth model proponents like Lucas, (1988), Romer (1990) and Barro (1991) validated the fact that the role of education in promoting economic growth is significant and positive. Thus, investment on education has a positive effect on both the individual manpower and the economy. Additionally, countries having greater stocks of human capital and investing more on education or research and development will enjoy a faster rate of economic growth. This, they (proponents of the endogenous growth model) suggest, may be one of the reasons for the slow growth rate of certain developing countries including many West African countries. This implies that improving education quality at all levels is imperative for development in West African countries in particular and Africa as a whole. According to Hanushek and Woessmann, (2008) theoretical contributions emphasize two main transmission mechanisms through which education affects economic growth. First, education increases the human capital of the labor force, which increases labor productivity and transitional growth toward a higher equilibrium output level. And second, in endogenous growth theories, education increases the innovative capacity of the economy, knowledge of new technologies, products and processes, and thus promotes growth

Primarily, education in the West African region, just like other regions in Africa, is funded by the government, which allocates its public education resources based on the country's priorities and needs. While public education spending priorities will vary from country to country, increased investment in education will help to successfully meet key education targets and build a skilled workforce, (Majgaard, and Mingat, 2012). In many of the West African countries, the public spending on education is complemented by the private sector through private ownership of some of the educational institutions. Thus, there is a combination of both public and private owned educational institutions at all tiers of education co-existing with one another. Nonetheless, access to higher education is unevenly distributed (World Bank, 2013). This can be attributed to the variations in the number of educational institutions in the countries of the region as both scarce human and financial resources are spread skewed throughout the sub-region. This notwithstanding, government role in enhancing education and research, in this region, cannot be underestimated and over time, there have be increased government spending on education (World Bank, 2016) but whether these spending translate to improvements in both education and manpower development remains contentious. Thus, to progress towards greater prosperity and economic growth, countries need to provide higher education that is relevant to current market needs, and this, among others, justifies the need more government spending on education.

Available data from the World Bank shows that government expenditure on education as a percentage of GDP fluctuated between 0.3% and 3.7% for the period 1990 to 2015 while government expenditure on education as a percentage of government expenditure ranged between 5.0% and 15% for the same time period. In line with this the World Bank (2013) indicates that in the last 10 years, many countries have made extraordinary gains. For example, across the sub-region more students are completing primary school, and schools are enrolling more female students than ever before. This increase notwithstanding, Pulse.org (2018) opined that that there are deficiencies in the education system in West Africa. This ranges from inadequate infrastructure, to old fashioned teaching methods, and a high level of students leaving school without having mastered required knowledge with inadequate funding from the government. One major reason for this according to Pulse.com (2018) is that of unskilled workers, which makes it difficult for the region to get the most positives out of education by creating a significant communication gap between the persons being impacted and the persons impacting the knowledge. This have a substantial effect on human capital within the region and consequently, it will affect the productivity and GDP growth.

According to Auty, (2001) human capital, which represents the skills and knowledge of workers, generates just under two-thirds of the income in developing nations. Furthermore, the World Bank stated that human capital as opposed to natural or physical capital exerts the greatest influence on income. Thus, the development of education, which generates human capital, plays an integral role in economic growth. Also, with respect to technology, the World Bank opined that in the new technology driven world, the ability of workers to compete is handicapped by the poor performance of education systems in most developing countries including the West African countries. Technological change and global competition demand the mastery of competencies and the acquisition of new skills for many. This is an area where spending on education can play a significant role and thus enhances a nation's income and economic growth.

One salient question here is, does public spending on education affect or cause economic growth in the West African Countries? Hanushek and Woessmann, (2008) stated that the impact of education on economic growth remains controversial, due to several conceptual and methodological problems, such as the measurement of education and growth, as well as differences in education coefficients across

countries or regions. Consequently, this study, using secondary data and econometric analysis involving co-integration technique will investigate the effect of the government education spending on economic growth.

2.0: Brief Literature Review

Investing in education has long been well-thought-out as a key factor in enhancing economic growth in the economic literature. Education develops, enhances and improves human capital and human capital in the form of education has economic value and thus education become an important form of investment in human capital. The endogenous growth model developed by Romer (1986) and Lucas (1988) focused on the role of human capital as a main source of increasing returns and divergence in growth rates between developed and underdeveloped countries. Studies by Mankiw, Romer, and Weil (1992) further stressed the indispensable role of education as the most important production factor in increasing human capital as a determinant of economic growth. Education, through schooling, aids individuals acquire knowledge which can be transformed into higher wages and higher economic growth. Investment in educated and skilled workers will bring out efficient use of labor and capital resources for greater productivity. This was collaborated by Nelson and Phelps (1966) aa well as Benhabib and Spiegel (2005) who accentuated that education can facilitate the sharing and transmission of knowledge needed for developing new technologies. This notwithstanding, Pritchett, (1991) found a significant negative relationship between human capital and economic growth.

Most recent studies show the existence of a positive relationship between education and economic growth. For instance, Otani and Villanueva (1993) studied the determinants of long-term growth in developing countries. They examined fifty-five (55) developing countries using time series data from 1970 to 1985. They found that education program and human capital investment such as vocational training and health training increases a country's output and per capita income. As such, countries will achieve high level of economic growth when they invest more in education. They stated that human capital development contributes an annual average of 1% increase in developing countries' growth rate.
Al-Yousif (2008) paper examined the nature and direction of the relationship between education expenditure as a proxy for human capital and economic growth in the six GCC economies using time-series data for the period 1977 to 2004. The analysis employs a Granger-causality test within an error-correction framework. His findings were mixed and vary across both countries and measures of human capital. Based on this, he submitted that to deepen our understanding of the complex relationship between education and economic growth, additional studies need to be conducted on the issues at hand with a special focus on countries that are similar in their policy and institutional environment using time-series data. And, that empirical result in this area can be more insightful if researchers could develop more accurate measures of human capital than the existing ones.

Muktdair-Al-Mukit (2012) study was on the long-run relationship between public expenditure on education and economic Growth in Bangladesh. He used an econometric model and time series data from 1995 to 2009. His findings indicate that public spending in education has a positive and significant impact on economic growth in the long run. Furthermore, he observed that a one percent increase in public expenditure in education contributes 0.34% increase in GDP per capita in the long run. Mekdad, Dahmani and Louaj (2014) studied the relationship between education and economic growth in Algeria over the period 1974 to 2012 with the use of endogenous growth model. Their results support their paper's main hypothesis that public spending on education affects positively economic growth in Algeria. They also found a bilateral causality and long run relationship between per capita GDP and public education expenditure. Lawanson (2015) empirically investigated the relevance of educational

and health components of human capital to economic growth, using a panel data from sixteen West African countries over the period 1980 to 2013 and using the Diff-GMM dynamic panel technique. His findings indicate that coefficients of both education and health have positive statistically significant effects on GDP per capita thus affirming the strong relevance of human capital to economic growth of West Africa.

Mussagy and Babatunde (2015) study focused on the effect of government education expenditure and economic growth in Mozambique using a cointegration approach and quarterly data between 1996 and 2012. They found out that the government expenditure on education in Mozambique was quite low and the government spending allocated from the budget was not more than 20% in the past 15 years. This was below the recommended percentage of 26% set by UNESCO and NEPAD (2002). Their cointegration and error-correction analysis confirmed that a long run relationship exists between economic growth and government expenditure in Mozambique. Hua (2016) did a master's thesis on the Relationship between public expenditure on education and economic growth in China. He used unit root and granger casualty analysis and data from 1992 to 2013 and found that the contribution of public expenditure on education is significant and high and that GDP granger causes public expenditure on education but public expenditure on education does not granger cause GDP. Mallick, Pradeep and Pradhan (2016) investigated dynamics of expenditure on education and economic growth in selected 14 major Asian countries by using econometric analysis and balanced panel data from 1973 to 2012. The results of Pedroni cointegration state the existence of long-run equilibrium relationships between expenditure on education and economic growth in all the countries. Also, expenditure on education only Granger causes economic growth in long-run in all the countries. The result of the Fully Modified OLS (FMOLS) shows a positive impact of educational expenditure on economic growth. The study argues that education sector is one of the important ingredients of economic growth in all 14 Major Asian countries.

Wang,Ying and Shasha Liu (2016) constructed a panel data model to investigate the effect of education human capital on economic growth, using the latest education data of 55 countries and regions from 1960 to 2009. He subdivided education human capital into higher education, secondary education and primary education; it also examines the effect of different education level on economic growth. Their result shows that in general, education human capital has a significant positive impact on economic growth. The positive impact of higher education on economic growth is especially significant, however, the primary education and secondary education does not have a significant impact on economic growth. Babatunde (2018) investigated government spending on infrastructure in Nigeria. She used both primary and secondary data. The secondary data comprise of reported annual spending on selected infrastructure and annual Gross Domestic Products for 1980 to 2016. She also carried out unit root and co- integration tests using Augmented Dickey–Fuller and Phillip–Perron model. Weighted least square was used to test the sample of 37-year annual time series using vector error correction model. Her findings indicate that government spending on transport and communication, education and health infrastructure has significant effects on economic growth while spending on agriculture and natural resources infrastructure recorded a significant inverse effect on economic growth in Nigeria.

In conclusion, most of the studies adapted the Mankiew Romer and Weil (1992) and supported that education is imperative for economic growth for a country or region. Despite this widespread belief that the investment in human capital development is a key determinant of economic growth, the empirical estimates especially focusing on low-income countries (LICs) are less than conclusive. This is partly attributed to how schooling is measured – quantity of schooling or quality of school.

3.0: Methodology and Data[1]

In this study we adapted the neoclassical production function to investigate the effect of expenditure on economic growth. This method was utilized by Mallick, Das and Pradhan (2016) and this study adapted it for this study. This is expressed as follows:

$$Y = f(L, K) \quad \ldots.(1)$$

Where L is the amount of labor and K is the amount of capital that needed to produce 'Y' level of output in the economy. For the impact of education on economic growth, we can include the government expenditure on education as an indispensable variable in the production function. This is in-line with Mallick, et al. (2016). Thus:

$$GDP = f(GEXPE) \quad \ldots (2)$$

Where, GDP represents the total economic growth and GEXPE refers to government (public) expenditures on education. The expenditure on education, which is a measure of education quantity, presents human capital formation which can make skilled labor force. This skilled labor force can enhance the productivity of physical and human capital and in return it would have positive impact on economic growth. It should be noted that various studies measured education quantity using various proxies. For instance, education quantity is measured by schooling enrolment ratios (Mankiw, Romer and Weil 1992, Barro 1991, Levine and Renelt 1992), the average years of schooling (Hanushek and Woessmann 2007, Krueger and Lindhal 2001), adult literacy rate (Durlauf and Johnson 1995, Romer 1990) and education spending (Baladacci et al.).

Equation (2) is then estimated to investigate the impact of expenditure on education on economic growth. This equation can be re-written as:

$$GDP_t = \alpha_1 + \beta_2 GEXPE_t + \varepsilon_t \quad \ldots(3)$$

Where:

GDP_t = Gross Domestic Product in time;
$GEXPE_t$ = Public Expenditure on Education;
ε_t = Error term;
The parameter α_1 is the intercept term; and β_2 is the slope coefficients.

Government (Public sector) expenditure on education was used and this was because of the non-excludable nature of skills which is being created through education. And as stated by Mallick, et al. (2016), private sector expenditures on education are considered as rent and profit maximizing entities whose main interest are concerned with maximum gain by their investment on education, thus their exclusion from the data set.

To be able to empirically investigate the relationship between government expenditure on education and GDP, equation (3) was modified into a linear panel model where the expenditure on education is the independent variable, and economic growth is the dependent variable. This is stated as follows:

$$lnGDP_{it} = \alpha_i + \beta_{2i} lnGEXPE_{it} + \varepsilon_{it} \quad \ldots(4)$$

For t = 1,…, T; I = 1, …, N. Where T refers to the number of observations over time and N refers to the number of individual countries in the panel. LnGDP is the natural logarithm GDP and lnGEXPE is the natural logarithm of expenditure on education.

[1] This section adapted and benefited substantially from Mallick, et al. (2016).

3.1: Estimation Issues

Panel Unit Root Test - for testing the panel cointegration among variables, the first step is to examine the units root properties of the data, because the variables must be integrated of the same order. In the present study we have used unit root tests by LLC (Levin et al., 2002), and IPS (Im et al., 2003). The null hypothesis of all these panel unit root tests has always been considered non-stationary of the data. Levin et al. (LLC, 2002) test are based on ADF test which assumes homogeneity in the dynamics of the autoregressive coefficients for all panel units with cross-sectional independence.

Panel Cointegration Tests – for this test we adapted the Pedroni (1999, 2004) test where he has proposed a heterogeneous panel cointegration test and has been used to estimate the cointegration between educational expenditure and economic growth in their study. This test allows various cross-sectional interdependences along with other different individual effects to establish the cointegration. He defines two kinds of test statistics, where the first one is based on pooling residuals within the dimension of the panel and second is without dimension. Finally, we will run a Panel Granger Causality (VECM).

3.2: Data

The study utilized time series data from 1990 to 2016 for 15 selected ECOWAS countries. The data include government spending on education and GDP. The GDP data was collected from the World Bank national accounts data, and OECD National Accounts data files while the data on government spending on education was sourced through the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics. The selected countries include: Burkina Faso, Benin, Cote d'Ivore, Gambia, Guinea-Bissau, Liberia, Mali, Nigeria, Senegal, Togo, Sierra Leone, Niger, Guinea, Ghana, and Cabo Verde.

4.0: Empirical Result

4.1: Panel unit Root Test Result

Testing for the unit root properties of the data is the first step in exploring panel cointegration among variables. And for this study the tests by LLC (Levin et al., 2002), and IPS (Im et al., 2003) was adapted to test for the unit root. As contained in the literature, the null hypothesis of all these panel unit root tests has always been that of non-stationarity of the data. Levin et al. (LLC, 2002) test are based on ADF test which assumes homogeneity in the dynamics of the autoregressive coefficients for all panel units with cross-sectional independence. The following equation adapted from Levin et al. (2002) was utilized to test the unit root of the data in the study.

$$\Delta X_{it} = \alpha_i + \beta_i X_{i,t-1} + \delta_i t + \sum_{j=1}^{k} \gamma_{ij} X_{i,t-j} + \theta_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where: Δ is first difference operator; X_{it} is dependent variable; ϑ_{it} is the white-noise disturbance with a variance of σ^2, i = 1,2, …, N indexes country and t = 1,2, …, T indexes time.

According to Levin *et al*. (2002) the hypothesis to test the stationarity of the panel data are given as:

$$\begin{cases} H_0: \beta_i = 0 \\ H_1: \beta_i < 0 \end{cases};$$

where alternative hypothesis corresponds to Y_{it} of being stationary.

The test also finds that while comparing with the single equation ADF test, the panel approach substantially increases it power in finite samples. Levin et al. (LLC; 2002) also specified another equation (6) which restricts $\hat{\beta}_i$ while keeping it identical across the cross-countries. The equation (6) follows as:

$$\Delta X_{it} = \alpha_i + \beta_i X_{i,t-1} + \delta_i t + \sum_{j=1}^{k} \gamma_{ij} \Delta X_{i,t-j} + \theta_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

In this equation, it is assumed that:

$$\begin{cases} H_0: \beta_1 = \beta_2 = \cdots = \beta = 0 \\ H_1: \beta_2 = \beta_2 = \cdots = \beta < 0 \end{cases};$$

Where: $t - statistics = t_{\hat{\beta}}/\sigma(\hat{\beta})$, $OLS\ estimate\ of\ equation\ 6 = \hat{\beta}$ *and* $its\ standard\ error = \sigma(\hat{\beta})$

The IPS was based on Im et al (2003) which was based on the mean group. (IPS; 2003) used the average of the $t_{\beta i}$ statistics from equation 5 and was used to perform the following $\bar{Z}$ statistic.

$$\bar{Z} = \sqrt{N}[\bar{t} - E(\bar{t})]/\sqrt{V(\bar{t})}$$

where $\bar{t} = (1/N)\sum_{i=1}^{N} t_{\beta i}$; $E(\bar{t})$ *and* $V(\bar{t})$ *are the mean and variance of each* $t_{\beta i}$ *statistic.*

The $\bar{Z}$ statistic converges to standard normal distribution. So IPS test is based on average individual unit root test and is expressed by $\bar{t} = (1/N)\sum_{i=1}^{N} t_{\beta i}$.

The result of the panel unit root test is contained in Table 1. The table comprises of both the Levin et al. (LLC, 2002) and Im et al. (IPS, 2003) approaches that was used for the test. And from the table, all the variables are non-stationary at their level as such we accept the null hypothesis indicating that the data series contains a unit root. But after the first order differentiation, test statistics show that we can reject null hypothesis of non-stationarity for all the series at 1% level of significance. In all, all the variables were integrated of order one, that is, they are I (1).

Table 1: Panel Unit Root Result

Variables	LLC Test		IPS Test	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
Ln Y	1.141(0.107)	1.811(0.614)	3.301(0.148)	2.213(0.230)
LnExe	1.541(0.624)	1.182(0.515)	1.411(1.118)	2.862(1.034)
ΔLnY	11.280(0.000)***	12.149(0.000)***	15.201(0.000)***	12.397(0.000)***
ΔLnGEXPE	20.352(0.000)***	23.052(0.000)***	21.213(0.000)***	22.289(0.000)***

Notes: Numbers in parentheses are p values.

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

4.1.1: Panel Cointegration Tests

Given that all the variables are I (1), we tested for the existence of a cointegrating relationship. This was done using the Pedroni cointegration test and Fisher-ADF test. The test enables us to investigate the long run relationship among the variables. The Pedroni's (1999, 2004) test allows various cross-sectional interdependences along with other different individual effects to establish the cointegration. From his

studies, two kinds of test statistics can be identified: one is based on pooling residuals within the dimension of the panel and the other is without dimension. For testing long run equilibrium in the panels, Pedroni (1999, 2004) has proposed two types of residual-based tests, which are stated as follows:

Panel v-statistic:

$$Z_v = \left(\sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\, \hat{e}_{it-1}^{2}\right)^{-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

Panel ρ-statistic:

$$Z_\rho = \left(\sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\, \hat{e}_{it-1}^{2}\right)^{-1} \sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\left(\hat{e}_{it-1}^{2}\Delta\hat{e}_{it} - \hat{\lambda}_i\right) \ldots\ldots\ldots\ldots\ldots(8)$$

Panel PP-statistic:

$$Z_t = \left(\hat{\sigma}^2 \sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\, \hat{e}_{it-1}^{2}\right)^{-1/2} \sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\left(\hat{e}_{it-1}^{2}\Delta\hat{e}_{it} - \hat{\lambda}_i\right) \ldots\ldots\ldots\ldots\ldots(9)$$

Panel ADF-statistic:

$$Z_t^{*} = \left(\hat{s}^{*2} \sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\, \hat{e}_{it-1}^{*2}\right)^{-1/2} \sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\left(\hat{e}_{it-1}^{*}\Delta\hat{e}_{it}^{*}\right) \ldots\ldots\ldots\ldots\ldots(10)$$

Group ρ-statistic:

$$\tilde{Z}_\rho = \sum_{i=1}^{N}\left(\sum_{t=1}^{T} \hat{e}_{it-1}^{2}\right)^{-1} \sum_{i=1}^{N}\left(\hat{e}_{it-1}^{2}\Delta\hat{e}_{it} - \hat{\lambda}_i\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(11)$$

Group PP-statistic:

$$\tilde{Z}_t = \hat{\sigma}^2 \left(\sum_{t=1}^{T} \hat{e}_{it-1}^{2}\right)^{-1/2} \sum_{t=1}^{T}\left(\hat{e}_{it-1}\Delta\hat{e}_{it} - \hat{\lambda}_i\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(12)$$

Group ADF-statistic:

$$\tilde{Z}_t^{*} = \sum_{i=1}^{N}\left(\sum_{t=1}^{T} \hat{s}_i^{2}\, \hat{e}_{it-1}^{*2}\right)^{-1/2} \sum_{t=1}^{T}\left(\hat{e}_{it-1}^{*}\Delta\hat{e}_{it}^{*}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(13)$$

where:

$\hat{e}_{it}$ *is the estimated residual from equation* 4

$\hat{L}_{11i}^{-2}$ *is the estimated long run covariance matrix for* $\Delta\hat{e}_{it}$.

$\hat{\sigma}_i^2$ *and* $\hat{s}_i^2\left(\hat{s}_i^{*2}\right)$ *are* the long run and contemporaneous variances for individual i

Note that equations 7 to 13 are normally and asymptotically distributed. The results obtained are stated in tables 2 and 3 below:

Table 2: Panel Co-integration Result

Panel Co-integration Test	Individual Intercept	Individual Intercept and Trend
With Dimension		
Panel V - Statistic	2.113(0.169)**	-1.024(1.201)
Panel rho - Statistic	-3.042(0.002)***	-3.032(0.002)***
Panel PP - Statistic	-5.131(0.000)***	-5.874(0.000)***
Panel ADF - Statistic	-5.672(0.000)***	-6.053(0.000)***
Without Dimension		
Group PP - Statistic	-1.443(0.211)	-0.731(0.334)
Group rho - Statistic	-3.018(0.005)***	-2.971(0.002)***
Group ADF - Statistic	-2.983(0.001)***	-2.852(0.004)***

Table 3: Combined Fisher – ADF Test

No. of CE(s)	Trace Test	Prob	Max-Eigen Value	Prob
r = 0	66.712	0.000***	53.381	0.000***
r > 1	49.926	0.000***	48.132	0.000***

Note: Probabilities are computed using asymptotic Chi-square distribution.
*** and *** indicates 1% and 5% level of significance respectively.

From the table, all the test conducted showed that the null hypothesis of no cointegrating relationship can be rejected at either 1% level or 5% level of significance for all the countries. Hence, the cointegration test result provides a backing for the existence of a panel cointegration between GDP and government expenditure on education at the specified level of significance. From the table 3, it can be observed that the trace statistics is greater than the maximum Eigen value and this also implies that the existence of cointegrating relationship between GDP and government expenditure on education thereby rejecting the null hypothesis of no cointegration. This result is also supported by the value of all the statistic obtained. It is pertinent to state at this point that the existence of a cointegrating relationship among the variables does not have any relationship with the long- and short-run dynamics of the variables. In other to do this, the study went further to estimate the Vector Error Correction Model (VECM).

4.1.2: Panel Granger Causality (VECM)

The Engle and Granger (1987) model was used for the causality analysis. This entails a two-step procedure to investigate both the short run and long run dynamic relationships between government expenditure on education and economic growth. First an estimation of equation 4 was done to captures the long run and then we define the lagged residuals obtained as the Error Correction Term (ECT). The estimation of the dynamic Vector Error Correction Model (VECM) is stated as follows:

$$\begin{pmatrix} \Delta LNGDP_{i,t} \\ \Delta LNGEXPE_{i,t} \end{pmatrix} = \begin{pmatrix} \emptyset_{i,1} \\ \emptyset_{i,2} \end{pmatrix} + \sum_{I=1}^{m} \begin{pmatrix} \theta_{1,2,k} \\ \theta_{2,1,k} \end{pmatrix} \begin{pmatrix} \Delta LNGDP_{i,t} \\ \Delta LNGEXPE_{i,t} \end{pmatrix} + \begin{pmatrix} \lambda_1 \\ \lambda_2 \end{pmatrix} ECT_{i,t-1} \begin{pmatrix} \varphi_{1,i,t} \\ \varphi_{2,i,t} \end{pmatrix} \dots\dots\dots\dots (14)$$

Where:

Δ presents first differences,

$\emptyset_{i,j}$ (j, k = 1, 2) present the fixed country effect;
I (I = 1,…m) is lag length determined by the Schwarz information Criterion (SIC), and
ECT_{t-1} is the estimated lagged error correction term (ECT) derived from the long run cointegrating relationship (Equation 1).
The term λ_i is the adjustment coefficient, and $\phi_{1,l,t}$ is the disturbance term, which is assumed to have zero mean.

The results are contained in Table 4. The result obtained supports the long-term Granger causality between government expenditure on education and economic growth in all the selected countries but there was no short-run Granger causality from government educational expenditure to economic growth. This indicates that in the long-run government educational expenditure has a significant impact on economic growth while in the short run government expenditure on education does not Granger cause economic growth.

Table 4: Panel Granger Causality Test based on PVECM

Dependent variable	Independent variable (Source of Causation)		
	Short run		Long run
	ΔLNGDP	**ΔLNGEXPE**	**ECT**
ΔLNGDP		10.743(0.0001)	-0.1894[-2.2461]***
ΔLNGEXPE	1.0135(0.4113)		-0.3978[-5.0019]***

Note: Lag lengths: 2,
P-value listed in parentheses and
t-statistic listed in brackets.
***, ** and * indicates significance level of 1%, 5% and 10%.

This implies that government spending on education through its impact on human capital development does have a significant positive impact on enhancing economic growth in the region. Precisely, this result supports other studies where government expenditure on education does not cause economic growth in the short run while in the long-run, it does cause economic growth in the respective countries. Given the results obtained the importance of education in boosting economic growth cannot be overemphasized. This includes both formal and informal, in-school and out-of-school and direct and indirect learning. Education being a major contributor to human capital development becomes a viable investment by the government to enhance economic growth. This is because, as stated Ehrenberg, (1994), includes skills and knowledge of workers, often derived from education and training, which contribute to productivity. And as such any investment or spending by the government to enhance education of the populace has the tendency to exert the greatest influence on economic growth in developing countries especially the selected West African countries. According to the World Bank, there have been changes in return patterns especially with the emergency of more advanced technology as labor markets adjust to automation. And in this in this new world, the ability of workers to compete is handicapped by the poor performance of education systems in most developing countries. This also supports the need for more government spending on education in West Africa and other developing countries as a way of enhancing economic growth given the results of this study.

5.0: Conclusion

The study investigated government spending on education and economic growth in West African countries. Data for the study covers the period 1990 to 2016 for 15 selected ECOWAS countries. Unit root, cointegration analysis and casualty test was done. The study findings include that government spending on education and economic growth in West African countries are positively and significantly

related. Long-term Granger causality exits between government expenditure on education and economic growth in all the selected countries but there was no short-run Granger causality from government educational expenditure to economic growth indicating that in the long run, government educational expenditure, through its impact on human capital, significantly and positively influences economic growth. This demonstrates that any investment (spending) on education is a crucial and critical factor in significantly promoting economic growth especially in the long-term. The channel of impact is indirect in that such an investment (spending) will aid the development of skilled labor and consequently enhance productivity there by leading to improvements in national out and economic growth. As concluded by Mallick, Das and Pradhan (2016), and supported by the results of this study, spending on education positively impacts on education and thus such spending on education can create better human capital which can in return accommodate the use of modern technology in the production process by minimizing huge adoption costs. In the West African countries, such spending on education should be encouraged in the public sector. West African countries should accord more importance to the education sector and accordingly increase its share of total government expenditure on education as a way of improving the various tiers of formal education namely primary, secondary and post-secondary education in the region. This will help enhance the availability of more skilled manpower for the long-term economic growth and development. One way to encourage more government on education and promote economic growth in the region is to allow and encourage regional collaboration amongst the countries as no single country has the means to develop expertise in all knowledge areas. This is imperative given that the West African sub-region has many countries with each country having its own educational structure yet, access to higher education is unevenly distributed while scarce human and financial resources are disproportionately spread throughout the sub-region. This regional collaboration will aid efficient use of limited resources in that it will allow resources to be concentrated, and knowledge to be shared across the countries in the region. And with more advancement in technology, strengthening education training in West Africa is crucial in meeting the needs of growing markets and this may entail more government spending and investment in the education sector.

5.1: Further Research

For future studies, examining the transmission mission of how spending in education translates to higher productivity and economic growth can be further explored with more advanced methodologies. Also, specific government spending on the different tiers of education should also be investigated as a way trying to evaluate at which tier of education should the government spend or invest more.

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