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THE RELATIONSHIPBETWEEN GOVERNMENT EDUCATION EXPENDITURE AND ECONOMIC GROWTH:THE CASE OF GAMBIA COMPARED TO GHANA

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Abstract: This study investigates therelationship between general government education expenditure and economic growth in two anglophone West African countries, Gambia and Ghana through cross-country comparison. We used econometric tools such as Augmented Dickey Fuller test (ADF), Johansson Cointegration Test, Error Correction Model (ECM) and Granger Causality Test Analysis. The data collected for Gambia and Ghana ranges from 1968 to 2015. After carefully running an individual test on all the variables, we observed a short-run economic meaningful relationship between education expenditure and economic growth in both countries based on the result revealed from ECM. The Granger Causality test result suggest a unidirectional causality that run from Gross Domestic Product (GDP) to Government Education Expenditure (Edu) for Ghana but we are unable to significantly determine a causal direction for the Gambia. However, the study concluded that Education Expenditure has statistically significant short run impact on economic growth in both countries.

Key words: Government Education Expenditure, Economic Growth, Cointegration Analysis, Error Correction Model, Granger Causality, The Gambia and Ghana.

I. Introduction

The main topic of interest concerns the generation of Knowledge to accumulate human capital through promoting education in the form of Public Education Expenditure. In this study, we will investigate two economies and try to see how spending on education impact their respective economic growth level since it is a stylise fact that developing countries can achieve sustainable long-run growth through increase in education, research and development (R&D) and accumulation of essential knowledge (Lucas, 1988). Most of the credible Literatures considered increase in education to be positively correlated with accumulation of knowledge and advancement of technology which eventual leads to economic growth. However, extend of the relationship between Education and economic growth vary from country to country. The study on EU countries revealed an argumentative relationship between an individual country's expenditure on Education (Tertiary Education) to their net annual earning and countries that displayed the highest value of total public expenditure on education are associated with highest level of net annual earnings with lower risk of long-run unemployment rate and poverty (Emilia Campeanu, DalinaDumitrescu, LonelaCostica&LustinaBoitan, 2017 p. 761). Ghana and Gambia are both considered developing countries with low human capital stock. However, Ghana has an edge over Gambia in terms of public education expenditure, the Gross domestic product level and the population size. The Similarities are the fact that both are West African countries and a former British Colony. They both run similar educational pre-tertiary education in 2-6-3-3 system of a 2-year Kindergarten, a 6-year primary, a 3-year senior high school education (Moses Ackah Anlimachic, 2020).

Poor and developing countries such as Gambia and Ghana have been the main concern in some of the reputable economic journals in trying to examine the effects that spending on education can have on economic growth considering the evidence their level of low human capital stock and given the poorest countries today, if the stock of human capital is too low, growth may not take place at all(Romer, 1990, p. 71). In order to mitigate this problem, the World Bank institute's knowledge for development (K4D) has developed a four-pillar framework that countries can use as a bases for their transition to a knowledge economy simply because it is

one of the key sources of growth in the global economy. Government expenditure on education is unarguably a form of improving human capital. Human capital has potentially altered either the theoretical modelling or the empirical analysis of economic growth. Properly accounting for human capital at the theoretical level may change one's view of the nature of the growth process (Mankiw, Romer &Weils, 1992, p. 415).

Based on (Mankiw, et al p. 419) assertion, the explicit spending on education take place at all levels of the Government as well as by the family which makes spending on education hard to measure. To investigate the relationship between education expenditure and growth level in Gambia and Ghana, we must narrow our focus on the explicit government spending on education thus ignoring the unobserved spending on education by private entities such as family members and other sources of investment on education. We will use general government expenditures on education at primary, secondary, tertiary and special education- science, research and development; that is not provided by private sectors or individuals as a proxy to the aggregate spending on education to determine its effect on GDP. A country like the Gambia, her government does not only invest their fund on basic education level but has extra-ordinarily invested chunk of its resources on tertiary and higher education level every year and Ghana spend even more based on the global economy rating. Since this study relates to time series and multi-dimensional data, previous studies suggest the use of a rigorous panel data framework. The goal is to examine whether or no these two developing anglophone countries are getting any causal effect of education expenditure on economic growth and how they can optimally allocate their funds to get the best result possible. Therefore, the effect of education spending on economic growth level in Gambia and Ghana will be studied using panel data to examine the causal relationship between government expenditure on education and GDP in a specific time interval.

1.1Background on Gambia's Government Education Expenditure

Recent empirical studies on the relationship between education expenditures and growth have revealed that countries with low stock of human capital show less pro-cyclical relationship between education expenditure and economic growth than countries associated with high stock of human capital (Mankiw, et al, 1992). The case of the Gambia seems to fit the low stock of human capital category but in 1988, the government began a major education initiative which included a 15-year plan that has emphasized increasing gross enrolment rates, developedbasic education curricula, and improved teacher training.In February 1998, the president ordered the termination of fees for the first six years of schooling making public primary education free for all. The Gambia as it is undoubtedly a poor country with a very low per capita income, most of the families try to minimize their spending on education by financing the education of only the male child with less consideration to their female child's education. However, in 2002 free education for girls was initiated to bridge the gap between male and female education. In 2014, the government continued in their quest to increase the gross enrolment level and made the basic school level affordable. UNESCO collected data on Gambia's public spending on education from 1985 to 2013. The average value for the Gambia during that period was 2.47 percent of GDP with a minimum of 1.03 percent in 2004 and a maximum of 4.3 percent in 1985. In 2018, the global economy ranked the Gambia's public spending on education 54th position in Africa with 2.42 as a percentage of GDP ahead of countries like Guinea, Uganda and Sri Lanka. However, The Gambia is still far behind Ghana and other west African countries. We must take note of the assertion made by (Romer, 1990, p. 71). and hypothesize that if Gambia being a smaller economy experience long-run growth from spending on education, there is high chance that Ghana will have the same or better result. This assumption is strengthened by the idea that Ghana compared to Gambia is experiencing higher economic growth, a larger market, a greater population with more productive human capital and better spending on education.

1.1Background on Ghana's Government Education Expenditure

Ghana is the world's second largest cocoa producer behind Ivory Coast, and Africa's biggest gold miner after South Africa. It is one of the continent's fastest growing economies and has made major progress in the attainment and consolidation of growth (UNDP, 2021). With regards to their public spending on education as a percentage of GDP, The Global Economy ranked Ghana at 28 in position among 60 African countries with an average of 3.99. The African country that spends the most on education as per the global economy raking is Belize with an average of 7.56 and the least was Burma with an average 1.92. To justify this higher rating, Ghana president Nana Addo Dankwa Akufo-Addo in 2017 announced tuition free for secondary education throughout the country. Ghanaian children now attend school in higher rates than their counterparts in many other African countries, as well as in developing nations in other world regions. While more than 84 percent of children participated in elementary education in 2017, the gross enrolment rate (GER) in secondary education increased from 57 percent in 2012 to 73 percent in 2017, compared with 42 percent in Nigeria (Mehwish Kamran, 2019). However, we want to understand ifthere is any relationship between Ghana's huge investment on education and their level of GDP?

1.2Scope of the Study

This study is designed to mainly investigate the effect of government education expenditure on economic growth by comparing two anglophone West African countries. The reason why these two countries

are compared is to caution for the assertion made by Mankiw et al, that small countries income is dominated by idiosyncratic errors. Therefore, the goal is to use the findings of Ghana which is relatively a bigger economy to correct and justify any anomalies associated to Gambia being a smaller country in our quest to determine if a small country such as the Gambia can be experiencing growth due to explicit government investment on education. The study is structured to capture both country specific relationship between government education expenditure and economic growth and generalized relationship between the variables in Gambia and Ghana.

II. Literature Review

The interest of this study is to examine the relationship between general government education spending and economic growth by investigating literatures on the basis country-specific and cross-country relationship between education expenditure and growth, human capital accumulation, and increase in schooling.

2.1 Country Specific Relationship between Education Expenditure and Growth

Country-specific relationship with growth is a term we used to refer to studies that concentrated on a specific country and how their education expenditure directly affects economic growth.Mpho Bosupeng (2015) examine the payoffs of education expenditure in Botswana using long run economic growth implications. His studies were based on two hypotheses: H1 GDP trends positively with education expenditures and H2 GDP is the leading variable. But from his Cointegration and Granger test result respectively, both the hypothesis was rejected which reveals that neither do education spending trend positively with GDP nor do they have any causal relationship in Botswana. However, a similar study was conducted on Turkey, (Mehmet Mercana&SevgiSezerb, (2014) the effect of education expenditure on economic growth. They used two analytical approaches: short-term analysis and long-term analysis between 1979 and2012 using autoregressive distributive lag method (ARDL) bounds test to determine the Cointegration analysis. The result revealed important evidence that education expenditure has effects on economic growth in both the two terms contrary to the case of Botswana. Lingaraj MALLICK & Devi Prasad DASH, *(2015)* developed research on Does Expenditure on Education Affect Economic Growth in India. They considered the period ranging from 1951 to 2012. Their result confirmed a positive and significant impact of education expenditure on economic growth at 5 percent statistically significant level, but the reverse does not apply as GDP reveals no statistical impact on education expenditure. The test for error correction was used to determine the dynamic mechanism among the variables. Ana Bela Nunes (2003) examine a case study on Government expenditure on education, economic growth and long waves: the case of Portugal. Her education expenditure includes only public account figures on administrative services concerning education- primary, secondary, higher and special education (science, research and culture). The data covered the period from the fiscal of 18511852 to the fiscal year 1998. Her case study however generally postulates a counter-cyclical behavior between state education expenditure and growth before the First World War and after the Second World War. However, a pro-cyclical relationship was realized during the interwar period when the state expenditure on education grew above the general trend. Furthermore, FoziehJeyhoonTabar, Zahra Najafi &Yaser Sistani Badooei (2017) conducted a study on Iran to ascertain the impact of education expenditures of government on economic growth using the annual data of Iran's economy from 1981 to 2012. Their study examines Wagner's law and the Keynesian hypothesis, and they also used bivariate and multivariate models in order to reduce the specific errors featuring the autoregressive distributive lag method (ARDL) of long-term and short-term relationships in order to control for Cointegration. They included capital stock and labor force in the model in order to reduce the severity of biasness as a result of omitted variables. The study revealed a positive impact between the variable education expenditure and GDP in the short-run but unfortunately, a negative impact is observed in the long-run.

2.2 Cross-Country Relationship between Education Expenditure and Growth

Numerous studies have revealed that cross-country relationship is very vital in determining the effect of education expenditures on economic growth (Emilia Campeanu, DalinaDumitrescu, Lonelacostica and lustinaBoitan(2017),

Lingaraj Mallick, Pradeep Kumar Das &KalandiCharan Pradhan, (2014) and Easterlin, (1981). The cross-country relationship compares different countries base on their level of effective spending on education, level of their human capital stock and other economic indicators to determine the impact of education expenditure on growth. This approach helps to distinguish the main catalyst that stimulate growth in countries after huge investment on education from other countries that experienced negligible change in their growth level, then draw a conclusion as to why some countries benefit more than others from spending on education. Many literatures have confirmed that countries differ when it comes to the benefits they attain from spending on education, human capital improvement and knowledge. Some other literatures assert that countries with moderate or high human capital stock reap more economic benefits than those that have low human capital stock. To look at few, Emilia Campeanu, DalinaDumitrescu, Lonelacostica and lustinaBoitan(2017), used an advanced technique to examine the impact of higher education funding on socio economic variables evidence from EU countries. They used Euclidean distance and squared Euclidean distance in order to merge EU

countries in groups based on similarities and dissimilarities. They also used two clustering method called Ward's minimum variance method and the complete linkage method to minimize the intra-group variance while maximizing outside group variance and observe the distance or similarity between the most distant countries in two clusters. The report on public expenditure on education as a percentage of GDP for EU countries put Bulgaria and Romania as the worst performers. These two countries are also labeled to have the lowest net earnings and higher risk of long-term unemployment. On the contrary, countries that display the highest values of total public expenditure on education as a percentage of GDP are associated to highest level of net annual earnings and a lower risk of unemployment and poverty which they considered tightly connected with macroeconomic development and its prospects. Lingaraj Mallick, Pradeep Kumar Das &KalandiCharan Pradhan (2014), studied the Impact of educational expenditure on economic growth in 14 major Asian countries: Evidence from pedroni's (1999, 2004) Cointegration test, Kao (2001) combined with fisher ADF test and Granger causality test. They asserted that all 14 Major countries have positive relationship between expenditure on education and economic growth only in the long-run while in the short run expenditure on education does not cause economic growth. Vincent Carpentier (2006) wrote an article on public expenditure on education and economic growth in the USA in the nineteenth and twentieth centuries in comparative perspective. In his article, he asserts that in USA there was a counter-cyclical relationship between public expenditure on education and economic growth before 1945 and a pro-cyclical relationship thereafter. He concluded that education should not be seen as the cause to the 1973 crisis but rather as a key factor in economic growth since 1945. Similarly, his investigation on the United Kingdom (UK) 18332000 period. He postulates that there was a massive rise of public expenditures on education from 1883 to 1999 in the UK. Over that period, the average annual growth rate increased substantially. Between 1870 and 1897, there was a twentyfold increase in public expenditure on education, which represented a rise from 0.1% to 1.2% of UK GDP. However, both his researches were based on historical investigation of the links between education systems and economic performance. Richard A. Easterlin (1981) Why Isn't the Whole World Developed? In his journal he tried to answer questions such as why countries failed to adapt the new technology and why some nations were rapid learners and others slow. He exerts that the more appropriate schools a nation's population had, the easier it is to master the technological knowledge becoming available. He postulated that the spread of modern technology of economic growth is linked to the development of formal schooling ''the leader of schooling is the leader of development- The United States''. He affirms that the spread in technology underlying modern economic growth depend on cross-country's population differences in their acquisition of appropriate formal schooling. Thus, country's that advanced in mass education are likely to signal sizable changes both in incentive structures and aptitudes favorable to modern economic growth. Zeynep Karazor, BurcuCuvenek, EsraEkinciSevilay Konya tried to find out the relationship between education expenditure and economic growth in OECD countries. They cited the fact that in some country's education expenditure is centralized while in other countries it is decentralized involving regional and local governments. In order to reveal a substantial result, they used cross-sectional data and time series (Panel data analysis) to analyze the relationship between education expenditure and economic growth among the selected 19 OECD countries. Based on their findings, they conclude that the education expenditure has not influenced growth since their probability values where less than the value retrieved from the fixed effect panel data regression estimation results.

2.3 Increase in Schooling vs Economic Growth

Schooling as a form of education has several connections with economic growth in this modern world. Some of the variables that link schooling and growth includes time (current generation vs future generation), earnings as a return to school and human capital. Jere R. Behrman, Andrew D. Foster, Mark R. Rosenweig and Prem Vashishtha (August 1999) examine some of these connections pertaining to Women's Schooling, Home Teaching, and Economic Growth. Unfortunately, in their conclusion, they rule out that female schooling have an important effect on earnings due to female non-agricultural employment and their low level of involvement in management decision in agriculture. But they observed a significant and positive relationship between maternal literacy and child schooling in India as a result of the efficient allocation of maternal time in the production of child human capital coupled with the increase in return to schooling for men. However, they made a valuable point concerning the application and reliability of this finding, that their conclusions about the productive role of maternal schooling, and in particular female literacy, and home teaching in India in that period do not necessarily generalize to all times and places. The sensitive analysis is based on Fixed-Effects Instrumental Variable Estimates and Maximum Likelihood Logit Estimates. Holger Seebens and Peter Wobst performed a study on the Impact of Increased School Enrolment on Economic Growth in Tanzania. Specifically, they examine the long-term effects of increased school enrolment (effective attendance) on economic growth in Tanzania using a dynamic computable general equilibrium (DCGE) model. Their study is based on three scenarios and all scenarios range between 2000 and 2015. The first scenario 'RedChild', consider the children who have been working in 2000, are now sent to school in five consecutive years.

The second "PrimChild" take into account the other labour segments that are affected by the reduction of the child labour force for primary education. The final scenario looks at the Pupils dropping out of primary school to enter labour force segment 'not-finished-primary school' using education transition matrix subjected to probability calculation and simulations. The simulation results indicate that schooling has implications on overall economic growth. But their result shows that primary school education alone does not have much significant impact on growth due to the short-run offsetting impact of the reduction on wage when more primary school graduate enter the labour market. However, the research postulate that when child labour reduces primary school enrolment rate, it also reduces economic growth which compensates the fact that an increase in primary education has a long run benefit to growth.

2.4Summary of Literature Gap

The literature is geared towards investigating the impact of education expenditure on economic growth in West African countries including small and developing country like the Gambia. Many literatures have shown contentious results and there are many factors associated to those anomalies. It is obvious that none of these results obtain from previous literatures can be used as a benchmark for the other, because there are many counterfactual variables that are aligned with their findings. The reason for that is a developed country cannot be compared to a developing country in terms of growth achieved from spending because the speed of convergence is not the same for those two categories. That is why it is in the best interest of this to compared to developing countries for a robust and accurate inference. The Gambia is relatively a very small country compared to Ghana with low per capita income and poor human capital but on average has spent a lot of money on education as a percentage of GDP than other related developing countries with higher real income. Small countries like the

Gambia can experience rapid growth in the long run if they are persistent in their spending because small countries less affected with high unemployment rate, high crime rate and other economic inhibitors but unfortunately, based on my rigorous researches on previous literatures, no other study have been conducted to find out detail analysis of the impact of education expenditure on economic growth on countries such as the Gambia, Ghana or any other related small economies.

III. Theoretical Framework.

The theoretical perspective of the impact of education expenditure on growth can be expressed in multiple of ways but the theory under study can be effectively verified if we express GDP as a function of the explicit real government expenditure using Vector Autoregressive (VAR) tools. In order to disentangle the relationship between the variables in the model we will require tools such as ADF test, Cointegration Analysis, Error correction model and Causality Analysis which will be discussed specifically in the subsequent sections. For simplicity, we can mathematically express the model as:

$$Y_t = F(Edu_t) \qquad (1)$$

Y_t represent Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

Edu_t represents the general government expenditure on education (current, capital, and transfers) expressed as a percentage of GDP. It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments.

This excludes all other local or private spending in education to caution for the assertion made by previous literatures and, it would be very hard to get accurate data that includes all those education expenditures. However, in other to discover the long and short-term relationship between the identified variables, we can express the model in the form of Autoregressive distributed lag (ARDL) model as it is exactly formulated by Mehmet Mercana et al (2014)

$$y_t = a_0 + \sum_{i=0}^{m} a_{1i}\, y_{t-i} + \sum_{i=0}^{n} a_{2i}\, edu_{t-i} + u_t \quad (2)$$

The dependent variable is a function of its lagged values and the lagged values of other variables in the model. Y_t represent economic growth level (GDP) which depends on its lag values y_{t-i} and edu_{t-i} which represents the aggregate Government Education Expenditures with all possible time lag length m and n. The lag length is determined by either Akaike

Information Criterion (AIC), Hannan-Quinn Information Criterion (HQ), Schwarz Information Criterion (SC) or Final Prediction Criterion (FPE).

3.1 Model Specification

Following the literatures and the theoretical positioning discussed above, in order to verify the relationship between education expenditure and economic growth, annual data of Gambia and Ghana have been collected from the Global Economy website. Furthermore, to reveal the relationship between government real education expenditure and economic growth, it is required to use VAR tools to describe the dynamic structure of the variables. Given the nature of the data availability, the study is conducted using VAR tools such as ADF test, Johansen

Cointegration test, Vector Error correction model and Granger Causality test. However, VAR can best be motivated by first considering the *structural form* which is a system of simultaneous equations.

$$y_t = a_0 + a_1 edu_t + a_2 edu_{t-1} + a_3 edu_{t-2} + a_4 y_{t-1} + a_5 y_{t-2} + u_{y,t} \quad (3)$$

$$edu_t = \beta_0 + \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 y_{t-2} + \beta_4 edu_{t-1} + \beta_5 edu_{t-2} + u_{e,t} \quad (4)$$

Where $u_{y,t}$ and $u_{e,t}$ are structural shocks, structural in econometrics sense just means that they are mean zero and are uncorrelated with one another: $cov(u_{y,t}, u_{e,t}) = 0$ with a known variance. Structural VAR methodology go along with certain assumptions that allows the system of equations to be estimated consistently. We can express the simultaneous equation in matrix form and abstract away from constant parameters:

$$\begin{pmatrix} 1 & -a_1 \\ -\beta_1 & 1 \end{pmatrix} \begin{bmatrix} y_t \\ edu_t \end{bmatrix} = \begin{pmatrix} a_2 & a_4 \\ \beta_2 & \beta_4 \end{pmatrix} \begin{bmatrix} y_{t-1} \\ edu_{t-1} \end{bmatrix} + \begin{pmatrix} a_3 & a_5 \\ \beta_3 & \beta_5 \end{pmatrix} \begin{bmatrix} y_{t-2} \\ edu_{t-2} \end{bmatrix} + \begin{bmatrix} u_{y,t} \\ u_{e,t} \end{bmatrix} \quad (5)$$

For simplification we can write equation (5) as:

$$A_0 \begin{bmatrix} y_t \\ edu_t \end{bmatrix} = A_1 \begin{bmatrix} y_{t-1} \\ edu_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} y_{t-2} \\ edu_{t-2} \end{bmatrix} + \begin{bmatrix} u_{y,t} \\ u_{e,t} \end{bmatrix} \quad (6)$$

Pre-multiplying equation (6) with A_0^{-1} we get the form:

$$\begin{bmatrix} y_t \\ edu_t \end{bmatrix} = A_0^{-1} A_1 \begin{bmatrix} y_{t-1} \\ edu_{t-1} \end{bmatrix} + A_0^{-1} A_2 \begin{bmatrix} y_{t-2} \\ edu_{t-2} \end{bmatrix} + A_0^{-1} \begin{bmatrix} u_{y,t} \\ u_{e,t} \end{bmatrix} \quad (7)$$

Then by notation we get:

$$\begin{bmatrix} y_t \\ edu_t \end{bmatrix} = A_1^* \begin{bmatrix} y_{t-1} \\ edu_{t-1} \end{bmatrix} + A_2^* \begin{bmatrix} y_{t-2} \\ edu_{t-2} \end{bmatrix} + u_t \quad (8)$$

By making the following definition:

$$u_t \equiv A_0^{-1} \begin{bmatrix} u_{y,t} \\ u_{e,t} \end{bmatrix} \quad (9)$$

We can refer to u_t as vector of innovations (forecast error) and $\begin{bmatrix} u_{y,t} \\ u_{e,t} \end{bmatrix}$ as the structural shocks; by assumption are uncorrelated.

From the above equation we can go ahead and set the Reduced form VAR as:

$$Y_t = A_1^* Y_{t-1} + A_2^* Y_{t-2} + u_t \quad (10)$$

Note thatY_t contains both GDP and Government Education Expenditure as a function of their lag variables. This system of equations can be estimated via ordinary least square and it would turn out to be both consistent and efficient because based on a realistic assumption all the regressors are dated $t-1$ or earlier and hence uncorrelated with the residuals in each equation. Since we can easily estimate the innovations $\hat{u}_t$ then we can also get an estimate of the variance covariance matrix of the innovations.

IV. Research Hypothesis

Drawing from the previous literatures, there are diverging views related to the relationship between education expenditure and economic growth which depends on series of economics factors. But majority of the

literature confirmed a pro-cyclical relationship between education expenditure and economic growth ((Mehmet Mercana&SevgiSezerb, (2014); Lingaraj
MALLICK & Devi Prasad DASH, *(2015);* Lingaraj Mallick, Pradeep Kumar Das &KalandiCharan). Those studies where done on countries with high human capital and income. However, there are few which revealed a-cyclical relationships and most of them is only in the short-run then pro-cyclical in the long run *(*Mpho Bosupeng (2015), Yazid Dissou, Selma Didic, &TatsianaYakautsava (2016); Holger Seebens and Peter Wobst). Many other literatures also emphasized in a different approach, the effect of education expenditure on economic growth. From this premise we will hypothesize:

H_1: Existence of cointegration between Edu and GDP.

H_2: Edu is the leading variable

4.1Hypothesis one (H_1)

This hypothesis dictates that GDP and Government Education Expenditure have a long-run relationship. Since the study is expressed in the form of panel data, to verify this claim, previous literatures suggested the use of an advanced econometric tool such as the Johansen Cointegration test to measure the speed of adjustment of the Short-run to the long run relationship between the two variables. This test will help us find out if there is a linear combination of the variables or not. The issue of cointegration applies when two series are cointegrated of order one (*I (1)*), but a linear combination of them are of order zero (*I (0)*); in this case, the regression of one on the other is not spurious (a situation where two variables are related through their correlation with a third variable). If we regress GDP on Edu, we find a significant relationship. But when we control for another variable, say unemployment or taxation, the partial effect of Edu on GDP becomes zero, but instead tells us something about the long-run relationship between them. Cointegration between two series also implies a particular kind of model, called an Error Correction Model, for the short-term dynamics (Wooldridge, 2004, p. 571) This relationship also requires the test of stationarity and nonstationary using Unit Root Test or ADF Test before testing weather they have a Cointegration relationship or not because it includes time series data.

4.2Hypothesis two (H_2)

This hypothesis is based on forecasting method to determine future impact of the variables depending on the past information of the variables. Granger Causality and Vector Autoregressive Model testing will be used to determine if there is any causal relationship between the two variables and which variable influence the other. Previous literature performs the Granger causality with different lags to know if any changes in lag can affect the causality between the variables (Lingaraj MALLICK & Devi Prasad DASH, (2015)). The concept of the Granger causality is a very important instrument that allow us to test whether, after controlling for past GDP, past Edu help to forecast GDP vice versa. Generally, we say that Edu Granger causes GDP. If we however find that GDP is the leading variable to Government Education Expenditure, it means that the government need to look back at their spending behaviour since their spending power on education is determined by growth and not the other way around.

There can only be pro-cyclical or counter-cyclical relationship involve if and only if there is absolute causal relationship between the variables. The test for the hypothesis can be verified using the probability value or the F-statistic result drawn from the granger causality test result.

V. Data Source and Description

Data for this study was collected from TheGlobalEconomy.com. They provide credible database to serve researchers, businesspeople, academics, and investors who need reliable economic data on foreign countries. The West African Countries under study are selected based on the availability and smoothness of country specific data. The data retrieved for the Gambia and Ghana have the following distribution:

Table 1. Data distribution and Statistics

Statistics/Country	Gambia	Ghana
Data range	1989-2013	1970-2014
Observation	24	44
Variables	2	2

In other to determine the gap between Gambia and Ghana in terms of their respective government spending on education and growth level, we generated a distribution by computing the Weighted average of each country's Growth and Education Expenditures to measure the distance between their respective growth and education spending. The Equation used for the weighted Average:

$$\bar{Y}_t = \frac{1}{T}\sum_{T=1}^{N} Y_t \quad \text{and} \quad \overline{Edu}_t = \frac{1}{T}\sum_{T=1}^{N} Edu_t$$

Table 2. ECOWAS Countries Weighted Values (2dp)

Average/Country	Gambia	Ghana
GDP	3.84	3.36
Edu	2.32	4.99

(GDP is in billions of USD and Edu is expressed as percentage of GDP). The table contains the weighted average for GDP and Edu measured separately as indicated in the above equation and it is estimated after cleaning the data collected from the global economy which is used as a proxy to the missing data.

VI. Econometrics Methodology

The determination of the relationship between Edu and GDP should be handled with caution and the usage of the right tools is very critical to the result. The West African education expenditures as clearly stated above involves panel data and the objective of this study is to verify the short-run and long-run impact of government expenditure on GDP or if instead GDP is the leading variable. Carefully referring to the previous similar studies: Mpho Bosupeng
(2015); Mehmet Mercana&SevgiSezerb, (2014); Lingaraj MALLICK & Devi Prasad DASH, *(2015)*; Lingaraj Mallick; Pradeep Kumar Das &KalandiCharan Pradhan (2014); the following advanced econometric tools are required to validate my claims:

6.1 Unit Root Test

Before testing for a cointegration relationship between GDP and Edu to verify if they have a linear combination or not, it is prudent to test whether the time series variables are nonstationary because the presence of a unit root implies that a shock today has a long
Lasting impact on the dependent variable. In that case, the variables contain a unit root otherwise they are stationary. One of the most famous models use to test for a unit root in a time series variable is called Dicky-Fuller test or for large time series data, its extension is called the ADF test which in our case we will use. The simple approach testing for unit root given our reduced form VAR (2):

$$Y_t = A_1^* Y_{t-1} + A_2^* Y_{t-2} + u_t \qquad (11)$$

Y_t Is the observed dependent initial value; also Y_t in this study represent GDP in time.
Wooldridge (2004) assumption was based on

$$E\left(u_t | Y_{t-1,} Y_{t-2}\right) = 0 \qquad (12)$$

This means thatu_t is independent and identically distributed with mean zero. We can transform the reduced form equation as:

$$(\mathrm{I} - A_1^* L - A_2^* L^2) Y_t = u_t \qquad (13)$$

Then rewrite it as:

$$(1 - \lambda_1 L)(1 - \lambda_2 L) Y_t = u_t \qquad (14)$$

Where L is a lag operator that decreases the time index of a variable by one period. Note:

$$LY_t = Y_{t-1} if \lambda_2 = 1 \qquad (15)$$

The model has a unit root and we can define $Z_t = \Delta Y_t$; then

$$Z_t = \lambda_1 Z_{t-1} + u_t \text{is stationary if}$$

$$|\lambda_1| < 1 \qquad (16)$$

We can estimate the slope coefficient, λ_1 using Ordinary Least Square Estimation.

6.2 The Cointegration Test and Error Correction Analysis

The notion of Cointegration was given a formal treatment by Engle and Granger in 1987. The issue of cointegration applies when two series are*I(1),* but a linear combination of them is *I(0);* which means it has constant mean, constant variance, autocorrelations that depend only on the time distance between any two variables in the series, and it is asymptotically uncorrelated. In this case, the regression of one on the other is not spurious, but instead tells us something about the long-run relationship between them. Between the two series also implies a kind of models called an error correction model, for the short-term dynamics.
(Wooldridge, Jeffrey 2004, 2nd ed.)
Assuming our Simultaneous equation model are two-unit root process (abstract from constants):

$$y_t = a_1 edu_t + a_2 edu_{t-1} + a_3 edu_{t-2} + a_4 y_{t-1} + a_5 y_{t-2} + u_{y,t} \qquad (17)$$

$$edu_t = \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 y_{t-2} + \beta_4 edu_{t-1} + \beta_5 edu_{t-2} + u_{e,t} \quad (18)$$

Suppose we take the difference between the two series i.e., $yt - \phi edu_t$, if however, it is stationary, then we can say that y_t and edu_t are cointegrated, with cointegrating vector [1 ϕ]. The idea is if the difference proved to be relatively constant over time or stationery then we might be able to conclude that we have some sort of economic meaningful relationship between
GDP and edu_t. To see this clearly, we can regress yt as a function of edu_t in the form.

$$y_t = \phi edu_t + u_t \quad (19)$$
$$y_t - \phi edu_t = u_t \quad (20)$$

u_t should be I (0) or stationary process which is weakly dependent but that is solvable if we estimate the parameter ϕ via OLS.

$$y_t = \hat{\phi} edu_t + \hat{u}_t \quad (21)$$
$$y_t - \hat{\phi} edu_t = \hat{u}_t \quad (22)$$

One of the good aspects of OLS is that it tries to minimize the sum of squared residuals. Hence OLS is trying to minimize equation (22), we expect to get $\hat{\phi} = \phi$, otherwise the residuals are non-stationery, which means, they will get arbitrarily big or small. We can use Dicky-Fuller test to determine whether they are stationary or not.
Suppose that our model equation 19 with a constant are nonstationary, the way to control for that is to take the first difference:

$$\Delta y_t = \phi \Delta edu_t + e_t \quad (23)$$

One of the good aspects of OLS is that it tries to minimize the sum of squared residuals. Hence OLS is trying to minimize equation (22), we expect to get $\hat{\phi} = \phi$, otherwise the residuals are non-stationery, which means, they will get arbitrarily big or small. We can use Dicky-Fuller test to determine whether they are stationary or not.
Suppose that our model equation 19 with a constant are nonstationary, the way to control for that is to take the first difference:

$$\Delta y_t = \phi \Delta edu_t + e_t \quad (24)$$

But if it happens that y_t and edu_t are cointegrated then taking the first difference would be completely inappropriate. We can put that claim into practice if we subtract y_{t-1} from both sides of equation (19):

$$\Delta y_t = -y_{t-1} + \phi edu_t + u_t \quad (25)$$

Now we can add and subtract ϕedu_{t-1} from the righthand side:

$$\Delta y_t = -y_{t-1} + \phi edu_{t-1} + \phi edu_t - \phi edu_{t-1} + u_t \quad (26)$$

Simplified version:

$$\Delta y_t = -(y_{t-1} - \phi edu_{t-1}) + \phi edu_t - \phi edu_{t-1} + u_t \quad (27)$$

However, we know that using OLS on equation (23) gives an inconsistent estimate of □. This is because there is an omitted term in the error which is $-(y_{t-1} - \phi edu_{t-1})$. In other words, in equation (23) $e_t = u_t - (y_{t-1} - \phi edu_{t-1}) \Delta edu_t$ is correlated with the omitted term, and so you have a bias. The formulation is called an *error correction model (ECM)*. The term $-(y_{t-1} - \phi edu_{t-1})$, is the "error" or deviation from the long-run equilibriums (Eric Sims, time series notes, sp.13)

6.3 Causality Analysis

We can simply identify the causality between the variables under study using two econometric tools called Vector Autoregressive model and Granger causality. At this level we have already shade some light on VAR, however If we set the assumption:

$$E(U_t | I_{t-1}, I_{t-2}) = 0$$

Where I_{t-1}, I_{t-2} contains y_t and edu_t dated at an earlier time. If we consider a double series consisting of y_t and edu_t we get two equations expressed in terms of their own past that look exactly as our simultaneous form model:

$$y_t = a_0 + a_1 edu_t + a_2 edu_{t-1} + a_3 edu_{t-2} + a_4 y_{t-1} + a_5 y_{t-2} + u_{y,t} \quad (28)$$

$$edu_t = \beta_0 + \beta_1 y_t + \beta_2 Y_{t-1} + \beta_3 y_{t-2} + \beta_4 edu_{t-1} + \beta_5 edu_{t-2} + u_{e,t} \quad (29)$$

Where each equation contains an error that has zero expected value given past information on y_t and edu_t equation (26) allows us to test whether, after controlling for past y_t, past edu_t help to forecast GDP in time. Generally, we say that edu_t Granger cause y_t, as depicted in equation (26) if

$$E(y_t | I_{t-1}) \neq E(y_t | J_{t-1}) \quad (30)$$

Where I_{t-1} contains past information on y_t and edu_t, J_{t-1} contains only information on past y_t. When the condition (28) holds, past edu_t, is useful in predicting y_t. The term Granger causality should be interpreted with caution because the only case in which edu_t causes y_t is if condition (28) holds.
From this we can easily test the null hypothesis that edu_t does not granger cause y_t against the alternative that edu_t Granger cause y_t by assuming a linear model and decide how many lags of the dependent variable should be included. Suppose $E(e_t | y_{t-1}, y_{t-2})$ depends on only two lags:

$$y_t = a_0 + a_4 y_{t-1} + a_5 y_{t-2} + e_{y,t} \quad (31)$$
$$E(e_{y,t} | y_{t-1}, y_{t-2}) = 0$$

Now, under the null hypothesis that edu_t does not Granger cause y_t, *any* lags of edu_t that we add to the equation should have zero population coefficients. If we add edu_{t-1}, then we can simply do a t test on edu_{t-1}. If we add two lags on edu_t, then we can do an F test for joint significance of edu_{t-1} and edu_{t-2} on equation (26).
(If there is heteroscedasticity, we can use a robust form of the test. There cannot be serial correlation under H_0 because the model is dynamically complete. (Wooldridge 2004, p.595-p.599)

VII. Empirical Results

We have mathematically formulated all the tools required for our studies in the previous sections and the empirical results are tabulated below.

Table 2. Augmented Dickey-Fuller Test.

Country	Variables	Value of TStatistics	T Statistics (1st Dif.)	Lag	Orderof integration
Gambia	GDP	-2.1942	-6.4637	3	I (1)
	Edu	-0.7266	-3.5071	3	I (1)
Ghana	GDP	-2.4394	-4.5666	3	I (1)
	Edu	-2.6008	-3.8215	3	I (1)

7.1Unit root test Analysis

The result of the ADF shows that the variables for both Gambia and Ghana are also individually nonstationary at level but stationary at first difference since we reject the null hypothesis of the existence of unit root at 5% statistical significance. They have equal and one order of integration.

Table 4. The Cointegration Test Results (Johansen-Procedure)

Country	Null Hypothesis	Test statistics (□ max)	5% Critical value	Test statistics (□ trace)	5% Critical Value2
Gambia	r <= 1	0.85	9.24	0.85	9.24
	r = 0	11.22	15.67	12.07	19.96
Ghana	r <= 1	8.10	9.24	8.10	9.24
	r = 0	25.71	15.67	33.8	19.96

7.2 Johansson cointegration Analysis

In table 3, we have conducted Johansson cointegration test on the variables in each individual country using both Eigen and trace statistical test with a null hypothesis of no cointegrating vector and at least one cointegrating vector. The Johansson cointegration result revealed for The Gambia indicate that there is no evidence of long-run equilibrium relationship between education expenditure and economic growth since we fail to reject the null hypothesis of no cointegrating vector between the variables at 5% level. But in the case of Ghana, we reject the null hypothesis of no cointegrating vector at 5% significance level for both Trace and Eigen test. This means that there is an evidence of long run equilibrium relationship between education expenditure and economic growth for Ghana and we do not reject the hypothesis of at least one cointegrating vector.

Table 5. Results of the ECM

Country	Variables	ect1	T-value	P-value
Gambia	GDP	-0.99862	-3.056	0.00442 **
	Edu	0.08273	1.343	0.1883
Ghana	GDP	-0.46933	-2.132	0.0399 *
	Edu	0.20531	3.339	0.00196 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

7.3 ECM Analysis

In table 3, ECM is presented to identify the dynamics of the short-run relationship between education expenditure and economic growth in the selected countries to support Johansson cointegration statistics. Based on the statistically significant result obtain via the error correction model, we can infer that, there exist some economic meaningful relationship between education expenditure and economic growth since the coefficient of the ECT indicates that about 99.86% of short-run deviation from equilibrium in the previous year is corrected for in the current year. The coefficient represents the speed of adjustment to the equilibrium. This shows that, at least, Education expenditure and economic growth has some economic meaningful relationship in the Gambia even though the effect is not substantial compared to Ghana. The case of Ghana produced much more convincing evidence as it indicates 46.9% convergence to the long-run equilibrium after short run deviation in the previous year. This further implies that; it would take less than 3 years for all the errors to be fully adjusted in Ghana.

Table 6. Result of Granger Causality Test (Direction)

Country	F-statistics GDP → Edu	P-value GDP → Edu	F-statistics Edu → GDP	P-value Edu → GDP
Gambia	1.3088	0.2891	0.2842	0.8364
Ghana	3.9333	0.01638 *	1.5328	0.2237

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

7.4 Granger Causality Result Analysis

We finally conducted Granger Causality test in order to evidently validate our claim that education expenditure is the leading variable in West African countries. Based on our results, there is no evidence that Edu granger cause GDP, vice versa, in The Gambia. However, a different result was revealed for Ghana, evidence pointed out that GDP is the leading variable at 5% statistically significance level. This intuitively means that, the government of Ghana adjust education expenditure in response to growth in the economy as previously explained in Hypothesis 2. These results do not deviate much from our priori expectation since Ghana is also a low income-based economy with low stock of human capital compared to the developed economies. This further implies that they need longer time and more investment on education to see the impact of spending on education. If the spending on education is persistent, they might see a different result in the future since there is an evidence of short run economic relationship according to ECM test result in both the countries.

VIII. Conclusion

In this study, we examine the relationship between general government spending on education and Growth level by comparing evidence revealed about Gambia and Ghana to justify any anomalies associated to

the poorest and smallest economysuch as the Gambia that most literatures failed to capture. With much regards to Mankiw et, al assertion that small countries data are dominated by idiosyncratic errors, we conclude that there is short run impact of education expenditure on economic growth in Both Gambia and Ghana but the Granger causality result revealed no directional effect between the two variables in The Gambia. However, we observed a unidirectional causality that run from GDP to Education expenditure in Ghana which isevidence that GDP granger cause education expenditure in Ghana. This outcome is not far from our priori expectation. For example, the economy of Ghana is diverse and rich in natural resources like gold, diamonds and oil and they are considered the second largest producer of Cocoa. This factors and among many other sources of fund continues to elevate the GDP of Ghana to subsidize education throughout the country. Unlike the Gambia, the government heavily rely on donor funds and often runs a budget deficit due to their spending making it harder to determine which of the two variables is the leading variable. However, since we observe short run significant effect between education expenditure and economic growth in both countries. This allows both Governments to be persistent in their spending on education in order to witness massive change in the economy in the long run just like the Asian Tigers. This could only be achieved through strategically diversifying their fiscal on schooling, research and development, learning by doing activities and infrastructures to enhance employment and improve agricultural mechanization since a larger percentage of their workforce are employed in Agriculture for both countries. The idea is to improve human capital stock in the area that they have a comparative advantage in, in order to have a positive impact on the industries that remain basic so that in the future investment on education will have a significant long run effect on economic growth.

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