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ANALYZING THE IMPACT OF EDUCATION EXPENDITURE ON ECONOMIC GROWTH IN SELECTED SUB-SAHARAN AFRICAN COUNTRIES: A DYNAMIC PANEL ARDL-PMG APPROACH

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ABSTRACT

This study investigates the impact of education expenditure on economic growth in selected Sub-Saharan African (SSA) countries from 1999 to 2022 using an ARDL Pool Mean Group (PMG) model. The findings show that a 1% increase in education expenditure results in a 9% rise in long-term economic growth. However, short-term effects are only significant in Guinea, where education spending remains inadequate. The Dumitrescu-Hurlin Causality Test reveals that economic growth does not lead to increased education funding, highlighting a persistent gap between economic performance and educational investment in SSA. Corruption control positively influences growth, emphasizing the need for governance reforms, while labor force participation negatively affects growth due to high youth unemployment. Additionally, the insignificant effect of mean years of schooling on growth indicates the need to enhance education quality and accessibility, given SSA's low school completion rates. The unidirectional causality suggests that economic growth has not translated into adequate investment in education, hampering human capital development. The study recommends that SSA governments prioritize education in national budgets, implement institutional reforms to improve education systems, and strengthen anti-corruption measures to ensure effective use of funds.

Keywords: Education expenditure, Economic growth, Sub-Saharan Africa, ARDL Pool Mean Group (PMG)
Jel Classification: A10, A13, A20

Contribution / Originality
This study contributes to the literature by focusing on selected Sub-Saharan African (SSA) countries, exploring the impact of education expenditure on economic growth. Utilizing a Dynamic Panel ARDL-PMG approach, it captures both short- and long-term effects from 1999 to 2022 and incorporates governance factors like corruption to assess expenditure efficiency. The findings offer valuable, region-specific insights that support educational policy recommendations aligned with the Sustainable Development Goals, particularly in promoting quality education and economic growth in SSA

1.0 Introduction

Education is widely recognized as a key driver of economic well-being, as it enhances human capital, which is integral to a country's labor force (Marquez-Ramos & Mourelle, 2019). Various aspects of education systems can influence the redistribution of public spending, such as the inclusiveness of the education system, the allocation of funds between primary and tertiary education, income inequality, and tax evasion (Cristina et al., 2023). Government spending on education contributes more to human capital development than to the formation of physical or social capital, significantly boosting economic growth (Mukhtarov et al., 2019).

Investments in education, whether by governments or the private sector, equip individuals with the skills and knowledge needed to enhance job performance, thereby increasing workforce productivity and economic output (Cristina et al., 2023).

The Africa Economic Outlook (2020) report revealed that despite significant investments in education, African countries exhibit low efficiency in education spending. The report showed efficiency scores of 58% for primary education, 41% for secondary education, and even lower for tertiary education. The 2022 progress report on the African Union's (AU) Agenda 2063 indicates that Africa fell short of meeting all its education targets, with an overall performance score of just 44% (ISS, 2024). Sub-Saharan African (SSA) countries have the worst education statistics globally, primarily due to low levels of public education funding (Musah et al., 2024). Exclusion rates in education are significantly higher in SSA than in other regions; over 20% of children aged 6 to 11 are not attending school, and this figure rises to over 33% for youth aged 12 to 14 Additionally, nearly 60% of young people aged 15 to 17 are out of school (UNESCO, 2023). This challenging situation highlights the difficulty in achieving the primary goal of public education spending, which is to stimulate economic growth. Inadequate funding in education sectors across most developing countries, including those in SSA, is reflected in poor conditions of service, such as low salaries and allowances for teachers, irregular payment of teachers' wages, inadequate staffing, lack of teaching materials, and outdated classroom facilities in secondary and tertiary institutions.

Many studies have sought to explore the relationship between education expenditure and economic growth on a global scale. However, a significant gap persists in understanding the specific dynamics of this relationship in Sub-Saharan Africa (SSA). While research such as Kocevska (2023), Effendy et al. (2023), and Tran (2023) has investigated the connection between public education spending and economic growth in various global settings although, a comprehensive analysis that focus specifically on the selected SSA countries Angola, Côte d'Ivoire, Cameroon, Ghana, Guinea, Mali, Niger, Nigeria, Senegal, and Uganda are notably absent. Additionally, the impact of education expenditure on economic growth in these selected SSA countries has been addressed in relatively few studies, with most either treating the issue on a country-specific basis or analyzing aggregate spending across the region. For instance, Musah et al. (2024) and Owusu-Mensah (2023) explored the broader relationship between government spending and economic growth, but these studies often overlook the unique variations in education spending across SSA countries and do not account for the effect of corruption which could alter the expected outcomes. Thus, the main purpose of this paper is to empirically investigate the impact of education expenditure on economic growth of selected SSA countries using Dynamic Panel ARDL Pool Mean Group (PMG).

2.0 Literature Review

2.1 Empirical literature

Odhiambo (2024) investigated the dynamic relationship between education, governance, and economic growth in 28 SSA countries from 2002 to 2018 using the Generalized Method of Moments (GMM). The study found that education's impact on economic growth is mostly insignificant across different specifications, except for secondary education, which has a positive effect on growth when regulatory quality is considered. Although governance quality generally promotes growth, it only interacts with education to foster growth in the case of secondary education under regulatory quality. Awolaja et al. (2024) assessed the influence of governance on economic growth in selected SSA countries using the Panel Corrected Standard Error (PCSE) method, which controls for heteroscedasticity. The results indicate that control of corruption; voice and accountability, political stability, and absence of violence positively

impact real GDP, while regulatory quality and government effectiveness have negative effects on real GDP.

Musa et al (2024) conducted a study on the influence of effective governance on health outcomes, education, and economic development in various African nations using data span from 2000-2020. They utilized the Generalized Method of Moment and discovered that indicators of governance have a beneficial and substantial impact on the real gross domestic product of the countries included in the study. The method was adopted because it controls for endogeneity issues. Chinoda and Kapingura (2024) examined how governance affects the relationship between digital financial inclusion and economic growth in Sub-Saharan Africa, from 2014-2020. They used the Generalized Method of Moments. The result reveals that governance has a beneficial and substantial influence on economic growth in the region.

Mumuni and Njong M. (2023) analyzed the impact of public sector spending and governance on economic growth in Sub-Saharan Africa (SSA). Using the Panel Corrected Standard Errors (PCSE) estimator on data from 31 SSA countries between 2002 and 2020, the study also employed the Dumitrescu and Hurlin (2012) panel non-causality test for robustness. The findings reveal that public sector spending, particularly in education and health, does not always lead to economic growth. Government education expenditure positively affects growth, though the effect is statistically insignificant, while health expenditure has a limiting impact. Governance indicators such as government effectiveness, rule of law, political stability, and absence of violence/terrorism are crucial for accelerating economic prosperity. In their study, Cristiana et al. (2023) investigated the impact of public education spending on economic growth in Central and Eastern Europe. The annual panel data of 11 former communist Eastern European states, current EU members, were used for the periods 1990 to 2020. The study employed Autoregressive Distributive Lag (ARDL) with a structural break. The results showed a mixed relationship in the long term; for five countries, there was no such impact, while for six countries, there was a significant impact on economic growth in the long term. In the short term, mixed results were observed, with four countries showing positive effects and two showing negative effects.

3.0 Methodology

3.1 Sources of data

This study investigates the impact of education expenditure on economic growth in ten selected Sub-Saharan African countries: Angola, Côte d'Ivoire, Cameroon, Ghana, Guinea, Mali, Niger, Senegal, Uganda, and Benin, using secondary data from 1999 to 2022. Data on GDP growth rate, education expenditure and labor force participation (labor participation rate) were sourced from the World Bank's World Development Indicators (WDI, 2022). For Nigeria, data were sourced from the Central Bank of Nigeria's Statistical Bulletin (2022). Mean years of schooling (MYS), was sourced from the United Nations Development Program (UNDP, 2022). Data on corruption were sourced from the World Governance Indicators (WDI).

3.2 Theoretical Framework

This study is based on Lucas's (1988) endogenous growth model, which emphasizes the role of education in fostering human capital, a key driver of economic growth and development. The model argues that investment in education promotes innovation and technological advancement, leading to sustained economic growth. It highlights the positive societal impact of education through knowledge sharing and the dynamic relationship between education, technology, and economic growth. The research uses a production function:

$$Y = f(A, K, L, H) \quad (1)$$

With Y is the changes in capital accumulation, A, K, L are indicators of labor, capital, technology that basic required elements for production process (Tran, 2023). The endogenous Growth Theory as the theoretical framework for this research, provide insights into the mechanisms through which investments in education drive long-term economic growth by fostering innovation, enhancing productivity, and facilitating the accumulation of human capital and knowledge.

3.3 Model Specification

To analyze the relationship between government expenditure on education and economic growth, this study adopts a modified model based on Dankumo et al. (2023). The modifications include substituting poverty with economic growth, using education expenditure instead of government consumption expenditure, and incorporating variables such as labor force participation, mean years of schooling, and corruption control. The model is formulated as:

$$GDP = f(GDP, EDX, LFP, MYS, CRP) \quad (2)$$

Where GDP represents Gross Domestic Product per capita, EDX denotes education expenditure, LFP is labor force participation, MYS is mean years of schooling, and CRP indicates control of corruption. This relationship is further specified in a linear panel model:

$$GDP_{it} = \alpha_1 + \beta_1 GDP_{it-1} + \beta_2 EDX_{it} + \beta_3 LFP_{it} + \beta_4 MYS_{it} + \beta_5 CRP_{it} + \mu_{it} \dots\dots\dots\dots\dots\dots\dots (3)$$

In this equation, GDP_{it} is the GDP growth rate for country i at time$t$, GDP_{it-1} is the lagged GDP growth rate, and μ_{it} represents country-specific effects. The model aims to identify the impact of education expenditure on economic growth while accounting for other influencing factors.

3.4 Cross sectional Dependence Test

In the modern era of globalization cross-sectional dependence is a common feature of countries due to spatial, residual interdependence and common factor omitting respectively (Kao and Chiang, 2000). As a result, Breusch and Pagan (1980) developed Lagrange Multiplier (LM) statistics to detect cross-sectional dependence in the panel data.

Breusch-Pagan LM Test:

$$\text{LM} = \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \left(\hat{p}_{ij}{}^2\right) \dots\dots\dots\dots\dots\dots\dots\dots (4)$$

where $\hat{p}_{ij}$ is the correlation coefficient between the residuals of cross-sectional units i and j. This test is suitable for panels with a small number of cross-sections (N) and a large time dimension (T). Pesaran (2004) argued that the Breusch-Pagan LM test may suffer from inconsistency. To address this issue, he proposed the CD test as a correction to reduce the bias inherent in the LM test.

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{p}_{ij} \quad \dots\dots\dots\dots\dots (5)$$

Where $\hat{p}_{ij}$ is the correlation coefficient between the residuals of cross-sectional units i and j. This test is more reliable when N is large relative to T.

3.5 Panel Unit Root Test

According to Pesaran (2007), first-generation panel unit root tests, such as Levin-Lin-Chu (LLC), Im-Pesaran-Shin (IPS), Augmented Dickey-Fuller (ADF), and Phillips Perron (PP), are not suitable when cross-sectional dependence exists in the panel. To address this issue, Pesaran (2007) introduced second-generation panel unit root tests that are specifically designed to handle cross-sectional dependence. These include the Cross-sectionally Augmented Dickey-Fuller (CADF) test and the Cross-sectionally Augmented Im-Pesaran-Shin (CIPS) test. The CADF statistic is calculated as follows:

$$y_{i,t} = \alpha_i + \beta_i y_{i,t-1} + \gamma_i \bar{y}_{t-1} + \delta_i \Delta\bar{y}_t + \varepsilon_{i,t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where $\bar{y}_{t-1}$ and $\Delta\bar{y}_t$ are the cross-sectional averages of the lagged levels and first differences of the individual series, respectively. The CIPS statistic is computed by averaging the CADF statistics across all cross-sections as follows:

$$\text{CIPS} = \frac{1}{N}\sum_{i=1}^{N} CADF_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

where $CADF_i$ is the t-statistic obtained from the CADF regression for each cross-sectional unit i.

3.6 Dynamic Panel ARDL

The ARDL approach, initially developed by Pesaran and Shin (1999), allows for the estimation of both short-run and long-run coefficients in a single equation, making it suitable for analyzing time-series data where variables may have different orders of integration (i.e., I(0) or I(1)). The extension of this approach to a panel data setting, known as the Dynamic Panel ARDL, was pioneered by studies such as those by Pesaran et al. (1999). To examine the short-run and long-run dynamic impact of education expenditure on economic growth in the selected Sub-Saharan African countries, the Panel ARDL model is specified as follows:

$$GDPP_{it} = \sum_{i=0}^{p} \alpha_{1,ij} GDP_{i,i-j} + \sum_{i=0}^{q} \alpha_{2,ij} EDX_{i,i-j} + \sum_{i=0}^{q} \alpha_{4,ij} LFP_{i,i-j} + \sum_{i=0}^{q} \alpha_{5,ij} MYS_{i,i-j} + \sum_{i=0}^{q} \alpha_{6,ij} CRP_{i,i-j} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots (8)$$

from the equation p represents the lags of dependent variable while q represents lags of independent variables, i = 1,2,3, . . .N *and t* = 1,2,3, . . .T, α_i represents the fixed effects, α_1– α_4 are the lagged coefficients of the independent variables and the error term is denoted by ε_{it} which is assumed to be white noise and varies across countries and time. A panel error correction (ECM) representation equation is framed as follows:

$$GDP_{it} = \sum_{i=0}^{p} \alpha_{1,ij} \Delta GDP_{i,i-j} + \sum_{i=0}^{q} \alpha_{2,ij} \Delta EDX_{i,i-j} + \sum_{i=0}^{q} \alpha_{4,ij} \Delta LFP_{i,i-j} + \sum_{i=0}^{q} \alpha_{5,ij} \Delta MYS_{i,i-j} + \sum_{i=0}^{q} \alpha_{4,ij} \Delta CRP_{i,i-j} + \sum_{i=0}^{p} \beta_{1,ij} GDP_{i,i-j} + \sum_{i=0}^{q} \beta_{2,ij} EDX_{i,i-j} + \sum_{i=0}^{q} \beta_{4,ij} LFP_{i,i-j} + \sum_{i=0}^{q} \beta_{5,ij} MYS_{i,i-j} + \sum_{i=0}^{q} \beta_{6,ij} CRP_{i,i-j} + \varepsilon_{it} + ECT_{t-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

From the equation p represents the lag of dependent variable while q represents lags of independent variables, where Δ is the first difference of variables and also $\alpha_1 - \alpha_6$ are the short-run parameter. The $\beta_1 - \beta_6$ are the long-run parameters and GDP is the Gross Domestic product, EDX Education expenditure, LFP is labour force participation and MYS is the mean years of schooling while CRP is the control of corruption while ECT is the error correction term.

3.7 The Pooled Mean Group (PMG)

The Pooled Mean Group (PMG) estimator, developed by Pesaran et al. (1999), provides a middle ground between the MG and DFE estimators. The PMG estimator allows short-run coefficients, intercepts, and error variances to differ across units while imposing homogeneity on the long-run coefficients. This is particularly useful when there is an expectation of common long-term effects across units but varying short-term dynamics.

The PMG model can be represented as:

$$\mathcal{Y}_{it} = \phi_i (\mathcal{Y}_{it-1} - \theta X_{i\,t}) + \sum_{j=1}^{P-1} \lambda_{ij} \Delta \mathcal{Y}_{it-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta X_{it-j} + \mathcal{E}_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Where: ϕ_i is the error correction coefficient specific to each unit, θ represents the common long-run coefficients across all units, λ_{ij} and δ_{ij} are short-run dynamic coefficients.

The PMG Imposes homogeneity on long-run coefficients which can increase efficiency when the assumption of a common long-run relationship is valid, it also allows short-run dynamics to vary across units, making it flexible in capturing diverse short-term responses.

3.8 Causality Test

The Dumitrescu and Hurlin (2012) panel causality test is an extension of the Granger causality framework designed for panel data. It tests whether past values of one variable (x) have a significant effect on the present values of another variable (y). The regression allows coefficients to differ across individuals but assumes they are time-invariant. The null hypothesis (H0) states that there is no causality for any individual, meaning all lagged values of x have no effect on y. The alternative hypothesis (H1) allows for the possibility of causality in some, but not all, individuals. If there is causality for all individuals, N1 = 0, otherwise the null hypothesis of no causality is retained for some individuals.

4.0 Result and Discussion

4.1 Data presentation and analysis

Table 1: Descriptive statistics

	GDP	EDX	CRP	LFP	MYS
Mean	4.387135	16.19641	-0.696958	66.72794	3.577390
Median	4.643162	16.42194	-0.700000	66.06400	2.887367
Maximum	12.32916	30.63431	0.250000	82.87300	7.585970
Minimum	-8.130444	1.690000	-1.500000	46.88200	1.114284
Std. Dev.	2.972095	4.952287	0.388533	9.000275	2.001939
Skewness	-0.552814	-0.346205	0.249945	-0.159583	0.553167
Kurtosis	2.734288	2.967381	2.093640	2.300550	1.887438
Observations	240	240	240	240	240

Source: Computed by the Author Data from World Bank, UNDP & CBN, 2022

Based on the result of the descriptive statistics in table 1 above, the average education expenditure (EDX) in the selected Sub-Saharan African countries is 16.19%, below the 26% recommended by UNESCO, with a maximum allocation of 30.63% and a minimum of 1.69%. The average GDP growth rate is 4.39%, exceeding the IMF's 2022 growth projection of 3.8% for Sub-Saharan Africa. However, the minimum GDP growth rate recorded is -8.13%. The mean value for control of corruption is -0.697, indicating weak governance, though the highest recorded value is 0.25, showing stronger control in some cases. The average labor force participation rate is 66.72%, with a range from 46.88% to 82.87%. The mean years of schooling range from a minimum of 1.114 to a maximum of 7.585 years. All variables are normally distributed, as their skewness and kurtosis values fall within the acceptable range of +2 to -2.

Table 2: Result of cross-sectional dependence test

Variable	CD test Statistics	P-Value
Gdp	2.137***	0.000
edx	3.647***	0.000
crp	3.572**	0.033
mys	7.496***	0.000

Source: Aurthor's computation using Stata 13. *** and ** indicates rejection of null hypothesis at 1% and 5%.

According to result in table 3 above, there is evidence of strong cross-sectional dependence. Therefore, the null hypothesis of no cross-sectional dependency in the variables among the countries is rejected at 1% and 5% level of significance. This finding can be a reflection of the fact that Sub Saharan African countries have commonalities in budgetary allocation to education, growth trajectories and strategies of reducing corruption.

Table 3: Result of CIPS panel unit root test

Variables	CIPS statistics	Conclusion
Gdp	-3.636***	Stationary at level
edx	-2.810***	Stationary at level
crp	-2.120	Not stationary
d.crp	-4.811***	Stationary at first difference
lfp	-1.552	Not stationary
d.lfp	-.3.232***	Stationary at first difference
mys	-2.482**	Stationary at level

Source: Aurthor's computation using Stata 13. *** and ** indicates rejection of null hypothesis at 1% and 5%. -2.57, -2.33 and -2.21 are CIPS critical values at 1%, 5% and 10% respectively.

The results of the Cross-sectional Augmented Im Pesaran Shin (CIPS) panel unit root test indicate that the null hypothesis of unit roots is rejected at the 1% significance level for GDP and education expenditure (EDX), and at the 5% level for mean years of schooling (MYS). This suggests that these variables are stationary at levels, or integrated of order zero (I(0)). However, for the corruption perception index (CRP) and labor force participation (LFP), the null hypothesis is not rejected at levels but becomes stationary after first difference, indicating they are integrated of order one (I(1)).

Table 4: Result of CADF panel unit root test

Variables	t-bar	z[t-bar]	P-value	Conclusion
Gdp	-2.730***	-3.161***	0.001	Stationary at level
edx	-2.313**	-1.803**	0.036	Stationary at level
crp	-1.778	-0.060	0.476	Not stationary
d.crp	-3.021***	-4.144***	0.000	Stationary at first difference
lfp	-2.210	-1.468	0.071	Not stationary
d.lfp	-2.476**	-2.336**	0.010	Stationary at first difference
mys	-2.578***	-2.668***	0.004	Stationary at level

Source: Aurthor's computation using Stata 13. *** and ** indicates rejection of null hypothesis at 1% and 5%. -2.570, -2.330 and -2.210 are CADF at 1%, 5% and 10% respectively.

The result of CADF in table 5 above shows that variables (gdp, edx, mys) are stationary at level while (crp and lfp) are stationary at first difference. The results of both the CIPS and CADF second generation panel unit root tests which accommodate cross-sectional dependency indicates that there is mixture of levels of integrations of the variables used in this study. Therefore, this makes panel ARDL suitable for analyzing empirical long run and short run relationship between education expenditure and economic growth in the selected Sub-Saharan African countries.

Table 5: Hausman Test Results Comparing MG, PMG, and DFE Estimators

Variables	Coefficient (MG)	Coefficient (PMG)	Difference (MG - PMG)	S.E. (MG vs PMG)	Coefficient (DFE)	Difference (PMG - DFE)	S.E. (PMG vs DFE)
Edx	0.0565317	0.0874587	-0.030927	0.0452047	0.0490457	0.384131	0.0652782
Crp	0.4956496	0.5636612	-0.0680116	0.6686601	0.0763374	0.4873237	0.9203022
Lfp	0.3054436	-0.0518928	0.3573418	0.4696903	-0.063434	0.0115357	0.514993
Mys	-1.178031	-0.0834116	-1.094619	1.509613	-0.160432	0.0652782	0.7613262
Chi-Square (MG vs PMG) = 2.06, P-value = 0.7254							
Chi-Square (PMG vs DFE) = 0.65, P-value = 0.9576							

Source: Aurthor's computation using Stata 13.

The Hausman test between MG and PMG shows PMG as the most efficient estimator, with a Chi-square of 2.06 and P-value of 0.7254, suggesting the null hypothesis cannot be rejected. Similarly, the Hausman test between PMG and DFE confirms PMG as the most efficient estimator, with a Chi-square of 0.65 and P-value of 0.9576, further supporting the null hypothesis. Therefore PMG is the most efficient estimator

Table 6: Result of PMG estimation

d.gdp	Coeff	St. Err	Z	P-Val	[95% Conf. interval]	
Long run						
edx	0.087***	0.018	4.82	0.000	0.519	0.123
crp	0.564**	0.260	2.16	0.031	0.053	1.074
lfp	-0.052***	0.015	-2.50	0.000	-0.081	-0.023
mys	-0.083	0.215	-0.39	0.698	-0.504	0.337
Short run						
ec	-0.984***	0.102	-9.67	0.000	-1.182	-0.785
edx	-0.232	0.161	-1.44	0.150	-0.055	0. 008
crp	-1.018**	0.412	-2.70	0.012	-1.825	-0.211
lfp	0.384	0.567	0.68	0.498	-0.727	1.496
mys	0.759	1.189	0.42	0.676	-2.806	4.326
Constant	3.864***	0.499	7.74	0.000	2.889	4.842

Source: Aurthor's computation using Stata 13. *** and ** indicates rejection of null hypothesis at 1% and 5%.

The PMG estimation results in table (6) above show that in the long run, education expenditure (0.087) and control of corruption (0.564) positively influence GDP, while labor force participation (-0.052) has a negative effect. Mean years of schooling does not significantly impact GDP in the long run. Error correction coefficient (-0.984) is negative and statistically significant implying a convergence to long equilibrium. Only control of corruption exhibits a significant impact on the dependent variable in the short. Education expenditure, labor force participation and mean years of schooling all are statistically insignificant in the short run.

Table 7: Result of Dumitrescu-Hurlin Causality test result

Null hypothesis/ Groups	Z bar statistics	P-value
edx does not homogeneously cause gdp	4.362	0.000
gdp does not homogeneously cause edx	1.954	0.051

Source: Aurthor's computation using Stata 13

The Dumitrescu-Hurlin causality test reveals a unidirectional causal relationship between education expenditure and economic growth in the selected Sub-Saharan African countries. The Z-bar statistic of 4.362 and a P-value of 0.000 indicate that education expenditure significantly causes economic growth. However, the reverse relationship, where economic growth would cause education expenditure, is not significant, with a Z-bar statistic of 1.954 and a marginal P-value of 0.051. This suggests weak or no evidence of causality from GDP to education expenditure.

4.2 Discussion of results

Based on the result of PMG in table 6 above, education expenditure has a positive and statistically significant impact on economic growth, with a coefficient of 0.087 ($p < 0.01$). This suggests that increased investment in education fosters economic growth in Sub-Saharan African countries, supporting the endogenous growth model's premise that human capital investments enhance productivity and innovation (Barro & Sala-i-Martin, 2004). Recent studies reinforce this, emphasizing the role of education in driving long-term economic development in low-income regions like Sub-Saharan Africa (Sarkodie & Adams, 2023). Control of corruption exhibits a positive and statistically significant long-term impact on growth, with a coefficient of 0.564 ($p < 0.05$). This highlights the importance of governance in driving economic outcomes. Corruption reduction enhances public spending efficiency and improves infrastructure and social services, which is vital for sustainable development (Mauro, 1995; Acemoglu & Robinson, 2012). Recent research corroborates this by showing how anti-corruption measures improve economic performance in developing economies (Tebaldi & Mohan, 2022). Surprisingly, labor force participation negatively affects growth, with a coefficient of -0.052 ($p < 0.01$). This may point to structural labor market issues like low productivity and underemployment, which limit the potential benefits of workforce growth (Ajakaiye & Ncube, 2021). These issues suggest that simply increasing labor force numbers without improving job quality and market efficiency may not drive economic expansion (Rodrik, 2018). Mean years of schooling, with a negative but statistically insignificant coefficient of -0.083 ($p = 0.698$), does not show a direct impact on growth. This may reflect variations in education quality or mismatches between schooling and labor market needs, consistent with findings that highlight the need for education reforms to match economic demands (Hanushek & Woessmann, 2020).

Short-run dynamics show that the error correction term, with a coefficient of -0.984 ($p < 0.01$), indicates strong convergence to long-term equilibrium, implying that short-run deviations are corrected swiftly. This aligns with expectations of rapid stabilization following shocks (Pesaran, Shin & Smith, 1999). Control of corruption significantly impacts growth in the short run, with a negative coefficient of -1.018 ($p < 0.05$), suggesting that anti-corruption efforts may initially disrupt established structures, resulting in short-term economic slowdowns (Jain, 2001). However, these reforms are likely to yield long-term benefits, as seen in the long-run analysis. Education expenditure, labor force participation, and mean years of schooling are all insignificant in the short run. This suggests that policy interventions in education or labor may take time to manifest as measurable economic gains due to the lag effects of institutional and structural adjustments (Blankenau & Simpson, 2004). Despite the importance of education

in propelling growth trajectories, countries in Sub-Saharan Africa budgetary allocation to the sector, is below internationally acceptable threshold. This is supported by the result of Dumitrescu-Hurlin causality which shows that education expenditure causes economic growth while growth does not cause expenditure in education. This implies that increase economic growth experienced by Sub-Saharan Africa is not translated to an increased allocation to education sector.

5.0 Summary and Conclusion

The findings highlight the complex relationship between education expenditure and economic growth in the selected SSA countries over the period 1999–2022, using an ARDL Pool Mean Group (PMG) model. A 1% increase in education expenditure is linked to a 9% rise in long-term economic growth, but the impact is significant in the short term only in Guinea, where education spending remains insufficient. The Dumitrescu-Hurlin Causality Test further supports the notion that economic growth does not drive higher educational investments, reinforcing the gap between economic performance and education funding across the region. Corruption control has a positive impact on economic growth, highlighting the importance of governance reforms. Conversely, labor force participation negatively affects growth, which can be attributed to the region's high youth unemployment rates. Additionally, the insignificant effect of mean years of schooling on growth signals a need to improve education quality and accessibility, as SSA school completion rates are among the lowest globally.

In conclusion, education expenditure is vital for promoting sustainable economic growth in SSA. However, challenges such as inadequate education funding limit the short-term effectiveness of these investments. The unidirectional causality between education expenditure and economic growth suggests that economic progress has not translated into sufficient investment in education, thereby restricting human capital development. Structural issues, including deficiencies in education systems, labor markets, and governance, must be addressed. Broader institutional reforms are essential to reducing unemployment and strengthening governance, which will support long-term economic growth in the region.

5.1 Recommendations

Based on the study's findings on the impact of education expenditure on economic growth in selected Sub-Saharan African (SSA) countries from 1999 to 2022, the following recommendations are made: Prioritize Education in National Budgets: Governments in the selected SSA countries should allocate a larger portion of their national budgets to education. This would improve infrastructure, teaching quality, and access, resulting in a better-educated workforce capable of driving economic growth. Institutional Transformation in Education: Significant reforms are needed in the education systems of SSA countries, aligning them with international standards. Governments must focus on policy development, implementation, and monitoring to ensure that educational reforms are effectively executed and yield the desired results and Combat Corruption and Financial Leakages: Strengthening anti-corruption measures is essential to prevent the diversion of education funds. Establishing governance structures that ensure transparency and accountability will help ensure that resources allocated for education are used effectively.

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