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IMPACT OF DISAGGREGATED PUBLIC EXPENDITURE ON ECONOMIC GROWTH OF SELECTED AFRICAN COUNTRIES: A PANEL VECM

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ABSTRACT: *The study investigated the long-run and short-run equilibrium relationship between economic growth and disaggregated public expenditure in selected West African Countries with panel data spanning 1990-2017. The study employed panel co-integration based on Pedroni and Panel Vector Error Correction Model (PVECM) with Engle and Granger´s procedure for empirical analysis. The findings revealed that expenditure on infrastructure, health and education have positive impact on economic growth at about 2%, 6% and 2% respectively, but only expenditure on infrastructure is significant. Defence expenditures and education expenditures at both lags have indirect and insignificant influence on economic growth while health expenditure has direct and insignificant impact on economic growth at all lags. The study recommends policy makers to focus on developing health, infrastructure and education sectors which has not contributed significantly enough to economic growth in the selected African countries.*

KEYWORDS: *Health, Education, Infrastructure, Defence, Economic growth, PVECM*

INTRODUCTION

Background to the study

Over the years, public expenditure has been increasing in geometric term through various government activities and interactions with its Ministries, Departments and Agencies (MDA's), Niloy, Emranul and Denise (2003). This sharp rise in public expenditure in African countries caught researchers' attention for more investigation owned to the poor welfare of the citizens, despite the gross government expenditure spree for decades. There has been growing concern about the extent to which government expenditure has impacted the economic growth in African countries. The rising cost of governance remained a challenge by African countries; the public expenditure size has expanded which has generated interest in both developed and developing world to optimise the size of government. The need to provide and expand the tentacles of public goods becoming too obvious and unavoidable recognised, mismanagement and misappropriation of public expenditure in the economy cannot be underestimated, coupled with the pressing demand to expand and cater for the rising population.

Amidst the unresolved foregoing controversies, most African countries are still faced with monumental development problems, therefore, the policy makers emphasized on the roles of public sector expenditure as important instrument which the government can apply to restore some economic problems such as reduction in inequality, inflation, fall in exchange rate, unemployment, dwindling oil price and the desire to restore the economy on the part of full employment, price stability, balance of payment equilibrium and above all, increase in economic growth. However, it has been argued that, the rising state of public sector expenditure

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contributed to economic growth, this has continued to generate series of debate among scholars, the empirical and theoretical positions on the subject is quite diverse and still remain mixed. According to lyoha and Oriakhi (2002), the overviews of some African countries performance compared to the developed world are not comparable, when the world's economy grew at an annual rate of close to 2% from 1960 to 2002, Africa growth performance was in dismal, from 1974 through the mid-1990s, growth was negative, reaching -1.5% in 1990 to 1994. Oteng-abayie (2011) noted that one half of the African continent inhabitants live below the poverty line which is still the same till date. There has been a continuous decline of per capita GDP in most African countries; social indicators among the worst in the world, infant mortality rate recorded highest, life expectancy at low ebb with many problems bedevilled the African nations.

Therefore, it is against these issues raised above that this study examine whether gross public expenditure has any impact on economic growth (proxied by gross domestic product) in selected African countries has become necessary. Hence, the study provides answers to the impact of public expenditure of selected African countries on the economic growth. The study is structured to the following arrangement, section one captures the background to the study, section two focuses on detailed theoretical propositions and empirical review. Section three explains the method adopts to analyse the data while section four shows outcome results and interpretations. Finally, section five entails summary, conclusion and policy recommendations.

LITERATURE REVIEW/ THEORETICAL UNDERPINNING

Wagner (1893), Peacock and Wiseman (1961) and others great economists have formulated different theories on public expenditure and economic growth. Wagner viewed public sector expenditure as a behavioural variable that positively dictates if an economy is growing. However, the neo classical growth model developed by Solow(1956) opined that the fiscal policy does not have any effect on the growth of national output. In the case of public economist, most of the studies opined that public expenditure is majorly to increase economic growth which is in tandem with Wagner's hypothesis. Solow (1956) argued that invention through fiscal policy helps to improve failure that might arise from the inefficiencies of the market. Similarly, Dar and Amir (2002) postulated that in the endogenous growth models, fiscal policy is very crucial in predicting future economic growth. Barro (1990), Barro and Sali-i-Martins (1992) and Roux (1994) all noted that the expansion of government expenditure contributes positively to economic growth.

Rostow (1960) attests the need for government intervention through massive injection of capital into economy to hasten massive development process in developing countries to stimulate the growth of the economy. Similarly, the big push theory encourages huge capital injection to drive the economy growth from the slow and epileptic state. The theory opined that if a low level of equilibrium trap exists, there is an urgent need for a critical minimum effort required to escape from economy stagnancy due to low saving and low income that may persist. It is noteworthy that Harrod (1960) and Domar (1946)economic growth model hold that, an impoverished individual have meagre or no saving, government intervention for massive capital injection in such an economy is to improve the people condition to move from abject state of poverty to prosperity. More so, a substantial capital injection into the economy will raise income and saving to make the process of capital accumulation self-sustaining.

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Among the notable theories, Keynes (1936) in his hypothesis draws a link between public expenditure and economic growth, implying that public sector expenditure is an exogenous factor and a public instrument for increasing national income and concludes that increase in government expenditure leads to higher economic growth. The link between the public expenditure and growth not limited to the purview of Keynes. Romer (1986) developed a model which revealed positive long run effect of government spending on economic growth while investigating the impact of government spending on economic growth. In the study of Lucas (1988), endogenous growth model was developed with human capital as the driver of perpetual growth.

Barro (1990) and King and Rebelo (1990) endogenous growth models predict that government spending and taxation will have both temporary and permanent effects on long run economic growth. Also, Barro (1991) endogenous growth appeared to support empirical evidence favouring the view that, a heavy government participation in economic activity tend to be growth enhancing. Therefore, the introduction of endogenous growth models that incorporate the government sector has led to the conclusion that fiscal policy can affect the long run growth rate of an economy (Barro and Sala-i-Martin, 1992). This provides a sort of linkage between government spending and economic growth. Harvey Leibenstein (1957) posited that developing countries are generally characterized by vicious circle of poverty, which ranks them around a low income per capita equilibrium state. The critical minimum effort required to raise the per capita income to a level at which sustained development could be maintained justified the government requirement effort for more spending that, will stimulate economic growth in the developing countries.

A lot of research works have been carried out on the link between public expenditure and economic growth yielding conflicting results. The conflicting remarks in this regard cut across countries and economies have been left unresolved both in theoretical and empirical among scholars. The inconclusive proofs from the existing literature further provided evidence for more research study. However, the complexities of the size, structure and growth of public sector expenditure have increased tremendously, especially in developing countries. In a study carried out by Olugbenga and Owoeye (2007), on the relationships between government spending and economic growth for a group of 30 developing countries, a long run relationship existed between government spending and economic growth. Also, the result indicated a unidirectional causality running from government spending to economic growth for 16 out of the 30 countries investigated. In a survey of 102 studies on the economic effects of military spending, Dunne and Uye (2010) observed that military expenditure has negative impact on growth in 39% of cross-country and 35% of case studies. While 20% of the survey revealed a positive relationship between military spending and economic growth.

Gisore *et al* (2014) investigated how government expenditure contributes to economic growth in East Africa. Most existing studies examining the relationship between expenditure and economic growth show conflicting results and mainly focus on aggregate expenditure. Hence this study focused on disaggregated expenditure over the period from 1980 to 2010. The objective of the study was to establish these expenditures that have effects on growth using balanced panel fixed effect model. Employing LLC test, this study tested for panel unit root and found that only GDP was stationary at level. The study found that expenditures on health and defense were positive and statistically significant on growth. In contrast, education and agriculture expenditure were insignificant. According to the investigation of Fan and Rao

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(2003) on the effect of different types of government expenditure on overall economic growth across 43 developing countries between 1980 and 1998 using OLS method and found mixed result. The rise in government spending on agriculture and health was particularly strong on promoting economic growth in African countries. The results showed that, among all types of government expenditures, agriculture, education, and defence contributed positively to GDP growth in Asia. In Latin America, health spending had a positive growth-promoting effect. Structural adjustment programs had a positive growth-promoting effect in Asia and Latin America, but not in Africa.

Also, the research work of Davarajan, Swaroop and Zou (1993) employed panel data for14 developed countries between 1970 and 1990 with OLS method, 5-year moving average. The study examined various functional types of expenditure (health, education, transport, and others) as explanatory variables and found that health; transport and communication have significant positive effectwhile education and defence have a negative effect on economic growth. Bleaney Gemmel, and Kneller (2001)in their study on the effect of government expenditure on GDP growth, using panels of annual and period-averaged data for 22Organizations for OECD countries during 1970-95.By employing OLS and GLS methods, the study found that productive expenditures enhance growth, but non-productive spending does not, in accordance with the predictions of Barro's (1990) model. M'amanja and Morrissey (2005) while investigating the effects of fiscal policy on growth in Kenya, categorized government expenditure into productive and unproductive expenditures. However, contrary to expectations, productive expenditure has a strong negative effect on growth, whilst unproductive expenditure was found to be neutral to growth. Although in the long run, government investment expenditure was found to be beneficial to growth. Studies on the relationship between government expenditure and economic growth in Nigeria, is still plagued with divergent conclusions. For example, Akpan (2005), Nurudeen and Usman (2010) employed a disaggregated approach to determine the components of government expenditure that enhances growth and those that do not. Their result arrived at a common standpoint i.e. that there is no significant association between most components of government expenditure and growth in Nigeria.

Sevitenyi (2012) on the relationship between government expenditure and growth employed both a disaggregated and aggregated approach of method. The study finding shows a unidirectional causality running from government expenditure to economic growth, meaning that government expenditure promotes economic growth. Fajingbesi and Odusola (1999), and Omoke (2009) made similar findings to that of Sevitenyi (2012). Meanwhile, Biswas and Ram (1986) reported an insignificant effect of expenditure on defence as regards economic growth in Nigeria. But by categorizing government's expenditure into sectors, Loto (2011) found that expenditures on agriculture and education were negatively related to economic growth in the short run whereas expenditures on security, transportation and communication were positively related to economic growth (although statistically not significant).

The studies of Abu-Bader and Abu-Quarnon Israel and Syria (2003a), Halicioglu (2005) for Turkey, Govindaraju et al. (2010) for Malaysia, Wahab *et al.* (2011) for Nigeria, Kalam and Aziz(2009), for Bangladesh, Kumar (2009), for China, Hong-Kong, Japan, Taiwan and South Korea, Keho, (2015), for Gabon, Senegal and Burkina Faso, Ebaidalla (2013), for Sudan and Gisore *et al* (2014) for East Africa. All argued in favour of government spending as an accelerator of economic growth. In the other way, studies against the support of relationship

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between government spending and economic growth include; Huang (2006), for China and Taiwan, Magazzino (2010), for EU-countries, Dogan and Tang(2006), for Indonesia, Malaysia, Singapore and Thailand, Abu-Bader and Abu-Quarn (2003), for Egypt and Chimobi (2009), for Nigeria. Similarly, Gwartney*et al.*, (1998), Schaltegger and Torgler (2006), Mitchell (2005) and others proved empirically against government spending as an impetus for economic growth. However, Frimpong and Oteng-Abaiye (2009) found neither support for Wagner law nor Keynesian view for three ECOWAS countries in the eco-zone sub-group called WAMZ that is Gambia, Ghana and Nigeria. Their results suggest that decreasing or increasing government spending might not be a necessary policy action to achieve the steady growth in those economies understudied. Olulu, Erhietovwe and Adrew (2014) noted that, not only has recent political developments engendered expenditure growth, the question on raising additional and identifying alternative sources of revenue to supplement the rising needs of governance have made it more imperative to take a more focused look at government activities, especially its expenditures.

METHODOLOGY

Data and Measurement

The selection of the sample period and countries are based on the availability of annual data, ranging from 1990 to 2017. The selected African countries is classified by World Bank. Hence this work makes use of a balanced panel data of 20 African countries(four from each sub-region); Angola, Benin, Botswana, Cameroun, Central African Republic, Chad, Egypt, Equatorial Guinea, Ethiopia, Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa, Sudan, Tanzania, Togo and Tunisia.

The study considered panel series data on real GDP per capita, defence expenditure, GFCF (as a proxy for infrastructural expenditure), health expenditure and education expenditure obtained from World Development Indicator (WDI) online database which was published by the World Bank. The variables above are measured as follows. Real Gross domestic product (RGDP) is measured in current US dollars by using current exchange rates of domestic currency against the US dollar. The GDP figures are divided by total population of the country to get per capita GDP.

Annual growth of gross fixed capital formation (GFCF) based on U.S dollar. This includes plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Defence expenditure (DEXP) measured in U.S dollar, this is the military expenditure (% of general government expenditure). This includes all current and capital expenditures on the armed forces, including peacekeeping forces, defence ministries and other government agencies engaged in defence projects. Health expenditure (HEXP), this is the general government expenditure on education (current, capital, and transfers), is expressed as a percentage of total general government expenditure on all sectors (including health, education, social services, etc.). It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments.

Model specification

Given that the goal is to investigate the long-run and short-run association between economic growth and disaggregated public expenditure, the empirical analysis makes use of panel co-

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integration and panel vector error correction methodologies. To this end, the empirical analysis employs a panel co-integration approach, as well as panel VECM tests to identify the long-run and short-run relationships among the variables. Building on the work of Gisore *et al* (2014), the study adopts the model stated below.

RGDPG = f (Open, Tot, Pop, Tg, Hea, Edu, Def, Agr,)……..(1)

Where: RGDPG = Real Gross Domestic Product Growth, OPEN = Openness, TOT = Terms of trade POP = Population, Tg = Total government expenditure, Hea = Health Expenditure, Edu = Education Expenditure, Def = Defence Expenditure, Agr = Agricultural expenditure.

Based on the study objectives, the model is re-specified and employed a panel co-integration and panel VECM techniques to analyse data in selected African countries. The panel linear function of the model is thus;

$RGDP_{it} = f(GFCF_{it}, DEXP_{it}, HEXP_{it}, EDEXP\ _{it}, v_i)$……(2)

RGDP represents economic growth. Disaggregated government expenditure includes GFCF (expenditure on infrastructure), DEXP (defence expenditure), HEXP (health expenditure), and EDEXP (expenditure on education).our main variable of interest. $v_i$represents individual fixed country effects. Similarly, countries are indicated by the subscript i (i=1, ... ,N), while t represents the time period (t=1, ...,T).

RGDPit = α_{it} +β_1GFCF$_{it}$ +β_2DEXP +β_3HEXP + β_4EDEXP+vi +ε_t+ μ_{it} ……(3)

Cross Dependence (CD) and unit root tests

We first identify whether the given series are cross-sectional dependent. To this end, the empirical analysis employs Pesaran's (2004) CD test. To select the correct type of unit root test, we must first test for cross-sectional dependence for the variables and the co-integrating equation. Thus, we employ the Lagrange Multiplier (LM) and bias-adjusted Lagrange Multiplier tests developed by Breusch and Pagan (1980) and Pesaran, Ullah, and Yamagata (2008), respectively. It is well known that when T is larger than N (T > N, as is the case in this paper), LM and LMadj tests are favourable to the tests suggested by Frees (1995) and Pesaran (2004). The LM test has a $\chi 2$ distribution with a cross-sectional independence null hypothesis. It is based on the sum of squared coefficients of correlation among cross-sectional residuals obtained through ordinary least squares (OLS). However, the LM test is biased when the group mean is equal to zero and the individual mean is different from zero. Therefore, Pesaran et al. (2008) corrected for bias by including variance and mean in the test statistic. In this way, they obtained the bias-adjusted LM test, which has standard normal distribution.

Panel unit root tests

Since none of the panel unit root test is free from some statistical shortcomings in terms of size and power properties, it is better for us to perform several unit root tests to infer an overwhelming evidence to determine the order of integration of the variables. In this paper three panel unit root tests: Levin, Linand Chu (LLC 2002), Im, Peasaran and Shin (IPS, 2003), and Breitung and Das (2005) tests are applied.

The LLC test is based on the assumption that the persistence parameters ρ_i are common across cross-sections so that $\rho_i = \rho$ for all i, but this assumption is not true for several variables. The second and third tests assume cross-sectional independence. This assumption is likely to be violated for the selected variables. It has been found by Banerjee et al. (2001) that these tests have poor size properties and have a tendency to over-reject the null hypothesis of unit root if

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the assumption of cross-section independence is not satisfied. Pesaran (2007) and Choi (2006) have derived other tests statistics to solve this problem.

Levin, Lin and Chu (LLC, 2002) considered the following regression equation:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \gamma_{ij}\, y_{it-j} + X'_{it}\delta + \varepsilon_{it} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

where, $\Delta y_{it} = y_{it} - y_{i,t-1}$, here the assumption is $\alpha = \rho - 1$ i.e. $\rho_i = \rho$ for all i, but allow the lag order for the difference terms $\rho_i$to vary across cross-sections. Here the null hypothesis to be tested is $H_0: \alpha = 0$against the alternative hypothesis$H_0: \alpha < 0$. The null hypothesis indicates that there is a unit root while the alternative hypothesis indicates that there is no unit root. Im, Pesaran and Shin (IPS, 2003) proposed the test statistic using the following model:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \gamma_{ij}\, y_{it-j} + X'_{it}\delta + \varepsilon_{it} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (5)$$

where, $\Delta y_{it} = y_{it} - y_{i,t-1}$, $y_{it}(i = 1,2, \dots\dots\dots\dots, n; t = 1,2 \dots\dots\dots\dots T)$ is the series under investigation for country i over period t, pi is the number of lags in the ADF regression and ε_{it}errors are assumed to be independently and normally distributed random variables for all i and t with zero mean and finite heterogeneous variance σ_i^2. Both $\alpha_i$and ρ_i in Eq. (5) are allowed to vary across the countries. The null hypothesis to be tested is that each series in the panel contains a unit root, i.e. $H_0: \alpha_i = 0\ \forall\ i$ against the alternative hypothesis that some of the individual series have unit root but not all.

$$H_1: \begin{cases} \alpha_i = 0; & for\ i \\ \alpha_i < 0; & for\ at\ least\ one\ i \end{cases}$$

Breitung and Das (2005) showed that when individual-specific trends are included, the IPS test can suffer from a loss of power due to bias correction. He proposes an alternative test unit root which corrects for the loss of power and shows that it has greater power than the IPS test. The null hypothesis of Breitung's test is that the panel series exhibits non-stationary difference, and the alternative hypothesis assumes that the panel series is stationary.

Heterogeneous panel cointegration

Granger (1981) showed that when the series becomes stationary only after being differenced once (integrated of order one), they might have linear combinations that are stationary without differencing. In the literature, such series are called co-integrated''. If integration of order one is implied, the next step is to use co-integration analysis in order to establish whether there exists a long-run relationship among the set of the integrated variables in question. Earlier tests of co-integration include the simple two-step test by Engle and Granger(1987) (EG). However, the EG method suffers from a number of problems. Therefore, this study shall follow the recently developed panel co-integration tests by Pedroni (2004) provide a technique that allows for using panel data thereby overcoming the problem of small samples, in addition to allowing for heterogeneity in the intercepts and slopes of the co-integrating equation. Pedroni's method includes a number of different statistics for the test of the null of no co-integration in heterogeneous panels. A group of the tests are termed ''within dimension'' (panel tests) and the other group as ''between dimension'' (group tests). The ''within dimension'' tests pool the data across the ''within dimension''. It takes into account common time factors and allows for heterogeneity across members. The ''between dimension'' tests allow for heterogeneity of parameters across members, and are called ''group mean co-integration statistics''.

Seven of Pedroni's tests are based on the estimated residuals from the following long-run model:

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$$y_{it} = \alpha_i + \sum_{j=1}^{m} \beta_{ji} x_{jit} + \varepsilon_{it}, \dots \dots (6)$$

where $\varepsilon_{it} = \rho_i \varepsilon_{i(t-1)} + w_{it}$ are the estimated residuals from the panel regression. The null hypothesis tested is whether ρ_i is unity. The seven statistics are normally distributed. The statistics can be compared to appropriate critical values, and if critical values are exceeded then the null hypothesis of no cointegration is rejected implying that a long-run relationship between the variables does exist.

Panel Vector Error Correction Model

In economics, deviations from a long-run equilibrium are possible, but these errors are characterized by a mean revision back to its long-run equilibrium (Pfaff & Gentleman 2008 p.76). The question is how to model this dynamic behaviour. Engle & Granger (1987) that proposed a two-step estimation technique to model dynamic behavior of I(1) variables that are cointegrated, which is implemented in this paper. In the first step, the following model is estimated:

$RGDP_{it} = \alpha_i + \beta_{1i} EXPV_{it} + e_{it}$

where i=1,2….,N is the number of countries in the panel, t=1,2,….,T is the number of time periods, RGDP is the economic growth rate, EXPV is the expenditure variables and e is the residuals. The residuals are obtained:

$\hat{e}_{it} = RGDP_{i,t} - \hat{\alpha}_{I,t} - \hat{\beta}_{1i} EXPV_{i,t}$

The lagged residual ($\hat{e}_{it}$-1) now contains information about the long-term relationship and the adjustment process to its long run equilibrium (Asteriou and Hall 2011 p. 365). in this paper, the lagged residual($\hat{e}_{it-1}$) is represented by ECT_{it-1}.The next step in Engle & Granger (1987) two-step procedure is to estimate a system of equations where the error correction term is incorporated with the short dynamics (Hill et al. 2011 pp.499-502). The system is written as:

$\Delta RGDP_{it} = \alpha_{11i} + \beta_{11i} \Delta EXPV_{it} + \sum_{k=1, j=1}^{2} \emptyset_{j1i} \Delta EXPV_{i,t-k} + \lambda_{11i} ECT_{i,t-1} + \mu_{11i,t}$

$\Delta EXPV_{it} = \alpha_{22i} + \beta_{22i} \Delta RGDP_{it} + \sum_{k=1, j=1}^{2} \gamma_{j2i} \Delta RGDP_{i,t-k} + \lambda_{12i} ECT_{i,t-1} + \mu_{22i,t}$

Where Δ is the first difference operator, k is the lag length, α, β,$\emptyset, \lambda,$ *and* γ are slope coefficient j in equation and μ is the residuals.

RESULTS AND DISCUSSION OF FINDINGS

Cross Sectional Dependence and Unit Root Test

As seen in table 1 below, all the LM tests including Pesaran CD reveal the existence of cross-sectional dependence at 1% significance level for all the variables. Hence we conduct a unit root test which allow for cross-sectional dependence. Table 2 is the panel unit root test result which shows evidenced of first order integration as all the variables are stationary at first difference I(1). This implies that we move on to co-integration test as the order of integration informed the use of co-integration.

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Table 1: Cross Sectional Dependence Test

Variables	Breusch-Pagan LM	Pesaran scaled LM	Bias-corrected scaled LM	Pesaran CD
Rgdp	355.9476(0.0000)	8.51293(0.0000)	8.142562(0.0000)	9.9611(0.0000)
Gfcf	289.3434(0.0000)	5.09621(0.0000)	4.725839(0.0000)	1.84099(0.0000)
Dexp	1443.834(0.0000)	64.3203(0.0000)	63.94996(0.0000)	10.9208(0.0000)
Hexp	2401.936(0.0000)	113.470(0.0000)	113.0995(0.0000)	2.2539(0.0242)
Edexp	289.3434(0.0000)	5.09621(0.0000)	4.72584(0.0000)	1.84099(0.0000)

Notes: P-values of the test statistics are presented in parentheses
Source: Authors Computations

Table 2: Panel Unit Root Test (LLC Breit IPS)

Variables	level I(0)			Difference I(1)		
	LLC	Breit	IPS	LLC	breit	IPS
Rgdp	**-0.21491**	**-3.65822**	**-3.73868**	**-10.4645*** **	**-9.52295*** **	**-17.361*** **
	(0.4149)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
Gfcf	**-1.62935**	**-0.82239**	**-5.74536**	**-15.3215*** **	**-11.0429*** **	**-20.9873*** **
	0.0516	0.2054	0.0000	(0.0000)	(0.0000)	(0.0000)
Dexp	**-0.34562**	**-3.85814**	**-4.55632**	**-6.37384*** **	**-5.02807*** **	**-12.550*** **
	0.3648	0.0001	0.0000	(0.0000)	(0.0000)	(0.0000)
Hexp	**-0.83286**	**-1.80243**	**-3.76883**	**-9.78705*** **	**-10.0036*** **	**-12.4679*** **
	0.2025	0.0357	0.0001	(0.0000)	(0.0000)	(0.0000)
Edexp	**-1.7024**	**-0.59419**	**-5.49155**	**-9.32313*** **	**-13.2122*** **	**-13.8179*** **
	0.0443	0.2762	0.0000	(0.0000)	(0.0000)	(0.0000)

*Significant at 10%, **Significant at 5%, and ***Significant at 1%.
The asterisks indicate the rejection of null hypothesis of unit root
Source: Authors Computations

Results of Panel Cointegration Test

The hypothesis of cointegration between all variables is tested using pedroni (2004) cointegration tests. As seen in table 3 below, all the three assumptions (no trend, trend and intercept and no trend or intercept) indicate the presence of cointegration among the variables. Thus majority of between and within dimension statistics indicate that the null hypothesis of no co-integration is rejected at 1% and 5% significance levels. This empirical finding further proves the presence of long run equilibrium relationship between economic growth and expenditure variables.

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1. Table 3: Panel Co-integration Test Result

Within-dimension			No trend				intercept and trend			none		
	Stat	Prob	w-stat	prob	Stat	Prob	w-stat	prob	stat	prob	w-stat	Prob
Panel v-Statistic	**-1.977**	0.9760	**-2.155**	0.9844	**-4.181**	1.0000	**-4.269**	1.0000	**-0.739**	0.7700	**-1.008**	0.8432
Panel rho-Statistic	**-3.198*** **	0.0007	**-3.267*** **	0.0005	**-1.396***	0.0814	**-1.422***	0.0775	**-4.285*** **	0.0000	**-4.268*** **	0.0000
Panel PP-Statistic	**-9.593*** **	0.0000	**-10.837*** **	0.0000	**-9.412*** **	0.0000	**-11.731*** **	0.0000	**-9.923*** **	0.0000	**-10.580*** **	0.0000
Panel ADF-Statistic	**-6.921*** **	0.0000	**-9.037*** **	0.0000	**-5.854*** **	0.0000	**-8.992*** **	0.0000	**-8.162*** **	0.0000	**-9.794*** **	0.0000
between-dimension												
	Stat	Prob			Stat	Prob			stat	prob		
Group rho-Statistic	**-3.01*** **	0.0013			**-1.135**	0.1282			**-4.371*** **	0.0000		
Group PP-Statistic	**-14.2*** **	0.0000			**-16.521*** **	0.0000			**-14.771*** **	0.0000		

Notes: Null hypothesis: No cointegration, lag selection: Automatic AIC with a max lag of 5.
***designate the significance at 1% significance level, **designate the significance at 5% significance level while *designate the significance at 10% significance level.
Source: Authors Computations

DISCUSSION OF RESULTS OF PANEL VECM

In this paper, we estimated the long-run and short-run parameters using panel VECM. Hence, the long-run estimates indicate that expenditure on infrastructure (gfcf), health expenditure (hexp) and expenditure on education (edexp) have positive impact on economic growth (rgdp) of the selected African countries at about 2%, 6% and 2% respectively, but only expenditure on infrastructure is significant. This result implies that expenditures on infrastructure, health and education recorded only a meagre contribution to economic growth in African countries investigated. This finding corroborates the study of Olugbenga and Owoeye, (2007). Also, defence expenditure (dexp) has both negative and insignificant impact on economic growth in the long-run. This is in line with the findings of Dunne and Uye (2010).

However, the short-run estimates revealed that expenditure on infrastructure at lag 1 and 2 have indirect impact on economic growth in both lags. Meanwhile, a unit rise in expenditure on infrastructure contributed about 3% significant reduction in economic growth at lag 1. Defence expenditures and education expenditures at both lags have indirect and insignificant influence on economic growth while health expenditure has direct and insignificant impact on economic growth at all lags. Most importantly, the speed of adjustment is high as ECT shows negative and significant implying that about 72% of the error is corrected annually from the short run to long run. This further indicates that the speed of adjustment is very fast in correcting the error from short run to long run. Finally, to examine if there is short run equilibrium, we estimated

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Wald test which indicates acceptance of null hypothesis. Thus p-value is insignificant and we accept the null hypothesis and conclude that there is no short run equilibrium relationship among the variables.

Table 4: Panel VECM of Long run and short run

PANEL VECM

LONG RUN REGRESSION

Variables	Coef	Std errors	t-stat*
GFCF(-1)	**-0.02867**	(0.01396)	[-2.05361]
DEXP(-1)	**0.004854**	(0.04888)	[0.09932]
HEXP(-1)	**-0.06974**	(0.19957)	[-0.34945]
EDEXP(-1)	**-0.02868**	(0.02878)	[-0.99634]

wald test

Stat	**9.60016**
Prob	0.2942

SHORT RUN ESTIMATES

variables	Coef	prob	t-stat*
GFCF(-1)	**-0.03302**	0.0125	-2.50792
GFCF(-2)	**-0.00574**	0.6601	-0.43999
DEXP(-1)	**-0.04618**	0.534	-0.62238
DEXP(-2)	**-0.02048**	0.7762	-0.28449
HEXP(-1)	**0.729968**	0.265	1.115998
HEXP(-2)	**0.441123**	0.5157	0.650475
EDEXP(-1)	**-0.02214**	0.4597	-0.73996
EDEXP(-2)	**-0.02329**	0.4255	-0.79762
ECT	-0.72108	0.0000	
R^2	0.420203		

Source: Authors Computations

The relation to existing literature

The positive impact of health expenditure and defence expenditure on growth is in line with the works of Fan and Rao (2003) and Devarajan, Swaroop and Zou (1993). The negative impact of defence expenditure on economic growth is in line with the work of Devarajan, Swaroop and Zou (1993) and Fan and Rao (2003), but against the work of Loto (2010). Also the positive impact of education expenditure in the long run is in line with the wok of Fan and Rao (2003) and Loto (2010) but against the work of Devarajan, Swaroop and Zou (1993).

Implications to Research and Practice

The main objective of this study is to investigate the long-run and short-run equilibrium relationship between economic growth and disaggregated public expenditure in Africa with panel data spanning 1990 through 2017. To achieve this aim, the present paper employed panel co-integration based on Pedroni (2004) and a PVECM estimated with Engle & Granger´s (1987) procedure. The result provided useful evidence of co-integration between economic growth and various types of government expenditure. The panel VECM result indicates that there is a long run equilibrium association between economic growth and various government expenditures as indicated by the error correction term which was high, rightly signed and significant. In the long run also, only infrastructural expenditures impacted positively and significantly on economic growth in Africa. Education and health have positive but insignificant effect on economic growth. On the short run only expenditure on infrastructure is significant in influencing economic growth in Africa although, it is inversely related to economic growth. The wald test revealed that there is no short run equilibrium relationship meaning that equilibrium only occur in the long run. This points to the fact that expenditure is a long run issue as the evidence in real life can be seen over a period of time. The study

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established that massive investment in infrastructural development will impact positively economic growth in selected African Countries. The studies unravel that expenditure on health sector and education has not met up with the necessary requirement to influence economic growth which are major pivotal to the selected African economies. Also, the research works found out that the impact of gross government expenditure over the study period has no significant contribution to economic growth which could be subject to gross mismanagement and corruption which had retarded the economy performance over the years.

CONCLUSION

The study concluded by recommending that the selected African countries policy makers to focus on developing their health, infrastructure and education sectors which has not contributed significantly enough to economic growth. This will enhance human capital formation which will ultimately promote economic growth. The study affirmed that despite huge funding on defense, the insecurity is still persistent in some of the selected African countries, yet these have not contributed to economic growth. Hence, the study recommends stiffer penalty on economic managers in order to reduce corruption and mismanagement of government funds. Finally, policy maker should put in place check and balance measures to raise the need for transparency, probity and accountability on how public expenditure is spent.

Future Research

Further researches should improve on comprehensive analysis of defense spending that will be used to enhance the representativeness and quality of the result of the selected African Countries.

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