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Abstract: *Previous classifications of public sector capital expenditure are more of accounting and identification purposes devoid of importance to economic development. The aim of this study is to explore which expenditure components drives economic development and thus the area of critical importance for expenditure driven economic growth. In this study, public sector capital expenditure was disaggregated and classified into four capital components: productive, human, institutional and transfers capital expenditures and evaluated in terms of their short-run and long-run relationship as well as direction of causality with economic development. The study covered the period 1960 to 2013 and applied the Johansson cointegration analysis, error correction model and Wald coefficient test to analyze the data. From the Johansson cointegration analysis, both the Trace test and Max-eigenvalue test indicates that our five variables system of equations were cointegrated at the 0.05 level of significance. The error correction model shows that long-run causality flows from the predictor variables to economic development. However, only Institutional and Transfers capital expenditures affect economic development in the short-run albeit positively and negatively respectively. We recommend that in the short run, public sector capital expenditure should be prioritized in favour of developing institutional capital and managing transfers' capital expenditure to reduce its negative impact on economic development. In the long run, an integrated systems or portfolio approach to public sector capital expenditure is required to sustain the positive impact of public sector capital expenditure components on economic development.*

Key words: *Public Expenditure, Economic Development, Cointegration, Error Correction*

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1. Introduction

The relevant theoretical models to this study on public sector capital expenditure and economic growth nexus are those of Wagner (1883) and Keynes (1936). A third approach with fundamental impact on the choice of classification of public sector capital expenditure and the dimension – sustainable development – which this study adopts are the World Bank studies: "Where is the Wealth of Nations" and The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium" (World Bank, 2006, 2011).

Adolph Wagner, a German economist had theorized that growth in the economy causes government expenditure to expand. According to Wagner, as the economy grows with its associated problems; population growth, rural to urban migration, social and economic vices,

insufficient infrastructure, security challenges, health and manpower needs among others, the government is forced to intervene. Thus, as government takes on more responsibilities, its expenditure profile also increases. However, Keynes (1936) in examining what should drive depressed economies (the great depression1930) out of depression proposed that government should as a matter of policy inject massive funds into the economy through higher expenditures on economic activities that generate employment and increase the income of the citizens. This Keynesians argue will stimulate demand for goods and services by the citizens which unarguably leads to increases in production of such goods and services by economic agents and by extension to growth in national output.

The present study is predicated on the Keynesian theory and extends to which components of public sector capital expenditure should be expanded to achieve sustained economic growth. This is where the World Bank approach which impinges on the classification of public sector capital expenditure comes in with the aim of showing which expenditure components drives economic development and thus the area of critical importance for expenditure driven economic growth. Over the years, the theoretical issue in public sector expenditure and economic growth analysis has been on both the direction of causality and relationship. That higher level of government expenditure tends to promote employment and economic growth is a widely debated hypothesis. Thus, Wagner's (1883) Law of Ever-increasing State Activity and the Keynes' (1936) General Theory of Income, Output and Employment present two opposite theories in terms of the relationship and causality between public expenditure and growth in national output. The acceptance of any one of the theories means the rejection of the other. Both Wagner and Keynes have made disciples among diverse scholars and researchers yet the empirical evidence is inconclusive.

Currently, much of the research in public sector expenditure and economic growth analysis dwells on thematic and components analysis of public sector expenditure impact on economic growth. Thus, public sector expenditure has been variously classified in terms of the functions the expenditures are incurred on. In Nigeria, Public expenditures are functionally classified into four classes by the Central Bank of Nigeria (CBN), (see 2013 CBN Statistical Bulletin, Table B.1.3: Federal Government Capital Expenditure) and include: Administration, Economic Services, Social and Community Services, and Transfers with recurrent and capital expenditure compositions. Other classifications (Partington, 1989) look at whether the expenditures are recurrent as in re- occurring consumption expenditures incurred year after year on expenditure heads like: civil administration, defence forces, public health and education, maintenance of government machinery as well as wages and salaries or capitalexpenditures incurred on building infrastructure like Roads, Dams, Power (Energy) projects, Machinery and Equipment. Capital expenditures are aimed at increasing the capital stock that increases the productive capacity of the economy. There are also Transfer and Non-Transfer Expenditure classifications (see Pigou 1989; Dalton, 1954) where Transfer expenditures are government expenditures, 'welfarist' in nature such as Subsidies, National Pension Schemes, Interest payments, Unemployment allowances, and programs for the old and less privileged. Non-Transfer expenditure consists of expenditures on economic infrastructure such as power, transport, irrigation, social infrastructure, public administration, etc. Other classifications include classification according to Benefits (Shiras, 1924) as well as Hugh Dalton's (1954) Productive and Unproductive Expenditures.Productive Expenditures increase productive capacity in the

economy and bring income to the government. Unproductive Expenditures relate to consumption expenditures which do not create any productive asset which can bring income or returns to the government. But can any government expenditure be truly classified as unproductive? A re-examination of the expenditure heads classified as unproductive reveal a misnomer of terms. For instance, are government expenditures on administration which includes general administration and defence unproductive? It is doubtful that expenditures for the provision of the right environment – security and industrial peace – for economic activities to thrive are unproductive. Again, the classification according to benefits this study believes serves only an identification purpose probably for audit and accountability reasons. However, expenditures classified on the basis of who benefits may be prone to sectionalism and agitation from sectors excluded from such expenditures which may not be beneficial overall. Another classification of public sector expenditure is productive and protective expenditures. This classification considers expenditures on economic services and social and community services as productive while expenditures on general administration and transfers are seen as protective expenditures. These classifications only express the need to aggregate similar expenditure items under particular heads for easy identification and management and not that they show which expenditures promote economic development except the Productive and Unproductive classification by Hugh Dalton (1954).

In the book "The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium" (World Bank 2011), economic development is seen as a process of building and managing a portfolio of assets. It goes on to say that the challenge of development is to manage not just the total volume of assets but also the mix of the asset portfolio, that is, how much to invest in different types of capital; natural, human, and productive assets as well as the institutions and governance that constitute social capital.

A divergent trust of this study relies on World Bank 2006 and 2011publications; "Where is the Wealth of Nations" and "The Changing Wealth of Nations". In these publications, certain capital components were identified as the main drivers of sustainable development and these include; human, social, and institutional capital. Where Is the Wealth of Nations?(World Bank, 2006) show that education - a social capital and the rule of law - an institutional capital accounted for most of the intangible capital of developed nations "contributing a large share of total wealth, an estimated 60–80 percent in most developed countries". This suggests that public sector capital expenditure in these areas affect economic development.

This study deviates from the previous classifications and re-classify public expenditure into four capital components in accordance to the pillars of sustainable development which play significant roles in the 'Wealth of Nations' and based on the Keynesian hypothesis treat Gross Domestic Product (GDP) as returns to these expenditures and monitor the individual capital components contribution. The classifications derived from the CBN (2013) statistical bulletin are; Economic services as productive capital expenditure (PCE), Social and Community services as human capital expenditure (HCE), General administration as institutional capital expenditure (ICE) and Transfers capital expenditure (TCE). Following the above introduction, the paper is organized as follows. Section two reviews related literature. Section 3 explores our methodology while in section four we present our data analysis and results. Finally, section 5 contains the conclusions of the study.

2. Empirical Literature Review

2.1. Institutional Capital Expenditure and Economic Growth

The importance of institutional capital in economic development has been canvassed and discussed both nationally and internationally. For instance, Platje **(**2008) provide a 'theoretical model in New Institutional Economics (NIE)' that examines the importance of institutional capital for sustainable development and conclude that the concept of an institutional equilibrium as it relates to institutional capital is an important determinant 'stimulating or hampering sustainable development'. This becomes clearer when we consider Stephenson (2007) who posed a question on the appropriate role of the judicial system in promoting economic development at the Annual World Bank Conference on Development Economics which gathered to discuss "Judicial Reform in Developing Economies: Constraints and Opportunities", and gave three reasons why the judiciary is important to development. He states that 'courts enforce and secure contract and property rights', which are 'important for fostering productive investment', 'improve economic performance by correcting various market failures' and that 'judicial enforcement can make commitments—particularly commitmentsby government—more credible'.

Feldand Voigt (2006) 'investigated the impact of judicial independence (JI) on economic growth for a cross section of about 80 countries'. They introduce two indicators of JI one measuring de jure and another measuring de facto JI and using growth theories modeling as found in Haan and Sturm (2000) they report that De facto JI has a strong, significantly positive impact on economic growth, while de jure JI does not. To appreciate what the de jure and de facto indicators are, Feldand Voigt (2006) explain that de jure indicator includes: 'the modus of nominating or appointing highest judges, their term lengths, the possibility of reappointment, the procedure of removing them from office, their pay and possible measures against reduction of their income, the accessibility of the court, the question of whether there is a general rule allocating cases to specific judges, and publication requirements concerning the decisions of the court' while 'de facto indicator includes variables such as the effective average term lengths, the number of times judges have been removed from office since 1960, the question of whether their income has remained at least constant in real terms since 1960, the question of whether the size of the budget of the court has remained at least constant in real terms since 1960, the number of cases in which the relevant articles of the constitution were changed as well as the number of times in which other government branches remained inactive when their action was necessary in order to implement a court ruling'. Dakolias (2003) in her speech to the European Union (EU) Judiciaries Representatives at The Hague, Netherlands on 'the Role of the Judiciary for Economic and Social Development' reiterated the importance of an effective judiciary for economic and social development and informed her listeners then that the World Bank sees a link between the judiciary, and more broadly the rule of law, and economic and social development. The essence and implication of these studies for the present research is to highlight the need for public sector capital expenditure in the institutions of state and governance processes that ensure effective and efficient economic activities necessary for growth of the economy.

2.2. Productive Capital Expenditure and Economic Growth

In examining the effect of fiscal policy variables on economic growth in South Africa for the period 1990 to 2004, Ocran (2009) found that government consumption expenditure as well as

Gross fixed capital formation has significant positive effects on economic growth. Sutherland *et al.* (2009) ran a cross country growth regression of infrastructure on economic growth and confirmed that investment in public infrastructure; especially in the telecommunications and energy generation sector have strong and significant effect on economic growth. Semmler *et al.* (2007) investigated the role of fiscal policy (especially the level and composition of public expenditure) to promote sustainable growth and welfare in 35 low and middle –income countries. The study apply the production function approach and conclude that composition of public investment expenditure matters and suggests that about two-third of public investment should be directed towards public infrastructure that facilitates market production. Earlier, Haque and Kim (2003) has examined the impact of public investment on economic growth of 15 developing countries using dynamic panel data techniques and found that public investment in transportation had significant effects on economic growth. This supports Easterly and Rebelo (1993) who used cross-section and panel data of different samples for more than 100 countries and concluded that investment in transportation and communication has a positive and strong effect on economic growth.

2.3. Human Capital Expenditure: Health, Education and Economic Growth

It has been repeatedly said that "Health is Wealth". The health of the population of a nation is crucial to meeting its developmental goals and thus a sin qua non for economic growth. In view of this reality, studies have examined the relationship between health and economic growth. For instance; Azeem *et al.* (2013) writing on the "Impact of Human Capital Development on Economic Growth of Pakistan: A Public Expenditure Approach"examined the relationship between human capital development and economic growth of Pakistan using secondary data from 1978 to 2008. They estimated the direction and magnitude of the coefficients for both short run and long run relationships using co-integration and error correction techniques. They report that expenditures on health have positive and statistically significant effects on the economic growth rate in the short run while expenditures on education have significantly positive long run impacts. Specifically, they distinguish between two measures of education (as used in their study) and report that primary school enrolment has positive while secondary school enrolment has negative impacts for both short and long runs relationships. As a result they conclude that 'there is a vast yet unfulfilled potential for Pakistan to move to higher trajectory of growth by investing in people in terms of education and health'. However, a prior study by Sayantan (2012) on the "Relationship between public education expenditures and economic growth: The case of India" show that expenditure on education though a necessary condition was not a sufficient condition for economic growth. This outcome was rationalized by reference to the fact that the effectiveness of education investments depends on other factors such as the institutional structure and labour market characteristics that determine whether 'skilled workers in the economy will engage in growth-enhancing or rent-seeking activities'.

In another empirical study, covering 28 developing economies, Dao (2012) examined the impact of various government expenditure programs on economic growth and found that growth in per capita GDP is determined by growth in per capita health expenditure, per capita public expenditure on education and total health expenditure. Interestingly, Balaji (2011) had applied Johansen and Julius cointegration and Granger causality methods on state level data from Southern Indian states for the period 1960-2009, 'to examine the dynamic relation between health expenditure and economic growth' and found that no long-run relation exist between

health expenditure and growth, but that a unidirectional causality runs from economic growth to health expenditure for Andra. Also, Usman *et al*. (2011)categorized Public expenditure into human capital expenditure, infrastructure expenditure and expenditure on administration and examined the impact of each sector on economic growth using augmented Solow model in Cobb-Douglas form. They conclude that in the short run public expenditure has negative impact on growth but the Cointegration and Vector Error Correction analysis indicate a statistically insignificant long run relationship between public expenditure and growth. Their results also show that both health and education variables have positive but statistically insignificant relationship with economic growth. These results obtain even as Nketiah-Amponsah (2009) had analyzed the effect of aggregated and disaggregated expenditures on economic growth in Ghana over a period of 35 years and concluded that expenditures on health and infrastructure promote economic growth.

Using a different specification, Weil (2007) had used adult survival rate of men as a proxy for health and report that health is a significant determinant of income variation. Specifically, he found that on average, 18.5% of the 'cross-country changes in income were explained by cross-country differences in health status'. Before Weill (2007), Acemoglu and Johnson (2006) used life expectancy at birth as a measure of health of population on economic growth and found that a small initial positive effect of life expectancy on total GDP was not sufficient to compensate for the increase in population and therefore conclude that life expectancy does not lead to economic growth. But Nisha (2006) used life expectancy and health expenditure as health variables and analyzed the effect of health - on economic growth in Fijis over a period of 33 years. Nisha's (2006) estimation shows that life expectancy has a significant effect on economic growth. Previous studies in health and economic growth analysis such as Arora (2001) examined the influence of health on economic growth of ten developed countries over a period of 125 years and concluded that health increased their pace of growth by about 35%. Similarly, Mayer (2001) used data from Latin America countries and conclude that there was a 'strong evidence of a unidirectional causality from health to income to the extent that the improvement in the health of adults and the aged led to some permanent increase in annual income of about 1.15%' while Zon and Muysken (2001) found that an increase in life expectancy promotes economic growth.

Yousra *et al.* (2014)examined the effect of public expenditure on education on economic growth in Algeria over the period 1974-2012 using endogenous growth model based on the Cobb Douglas form with five variables - Real Gross National Product (GDP), Capital (K), Labor (L), and Expenditure on Education (SEDU). They apply Ordinary Least Squares (OLS), Johansen Co-integration and Causality Tests and affirm that public expenditure on education affects positively economic growth in Algeria.

Japheth *et al.* (2014) extend Babatunde and Adefabi (2005) and 'investigated the Impact of public expenditure on tertiary education on economic growth in Nigeria' for the period 1990 to 2011 under a VAR-based approach of cointegration and error correction technique and confirm that public expenditure on tertiary education has positive impact on economic growth in Nigeria. Earlier, Babatunde and Adefabi (2005) had investigated the long run relationship between education expenditure and economicgrowth in Nigeria between1970 and 2003 through the application of Johansen cointegration techniqueand vector error correction model and report that public expenditure on education positively and significantly affects economic growth.

3. Methodology

3.1. Data

Annual data for public sector capital expenditure as reclassified in this study for the period 1960-2013 were sourced from the publications of the Central Bank of Nigeria (CBN) Statistical Bulletin several issues.

3.2. Analytical procedure/Model Specification

The study adopted the Johansson (1991, 1995) cointegration test to analyze the Public sector capital expenditure and Economic development data to determine if there exist long-run relationships between them. The Johansson cointegration test is a vector autoregression (VAR) based model of order p given by:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + \beta x_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where y_t is a k-vector of non-stationary variables I(1), x_t is a d –vector of deterministic variables, and $\varepsilon_t$is a vector of innovations. According to E-Views 7.0 Users Guide 11, Vector Autoregressions (VAR) introduced by Christopher Sims (1980) is an 'econometric model used to capture the evolution and the interdependencies between multiple time series'.

Specifically, the study models a five-variable system of equations that includes: Gross Domestic Product (GDP), Productive Capital Expenditure (PCE), Human Capital Expenditure (HCE), Institutional Capital Expenditure (ICE) and Transfers Capital Expenditure (TCE). To establish causality and investigate the short run dynamics between public sector capital expenditure components and economic growth when the variables in my model are cointegrated, the error correction model (ECM) was implemented. A vector error correction model (VECM) is a restricted VAR designed for use with nonstationary series that are known to be cointegrated (see E-Views Users Guide 11 Pgs.478, 685 – 692).

3.3. Econometric Issues, Unit Root Test and Software used

A test for cointegration is only valid when working with series that are known to be nonstationary. Thus, the Augmented Dickey-Fuller (ADF) Unit root test was implemented to investigate the integration properties of all the variables included in the study. Furthermore, to effectively conduct the analysis using the proposed methods, E-views 7.0 software - a product of Quantitative Micro Software, LLC was employed.

4. Analysis and Results

TABLE 1: Augmented Dickey and Fuller (ADF) Unit Root Tests

Variable	ADF t-stat.	McKinnon critical values		~I(d)
		5%	10%	I(1)
GDP	-7.392061	-2.919952	-.597905	I(1)
HCE	-8.609794	-2.919952	-.597905	I(1)

ICE	-4.555616	-2.919952	-597905	I(1)
PCE	-8.575114	-2.919952	-.597905	I(1)
TCE	-8.212902	-2.921175	-.598551	I(1)

The ADF unit root tests based on Akaike info criterion (AIC) with specified Lag Length = 1 show that all the variables are integrated of order one [I(1)] and therefore qualify for our cointegration and error correction model analyses.

4.2. Cointegration results

Table 2: Johansson Cointegration results

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.664217	104.7123	69.81889	0.0000
At most 1 *	0.423242	49.05658	47.85613	0.0384
At most 2	0.206666	20.98958	29.79707	0.3583
At most 3	0.138408	9.182539	15.49471	0.3488
At most 4	0.030599	1.584898	3.841466	0.2081

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob. **
None *	0.664217	55.65576	33.87687	0.0000
At most 1 *	0.423242	28.06700	27.58434	0.0434
At most 2	0.206666	11.80704	21.13162	0.5668
At most 3	0.138408	7.597641	14.26460	0.4211
At most 4	0.030599	1.584898	3.841466	0.2081

* denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values.

From table 2 above, both the Trace test and Max-eigenvalue test indicates 2 cointegrating equations at the 0.05 level of significance and produce a normalized cointegration equation for GDP as follows:

GDP = 11.33HCE + (-7.78)ICE + 3.36PCE + (-11.20)TCE 2

Having established that our variables are cointegrated, we apply the error correction model and estimate the system equation with GDP as the dependent variable to test for both short-run and long-run causality.

4.3. Error Correction Estimates

The error correction estimates show that the GDP cointegrating equation is properly signed with a coefficient of -0.0913, a standard error of 0.0192 and t-statistics of

-4.7449. The fit of the model is very tight at R-squared (R^2) = 0.828 and Adjusted R-squared = 0.7722. To establish and confirm causality between GDP and the predictor variables (HCE, ICE, PCE and TCE), we estimate the systems equation for GDP using ordinary least squares (OLS) regression analysis. The estimated GDP system equation and the results are shown below.

Table 3: The estimated GDP system equation and the results

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.091287	0.019239	-4.744888	0.0000
C(2)	3.586517	1.179626	3.040384	0.0043
C(3)	-0.049699	0.118206	-0.420447	0.6766
C(4)	-0.047026	0.262747	-0.178979	0.8589
C(5)	-1.424097	1.091672	-1.304511	0.2001
C(6)	-0.060333	0.940825	-0.064128	0.9492
C(7)	2.974647	0.583872	5.094693	0.0000
C(8)	4.264559	0.638340	6.680704	0.0000
C(9)	0.052258	0.169014	0.309195	0.7589
C(10)	-0.268814	0.164249	-1.636621	0.1102
C(11)	-0.562156	0.279903	-2.008398	0.0519
C(12)	0.906101	0.287382	3.152953	0.0032
C(13)	-21550.72	9272.610	-2.324127	0.0257

R-squared 0.827959, Adjusted R-squared 0.772162, F-statistic 14.83879, Prob(F-statistic) 0.000000 Durbin-Watson stat 2.047445

4.4. Long-run causality

From the results in table 3 above, C(1) is the coefficient of the cointegrated model for GDP and represents the speed of adjustment towards long run equilibrium. With a significant and negative coefficient for C(1), the study indicates that there exist a long-run causality running from the predictor variables (HCE, ICE, PCE and TCE) to GDP. C(2) is the coefficient of the cointegrated model for HCE and show there is no long-run relationship when the second cointegratingequation is considered.

4.5. Short-run model - Wald statistics

We apply the Wald statistics to establish if the predictor variables in any way influence GDP

Table 4: Wald Test: Null Hypothesis: C(3) = C(4) = C(5) = C(6) = C(7) = C(8)= C(9) = C(10) = C(11) = C(12) = 0

Test Statistic	Value	df	Probability
F-statistic	15.01891	(10, 37)	0.0000
Chi-square	150.1891	10	0.0000

The results of the Wald coefficient tests with F-statistics and the Chi-square statistics both significant at the 5% level show that together, HCE, ICE, PCE and TCE causes GDP in the short-run. Thus we reject the hypothesis that the coefficients of the predictor variables are equal to zero. However, the OLS, and further Wald test analysis indicate that individually, short run causality runs from Institutional as well as Transfers capital expenditure to GDP albeit positively and negatively respectively. On the other hand there is no short run causality between PCE, HCE and GDP. Further diagnostics tests on the estimated OLS equation include: tests for serial correlation, heteroscedasticity and normality tests. These tests; Correlogram Q-Statistics tests, Breusch-Godfrey Serial Correlation LM Test, and heteroscedasticity Test ARCH indicates that there is no serial correlation and Heteroscedasticity ARCH in our model. Nevertheless, the Jarque-Bera normality test shows that the standardized residuals of the model are not normally distributed.

5. Conclusions

In this study, public sector capital expenditure was disaggregated and classified into four capital components: productive, human, institutional and transfers capital expenditures and evaluated in terms of their short-run and long-run relationship as well as direction of causality with economic development. The study covered the period 1960 to 2013 and applied the Johansson cointegration analysis, error correction model and Wald coefficient test to analyze the data. From the Johansson cointegration analysis, both the Trace test and Max-eigenvalue test indicates that our five variables system of equations are cointegrated at the 0.05 level of significance. The result of the error correction model indicates that causality runs from the predictor variables to economic development. These results agree with Babatunde and Adefabi (2005), Yousra et al. (2014) andAzeem et al. (2013) but at variance with the findings of Srinivasan (2013), Balaji (2011), and Usman,et al (2011) as reviewed above. However, only Institutional and Transfers capital expenditures affect economic development in the short-run albeit positively and negatively respectively. We recommend that in the short run, public sector capital expenditure should be prioritized in favour of developing institutional capital and managing transfers capital expenditure to reduce its negative impact on economic development. In the long run, a coordinated policy on public sector capital expenditure is required to sustain the positive impact of public sector capital expenditure components on economic development.

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