

## PUBLIC CAPITAL INVESTMENTS AND NIGERIA'S ECONOMY: AN ERROR CORRECTION MODEL APPROACH

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### **Abstract**

*Motivated by the need to evaluate the prevailing interrelationships between disaggregated elements of government capital investments and Nigeria's economic growth, this study covered the period 1981 to 2019. It employed time series secondary data obtained from Central Bank of Nigeria's Statistical Bulletin. Stationarity/unit root, cointegration, lag-length selection criteria and error correction tests were employed. The findings revealed that government capital investment in education is the most valuable factor in explaining Nigeria's economic growth along with government's capital investment on construction and transport/communication. Others failed the significance test. In light of the findings, the study recommends that; (i) Government should increase investments in education for the enhancement of human capital development for overall economic growth in Nigeria. (ii) There should be strict budgetary control and financial discipline to ensure that the funds provided are properly channelled to projects and implemented wholly. (iii) Proper monitoring of the projects by the supervising agencies to safeguard these investments against abandonment and (iv) A national plan for agricultural development should be set up by the government as agriculture have potentials in generating huge employment for the country's economic growth.*

*Key Words: Human Capital, Material capital, Economic Growth, Expenditure, Investment.*

### **Introduction**

The contributions of government capital investments to the economic growth of Nigeria have been of special interest to academic researchers globally. The size and weight of public investments in the economy particularly in human and material capital, greatly determined the extent of the country's economic performance (Olulu, Erhieyovwe & Andrew, 2014; De Long & Summers, 1991). These investments

comprise of roads, building of schools, health and education and other critical infrastructures to jumpstart economic growth of the deloping nations (Rosenstein-Rodan, 1943; Ahmed & Malik, 2012).

It is expected, that government's capital investments should ordinarily improve over time, so as to set the pace for continuing national output improvements with associated multiplier effects to accelerate additional capital stock formation

(Nnamdi, Omotayo & Onugha, 2018). The increased output of goods and services resultantly cause economic growth of the country. To steadily improve production of goods and services that reasonably better the standard of living of the accumulation of saving for investments in capital goods and other factor inputs (Nurske, 1953).

Government capital investments are basically classified into human and material/physical capital investments and a balance in the provision of these investments is geared toward viable national growth in output (Olulu *et al.* 2004). The study underscored investments in education and health as the essential part to improve the productivity of labour due to constant training and retraining together with health care facilities to provide skilled workforce in good and sound health that will promote optimum capacity utilization and by extension, economic growth (Ranjan, 2008).

In advancing the crucial nature of public investments, Bhatia (2002) contended that developing nations are known for increased government capital investment as it ensures the reduction of regional inequalities in economic growth. The study affirmed that a rise in public expenditure on government overheads as well as infrastructural amenities is assuredly a precondition for the economic growth of any country. Investments like transport/communication, education including highly skilled training for industrial personnel/installations are prominent aspects of government capital investments. Investments in capital infrastructures is capable in driving economic performance as asserted by Barro and Sala-i-Martin (1992).

The Structural Adjustment Programme (SAP) of government initiated in the early 1980s was conceived as remedial for efficiency in government businesses

(Ojimadu, Amiebi and Ogu, 2016). The intent and purpose revolve around capital formation. Further, to the above, deliberate financial reforms were embarked upon, with a view to reducing cost of funds and resultantly induce real sectors participation (Shuaibu & Ndidi, 2015). These efforts and many others will result in local capacity utilization and production of goods that meet the tastes and demand of the local populace through creation of home made goods (Awolabi-Merus, 2015). The above feat will resultantly generate increased demand for and production of efficient human and physical capital investment infrastructure (Awolabi-Merus, 2015).

The expansion of government capital investment will prompt national economic prosperity and will result in speedy economic recovery in time of recession (De Long and Summer, 1991). This was asserted strongly by the likes of Ray (2013). The accumulation of investible funds is a function of saving and usually gradual. Consequent upon this, the resulting economic growth also followed a gradual trend (Nnamdi, Omotayo and Onugha, 2018). To ensure the desired economic growth of nations, there is a lead argument that countries should keep aside a portion of its income in saving so as to avoid spending all outputs in immediate consumption (Nurske, 1953). In the view of Nurske (1953), the saving will be allocated to material capital investments.

Other scholars proffered empirical evidence for government's capital investments, showing the two major constituents. Bowman (1961), Kuznets (1961, 1971) together with Schultz (1962) incorporated material and human capital investments. They recognized investments in education, health, research and other social services as vital segments of public capital

investments. On the basis of this, Shaheen *et al.* (2013) observed that investment in human competencies and capabilities provide innovative workforce and technology for improved output for economic growth.

Usman *et al.* (2011) posit partly, the need for government intervention in availing public infrastructures to ensure improvement in economic conditions for future development and bridge the economic growth gap. The deliberate and timely investments in education, social security, health, agric improvement as well as provision of telecommunication, power supply, road transport facilities and welfare services. These sectors still need further investments.

Several studies have been conducted on the influence of government capital investments on national economic growth, both in advanced or less developed countries. Studies like Laudau (1986), Kelly (1997), Achauer (2000), Haque and Kim (2003), Egert, Kozluk and Sutherland (2009), Bleaney, Gemmel and Kneller (2001), Akpolat (2014) were carried out on other economies. Results show conflicting positions or at best in most cases, country specific. The above studies aggregated the variables into human and material capital investments. These main categories were regressed separately on gross domestic product.

However, these studies did not decompose human and material investments into the composite variables of education, health, social services, agriculture, construction, transport and other economic services. Further, other studies conducted in Nigeria like Ogiogio (1995), including recent studies by Usman and Agbede (2015), Vincent, Nwosu and Okonma (2013), Olulu *et al.* (2014),

Ugwuegbe and Uruakpa (2013), Shuiab and Ndidi (2015), Oluwatobi and Ogunrinola (2011), Nnamdi *et al.* (2018) and Werigbelegha and Peter (2018) all aggregated government capital investments under two main classification of human and material public investments. These studies all show varying relationships between each of human and material capital investments and Nigeria's economic growth/progress but also failed to decompose government capital investments into specific components/variables and their relationships with economic growth.

Several other studies conducted by scholars took the specific and sectoral approach and their individual/respective influences on economic growth. Particularly, Alexious (2007), Bose, Haque and Osbon (2007), Singh and Weber (1997), Nurudeen and Abdullahi (2010), Egbo, Nwankwo and Okoye (2016), Isola and Aladi (2017), Fray and Perotti (1994), Eneji, Dickson and Bisong (2013) and Atoyebi, Olaleye, Ishola, Adekunjo and Kadiri (2013) all took specific dimensions of government capital investments and their interrelationships with economic growth.

The earlier studies do not reflect currency of data at all. Based on the foregoing and identified gaps, it is therefore pertinent to embark on this study using new evidences and latest data to ascertain the interrelationships between government capital investments variables and Nigeria's economic growth.

The time scope for this study covers the period 1981-2019 (40 years). The results are hoped to be of significant interest to both policy makers and drivers of the private sector of the economy in Nigeria, as they would hopefully add to the list of objective criteria for formulation of new policies and/or modification of existing policies.

Having dealt with the introductory part, the rest of this study is divided into four sections. Section 2 provides the theoretical framework and literature review while section 3 deals with the materials and methods. Section 4 presents the results and analysis of same, while section 5 deals with the discussions, conclusions and policy recommendations.

### **Theoretical Framework and Literature Review**

#### **Theoretical link Between Public Capital Investments and Economic Growth:**

The following theories underpinned the study of public capital investment and economic growth:

#### **The Balance Growth Theory**

The balance growth theory got empirical backing from the work of Nurske (1953). It states that for investments to be plausible and feasible in developing countries, there is need for massive investments, occurring at the same time in diverse sectors or industrial sectors. When this is done, it propels the achievement of large scale market in terms of size, productivity increase, purchasing power enhancement, increment in domestic demand as well as provision of favourable business environment for private investments activities in the promotion of economic growth. The investments that can prompt such massive economic growth can only be undertaken by government due to the risks associated and/or inherent in such investments outlay. This resultantly constitutes a limitation excluding the private sector from participating in such form of large scale investment programs as noted in Ray (2010).

#### **The Big Push Theory**

According to Rosenstein-Rodan (1943), less developed nations/economies find it difficult to attain the needed development and continue to lag behind in achieving the take-off of significant development. To achieve significant kick-start of the envisaged country's economic development, it is incumbent on that nation to initiate a minimum amount/quantum of investment aggregated to jump-start the process of economic development. In driving the point, it was asserted that just as an airbus gathers initial momentum on the runway before take-off into the airspace using minimum up-thrust, the theorem opined that the accumulation of saving on a gradual and continuous manner will not support the benefits that can jerk up development, owing to the effect of depreciation and obsolescence. The depreciated resources initially accumulated deny the economy of the expected yield of the capital funds. In a contrary observation, Ellis (1958) together with Viner (1956) opined that due to indivisibility feature of investment programs, the theory and the application are significantly limited from achieving the expected results.

#### **Keynes' Theory of Public Investment**

Keynes (1936) theory of public investment assumed that changes in public expenditures will promote to a large extent, short-term economic stability and engender higher long-run national growth. Keynes posited that public expenditures contribute positively to economic growth. Increasing government consumption will lead to increased employment, profitability and investment through multiplier effects on aggregate demand. These multiplier effects demonstrate the causality between public expenditure and national growth in income. Public investments resultantly contribute

positively and in no small measure to sectoral economic growth such as agriculture, manufacturing and service oriented products of a country.

Accordingly, the Keynesian theory further stated that increased public spending spinned the economy out of depression. Short run government intervention is the cure for a recessed economy. When government spends, individuals are given purchasing power and producers will invariably increase production, creating more employment. The Keynesian theory of public expenditure derived empirical back up from some studies in Nigeria like Ighodaro and Oriakhi (2010), Njoku *et al.* (2014) and Adigun (2017).

### **Empirical Review**

Several scholars have researched into the interrelationships occurring between public sector human and physical capital investments in the Nigerian economic space. A detailed review of these studies deserve prominent attention to grant empirical retrospective backing to the current study.

Nnamdi *et al.* (2018) examined the predictive relationships that subsist between government capital investment expenditures and Nigeria's economic growth. The study utilized data sourced secondarily from Nigeria's Central Bank's Statistical Bulletin spanning 36 years (1981 to 2016). The study adopted Unit Root, Ordinary Least Squares, Co-integration, Error Correction as well as Granger's causality tests to obtain the short run and long run prevailing relationships including the assessment of how the employed variables reinforce themselves for growth promotion. The analysis results show both short and long term sensitivities among the human capital as well as material capital investment in connections with economic growth. The causality tests, however,

demonstrate significant insensitivities of public sector capital investments in relation to Nigeria's national economic growth. Following from the findings, the study consequently assert that successive public authorities should take up abandoned projects by their predecessors to stem down public investments abandonment. The issue of inconsistent policy guidelines demean public governance and as such, fiscal and budgetary framework must be committedly followed to curtail wastage of government financial resources as recommended in the study.

Barro (1991) conducted a cross sectional study of 98 sampled nations covering the period 1960 through 1985. The analysis took into cognisance mean annualized growth rate of per capita Gross Domestic Product together with the ratio of real government spendings to real gross domestic product (Real GDP). A negatively significant relationship was found between public consumption expenditures and economic growths of sampled countries.

Additional evidence was provided by Jong-Wha (1995) on the interrelated influence of government investment spendings in respect of importation of capital goods on national economic growth. Substantial evidences affirm that public investment expenditures have significant relationship with economic growth. Besides, it was asserted that government investment and/or capital accumulation capacity shows significant contribution to economic output growth.

To the credit of Laudau (1986), it is affirmed that increase in public expenditure contribution to Gross Domestic Product has reducing effect on economic growth. Taking a perspective view of the above, the study finds a supportive evidence as posited by the pro-market reasoning that argued that in the

long-run, increased public spending causes reduction in economic growth of countries.

In a similar study, Kelly (1997) studied the influential relationship between publicly incurred spending/expenditure and economic growth of 73 nations. This study covers 1970 to 1989 (a duration of 20 years). A significantly positive result was evidenced maintaining that government spendings in terms of public investment together with social security expenditures possess significant potentials to promote national economic growth.

In another study that focused on the economy of Greece, Alexiou (2007) provided evidence underscoring the effectiveness of disaggregated public expenditures in asserting that there exists a strong significant relationship between overall government investment spendings and the country's economic performance. To this end, the Greek economy enjoyed significant economic growth via deliberate investments in public infrastructures. In a different but related empirical study, Achauer (2000) showcased that government expenditure indicates a significantly positive relationship with economic growth in the sampled economies.

From the sectoral perspective, Bose *et al.* (2007) conducted a study using panel data to ascertain the effects of sectorally allocated government expenditure on national growth of 30 sampled nations with data spanning period 1970 to 1990. On the aggregate, the bulk of government capital investments show positive correlation with national economic growth. Taking individual sector into focus, government investment expenses in education was found to maintain positive significance in strengthening economic growth of the sampled economies.

Utilizing fifteen emerging economies/countries, Haque and Kim (2003) executed a study on the influence of government investment spendings on the economic growth of the sampled nations. Dynamic data utilized in the analysis. Findings reveal that government expenditure in respect of transport was strongly significant in promotion of nation economic growth.

In a cross-country approach, Egert *et al.* (2009) evaluated the effects of government infrastructure on economic performance. Findings show the efficacy of national investment in the telecommunication and energy/power generation sector in promoting economic growth. In support of the above results, Romp and De-Haan (2005) concluded that government investments in public goods induce economic growth.

Ram (1986) utilized the production functions to evaluate the effectiveness of government expenditure in relation to the privately owned and publicly owned investments in the national economy. Surveying 115 nations, valuable externalities was exerted by government investments on the growth of the nations in focus.

The Switzerland economy was put into focus by Singh and Weber (1997) to access the linkage the country's investments in public infrastructure have on economic growth, covering 1950 to 1994 periods. The broad classes of public investments including social security, justice delivery, human capital, transportation and defence spendings were conducted using multiple regression on economic growth of Switzerland. Findings provide reliable ground to evidence that public expenditures improve the overall economic growth of Switzerland. To be specific, human capital investments (education and health

spendings) show concrete evidence for the promotion of the country's GDP. The likes of social security, Judiciary, transportation and defence infrastructures were statistically immaterial. Particular spending on education was noted to be positive and significant in substantiating economic growth in Swiss economy. Fiscal investments in health infrastructures maintained negative trends during the study period in relation with gross domestic product of Switzerland.

Iheanacho (2016) evaluated the short run and long-run interrelationships between government spending investments and the national economic growth. The co-integration technique together with error-correction models were utilized to substantiate the estimation of the breakdown of gross capital formation using Cobb-Douglas production functionality. On the one hand, findings show insignificant relationship between the variables in the long-run while there exists evidence of significantly positive relationship occurring in the model. This portrays the short-term estimation having recurrent expenditures driving the growth of the economy of Nigeria.

Nurudeen and Abdullali (2010) argued that the government of Nigeria is increasing annually the nation's expenditures but poverty is still unabated. They employed selective sectoral data to ascertain the extent of relationships subsisting between each of government's capital and recurrent fiscal spendings and the Nigerian gross domestic product. Results revealed negative relationships between the variables. On the contrary, transportation, communications, as well as health showed positive inter-relationships with gross domestic product. In the light of the core findings, the study recommended that increased budgetary spending in the studied

sectors with negative and insignificant probability values will avoid wastage of public resources. The near comatose sectors will resultantly be active and promote economic progress.

Usman and Agbede (2015) considered government's capital investments as they affect economic growth in Nigeria. The study covered 1970 to 2010 periods. The results of long-run estimation affirmed positively significant results between both fixed and variable capital investment infrastructures and gross domestic product. The short-run estimations revealed that recurrent expenditure contributes significantly to economic growth while capital infrastructures still exhibited negatively significant relationships with gross domestic product. Taking Granger technique of causality estimations, the finding of the study furnished substantial evidence of unidirection in causing the reinforcement between each of recurrent and capital spending and GDP with the causal effect flowing from GDP to the capital as well as recurrent expenditures. Based on the foregoing, the study recommended improvement and sustainability of national economic progress through equitable allocation of the country's resources (funds) to capital as well as current public investments nationally.

Ogiogio (1995) argued that there exists a significant long-run influence between public expenditures and Nigeria's economic growth. In a bid to draw concluding remarks, evidence from result strongly affirmed that recurrent public investment promotes economic growth while capital investment remained low in promotion of the desired growth.

Dike-Ogu *et al.* (2016) evaluated the influential capacity of government public spending as it relates with the growth of

Nigeria's economy, taking data covering period 1970 to 2013. Conducting this study, they employed both aggregated and disaggregated format of data while considering money supply as control variable. The model was analysed using Dickey Fuller, multiple regression and Error Correction techniques. Results show in strong term that aggregated public investments do not show any significant relevance in influencing the growth of Nigeria's economy. Further, disaggregated public investment spendings influence GDP significantly. The study recommended among others, the channeling of funds properly to promote/stimulate growth and stability in price. Appropriate strengthening of law enforcement and judicial institutional frameworks to moderate corruption, reduce diversion of budgeted funds and to a large extent, checkmate misappropriation of public funds was further recommended.

Narayan (2006) classified government expenditure mainly into consumption and capital accumulation expenditures. The researcher opined that public capital investment expenditure shows positive influence on the output growth. As well, public investments possess positive and strong significance on production growth overall in the economy. The increasing trend of current consumption expenditure demonstrated growth retardation, while affirming the efficacy of investments in human capital (education), having positive impacts on growth.

Bleaney *et al.* (2001) splitted public expenditure into productive spending and non-productive spending. Public productive expenditure provides positive impact while recurrent/non-productive expenditures are negatively characterized in terms of growth promotion in OECD nations over the period 1970 to 1995. From the above and other

empirical outcomes, it is asserted that mixed concluding results abound that it appears that there is no consensus on whether or not public investments in education infrastructure affect economic growth.

In an attempt to unravel the contribution of educational investment spending with evidence from Russian and Ukraine, mainly robust economies of the erstwhile soviet union, Ararat (2007) delved into the essence of human infrastructural investments as regards the overall economic growth. Taking the stand-point of the endogenous school of thought for economic growth, selected levels of learning were studied. The post-primary and post-secondary/tertiary levels were especially focused to ascertain if they played roles in driving these soviet economies as seen today. Considering the model estimation, no relationship was established between the variables in terms of growth potentials while the system equation results reveal that increased access to further tertiary education provides positive impacts in regard to per capita gross domestic product growth especially in the long-run. These diverse results create a good ground for further empirical adventure in this domain of government investment expenditure and growth of the economy.

Nurudeen and Abdulahi (2010) disaggregated public investment expenditure and related the individual constituents like education with economic growth in Nigeria. The results specifically validated education investment spending with valuable contributions to national economic growth. On this note, therefore, the study recommended increased spending on the educational sector by public authorities so as to achieve massive economic growth of the country as the study emphasized that education is the nursery



bed for incubation of necessary skills required for overall national growth.

Vincent *et al.* (2013) evaluated the interrelationships between economic growth and public expenditures/investments in human capacity improvement in Nigeria's economy over the periods 1980 to 2012. Human investment expenditures were segmented into public spending on education, Hospital facility/health infrastructure spending as well as social and communal service delivery. For simplified classification, the study sub-divided public spending into capital/material expenditures and recurrent/human factor expenditures. The study utilized Vector Autoregression, co-integration including Granger's causality model. Prominent among the findings is bidirectional causal relationships flowing from both government capital and recurrent investments in human capital to real gross domestic product over the study period. Further, a uni-direction of causality was observed running from government investments in capital invested in human beings to public recurrent investments in human capital. In the light of the foregoing, the study recommended increased public investment expenditures in human and intellectual capital for resultant economic growth.

Adekunle and Aghedo (2015) examined public investment in human capital infrastructure and productivity increase in economic output in Nigeria. Some specific indicators of human capital including government real expenditure on education, public current spending on educational infrastructure, level of educational awareness and admission into school rate as they influence economic growth in Nigeria. The study used secondary data from 1980-2013 that were sourced from the publications of National Bureau of

Statistics (NBS) and Central Bank of Nigeria (CBN) on the identified variables. The error correction modeling (ECM) technique was used to analyze the relationship between human capital development and productivity growth over the specified period through the ordinary least square (OLS) framework. It was found that government recurrent expenditure on education; literacy rate and school enrolment rate positively and significantly affect productivity growth in Nigeria. However, government capital expenditure on education records negative but significant relationship with productivity growth. This may be due to the high level of corruption that characterized the disbursement and utilization of fund meant for public projects. The study recommends that proper distribution of capital and recurrent funds on the educational sector to achieve the desired level of growth in the country.

Simon-Oke (2012) investigated the linkage between public investment expenditures in human/intellectual capital and industrial productive activities in the Nigerian economy. Data was collected from secondary sources over the period 1978 to 2008. Johansen's cointegration, error correction, as well as Granger causality tests were executed in the study. The results show that public expenditure on educational and intellectual investments demonstrated significant positive long-run relationship with index of industrial productivity. On further analysis, it was asserted that public investment spending on health care and gross fixed capital formation were characterized by negative long-run cointegration with the explained variable. Following from the results, it was recommended there is an urgent need to improve the fiscal allocation for the acquisition of material capital infrastructure.

When this is achieved, human capital training as well as technical knowhow will resultantly be realised while the output of goods and services will definitely create multiplier effects which would make the Nigerian economy to become prosperous in the long-run.

In a related study Ditimi and Nwosa (2011) evaluated the effectiveness of human capital expenditure as it concerns the promotion of Nigeria's economic growth. Like Simon-Eke (2012), Ditimi and Nwosa (2011) adopted vector error correction (VEC), cointegration and pair-wise Granger causality tests. The study covered 1970 to 2009. The results affirmed significant long-run relationships among the study variables and resultantly recommended increased fiscal budgetary allocation to education and health. Further recommended was the establishment of functional vocational training centres for training and inculcation of technical competencies needed to promote national economic growth in Nigeria.

### Materials and Methods

For clarity of presentation and analysis, this part is further divided into the sub-parts that follow;

#### Research Design

The quasi-experimental research design was adopted in this study.

#### Data and Employed Variables Description

The employed time series data are presented in this section as follows to reflect the numerical trend of employed variables over the study period 1981-2019. The data for this study is as indicated in appendix 1.

#### Model Specification

Since governments capital investment outlays in the form of human and material capital investments

theoretically induce some multiplier effects on the economy, the generalized form of the model adopted for this study following Kelly (1997), Usman and Agbede (2016) as well as Dike-ogu *et al.* (2016) is modified and specified as follows;

$$GDP = f (EDU, HEH, OSC, AGR, CON, TRC, OES.....)(1)$$

#### Where:

GDP = Gross domestic product,

EDU = Government capital investments on education,

HEH = Government capital investments on health,

OSC = Government capital investments on other social and community services,

AGR = Government capital investments on agriculture,

CON = Government capital investments on construction,

TRC = Government capital investments on transportation and communication and

OES = Government capital investments on other economic services.

For estimation purposes, equation (1) is re-written as follows;

$$GDP_t = \beta_0 + \beta_1 EDU + \beta_2 HEH + \beta_3 OSC + \beta_4 AGR + \beta_5 CON + \beta_6 TRC + \beta_7 OES + \mu_t.....(2)$$

Where

$\beta_0$  = Constant/intercept,  $\beta_1$  to  $\beta_7$  are coefficients of the independent variables respectively while  $\mu_t$  is the stochastic term.

#### Apriori Expectations

Theoretically, increased government's capital investments in education directly boost the level of human capital development in the country. This will certainly promote the national output

through improved contributions of the educated work force. Accordingly, a positive relationship is theoretically expected between government's capital investments in education and Nigeria's gross domestic product. Further, it is theoretically asserted that increases in public investments in health care will resultantly improve the quality of human capital of the nation. Accordingly, a healthy workforce will invariably reduce medical expenditure as well as enhance the productivity of the human capital. In this regard, a positive relationship is theoretically expected between government's capital investments in health and Nigeria's gross domestic product. Similarly, increases in government investments in social and other community services is theoretically expected to stimulate national economic growth. Therefore, government's investments in social and other community services is expected to relate positively with gross domestic product.

In accordance with multiplier theory, government's material investments in construction, agriculture, transport/communication, as well as other economic services are expected to enhance national economic progress. The multiplier effects all constitute a boost and promote the businesses activities in the real sector for increased national outputs respectively. On this note, positive relationships are expected between these variables and economic growth in Nigeria. Given that increases in government's human and material capital investments would theoretically be expected to induce some multiplier effects on Nigeria's economy, it is correspondingly expected that sensitivities of Nigeria's GDP to increases in those capital investments components will each be greater than zero. In summary, it is expected that;

$\beta_1 > 0; \beta_2 > 0; \beta_3 > 0; \beta_4 > 0; \beta_5 > 0; \beta_6 > 0; \beta_7 > 0.$

#### **Specification of Analytical Tools and Tests:**

This study is fundamentally driven by the need to ascertain empirically, the relative influences of government's human and material capital investments on economic growth in Nigeria. Further the study is also to ascertain the extent to which government's capital investments promote as well as support economic growth and vice-versa in Nigeria. To further enshrine detailed clarification of the needful analytical experimental instruments, this sub-section is further expanded as highlighted hereunder:

#### **Stationarity Tests**

The stationarity properties or otherwise of the time series data employed would need to be ascertained through unit root tests. This is to ensure that employment of the time-series data will not lead to any spurious estimates. In this vein, according to Brooks (2009), the Augmented Dickey Fuller (ADF) test will be deployed. The decision rule is to reject the null hypothesis when the resulting ADF test statistic is on absolute basis, more than all their associated Mackinnon's critical values at 1%, 5% and 10% levels of significance.

#### **Multiple Regression (Ordinary Least Squares) Test**

The multiple regression test captures the short-run estimates of the prediction function. Accordingly, the significance level of the corresponding t-statistic of any of the independent variables is expected to be not less than 0.05 for the null hypothesis of statistical insignificance to be rejected, in accordance with Maddala (2007), Brooks (2009) and Gujarati, Porter and Gunasekar (2009). Multiple regression analysis will be

employed only if all the variables are stationary at levels.

### Johansen's Cointegration Test

Johansson's Co-integration test will be utilized to ascertain the level of long-term equilibrium relationship that prevails among the employed set of study variables (Brooks, 2009). The decision rule according to Maddala (2007) is that the value of the Max-Eigen statistics should be higher than the critical value at 0.05 level.

### Error Correction Estimates (ECM)

Brooks (2009) asserts that the ECM tends to evaluate the extent of long-run

sensitivities of the explained variable to variations in each of the explanatory variables. Further, it provides information on the speed at which the dependent variable adjusts back to long-run equilibrium following short run distortions in the independent variables. The study therefore, intends to employ ECM conduct this investigations.

### Presentation of Results

The results of the tests executed are presented in the various sub-sections that follow;

### Presentation of Stationarity (Unit Root) Tests:

**Table 4.1: Presentation of Results of Unit Root Test: (Augmented Dickey Fuller) at First Difference.**

Variable	ADF T-statistics	Mackinnon's test critical values @			Probability Level	Order of Integration	Decision
	1st difference	1%	5%	10%			
D(GDP)	-5.468656***	-3.621023	-2.943427	-2.610263	0.0001	I(1)	Stationary
D(EDU)	-4.704018***	-3.689194	-2.971853	-2.625121	0.0004	I(1)	Stationary
D(HEH)	-5.696654***	-4.262735	-3.552973	-3.209642	0.0017	I(1)	Stationary
D(OSC)	-5.907754***	-4.226815	-3.536601	-3.200320	0.0001	I(1)	Stationary
D(AGR)	-6.879551***	-3.626784	-2.945842	-2.611531	0.0000	I(1)	Stationary
D(CON)	-5.631244***	-4.323979	-3.580623	-3.225334	0.0003	I(1)	Stationary
D(TRC)	-4.960637***	-3.621023	-2.943427	-2.610263	0.0003	I(1)	Stationary
D(OES)	-6.557400***	-3.626784	-2.945842	-2.611531	0.0000	I(1)	Stationary

**Source:** Extracts from E-Views 10.0 output.

From the unit root results of the first difference presented in table 4.1, all the study variables are observed to be stationary at first difference. In essence, the Augmented Dickey-Fuller (ADF) statistics for the study variables are all greater than their respective MacKinnon's critical values at 1%,

5% and 10% levels. Their accompanying level of significance are all higher than 0.05, the preferred level of significance. In all, the first difference unit root estimations reveal stationarity at first difference. Consequently, all the study data are acceptable for further estimations procedure in the study.

### Results of Johansen's Co-integration Test

**Table 4.2: Presentation of Results of Johansen's Co-integration**

Date: 11/15/20 Time: 11:07

Sample (adjusted): 1983 2019

Included observations: 37 after adjustments

Trend assumption: Linear deterministic trend

Series: D(GDP) D(EDU) D(HEH) D(OSC) D(AGR) D(CON)  
D(TRC) D(OES)

Lags interval (in first differences): 1 to 1

#### Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.991336	453.6689	159.5297	0.0000
At most 1 *	0.963091	277.9734	125.6154	0.0000
At most 2 *	0.713755	155.8993	95.75366	0.0000
At most 3 *	0.697418	109.6157	69.81889	0.0000
At most 4 *	0.592808	65.38577	47.85613	0.0005
At most 5 *	0.391656	32.14234	29.79707	0.0264
At most 6	0.293771	13.75278	15.49471	0.0900
At most 7	0.023597	0.883574	3.841466	0.3472

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

#### Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.991336	175.6954	52.36261	0.0000
At most 1 *	0.963091	122.0742	46.23142	0.0000
At most 2 *	0.713755	46.28355	40.07757	0.0088
At most 3 *	0.697418	44.22996	33.87687	0.0021
At most 4 *	0.592808	33.24343	27.58434	0.0084
At most 5	0.391656	18.38955	21.13162	0.1160
At most 6	0.293771	12.86921	14.26460	0.0821
At most 7	0.023597	0.883574	3.841466	0.3472

Max-eigenvalue test indicates 5 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

**Source:** E-Views 10.0 output extract

From the results of Johansen's cointegration tests in table 4.2 above, the Trace statistics evidence the prevalence of 5 cointegrating equations. The results affirm the existence of long run relationships

among the main variables under study. Thus, it is concluded that there exists a long term relationship between the dependent variable and the explanatory variables.

### Determination of Lag Lengths Selection Criteria for Employment of Error Correction Model:

Establishment of lag lengths is essential for error correction estimations. Basically owing to the fact that post investment disbursements could be effective on economic growth in a later periods. To ascertain the most suitable lag for the time series, the study proceeds to evaluate the

lag length selection criteria. Before undertaking the error correction modelling, the study proceeds to evaluate the lag length selection criteria. Basically, suitable lag length determination enables the study determines the appropriate lag to infuse into the error correction model. The results in table 4.3 below reveal the lag order selection criteria of the study.

**Table 4.3: Results of Lag Length Selection for D(GDP) D(EDU) D(HEH) D(OSC) D(AGR) D(CON) D(TRC) D(OES)**

VAR Lag Order Selection Criteria

Endogenous variables: D(GDP) D(EDU) D(HEH) D(OSC) D(AGR)  
D(CON) D(TRC) D(OES)

Exogenous variables: C

Date: 11/15/20 Time: 11:10

Sample: 1981 2019

Included observations: 36

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1531.759	NA	1.95e+27	85.54218	85.89408	85.66500
1	-1262.022	404.6066	2.31e+22	74.11231	77.27935	75.21769
2	-1060.862	212.3351*	2.00e+19*	66.49234*	72.47452*	68.58028*
3	-589.4776	288.0683	2.06e+10	43.85986	52.65719	46.93037

\* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

**Source:** E-Views 10.0 output extract

The results shown in table 4.3 above revealed the prevalence of lag length 2 as the most effective lag length to be adopted in the study. Consequently, the lag periods of two (2) years was considered as most appropriate. Having confirmed the lag length, the study proceeds to conduct the error correction model estimations.

### Presentation of Error Correction Model Estimations

To ascertain the nature of long run dynamics in the study model, the Error Correction analysis estimation was implemented. The results are presented in table 4.4 below:

**Table 4.4: Results of Error Correction Estimation**

Error Correction Model

Dependent Variable: GDP

Date: 11/15/20 Time: 11:13

Sample (adjusted): 1983 2019

Included observations: 37 after adjustments

Maximum dependent lags: 1 (Automatic selection)

Model selection method: Akaike info criterion (AIC)

Dynamic regressors (2 lags, automatic): D(GDP) D(EDU) D(HEH)

D(OSC) D(AGR) D(CON) D(TRC) D(OES)

Fixed regressors: C

Selected Model: ARDL(1, 2, 2, 0, 1, 1, 1, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
EDU	53.04008	10.78148	4.919555	0.0001
EDU(-1)	13.17443	8.453123	1.558528	0.1341
EDU(-2)	20.51426	8.355535	2.455170	0.0229
HEH	-27.79543	10.61100	-2.619492	0.0160
HEH(-1)	-63.76028	10.37539	-6.145336	0.0000
HEH(-2)	-22.44206	10.92945	-2.053357	0.0527
OSC	-32.15885	9.841151	-3.267793	0.0037
AGR	-31.80408	12.20571	-2.605673	0.0165
AGR(-1)	-36.96669	11.32816	-3.263256	0.0037
CON	-3.654103	9.160294	-0.398907	0.6940
CON(-1)	40.17120	13.78670	2.913764	0.0083
TRC	0.258643	14.32355	0.018057	0.9858
TRC(-1)	50.99169	20.21241	2.522791	0.0198
OES	10.29419	5.286652	1.947204	0.0650
C	539.4781	728.0262	0.741015	0.4669
R-squared	0.899487	Mean dependent var	35748.73	
Adjusted R-squared	0.899120	S.D. dependent var	20246.34	
S.E. of regression	600.6305	Akaike info criterion	15.93231	
Sum squared resid	7575898.	Schwarz criterion	16.62892	
Log likelihood	-278.7477	Hannan-Quinn criter.	16.17790	
F-statistic	2725.628	Durbin-Watson stat	1.528899	
Prob(F-statistic)	0.000000			

\*Note: p-values and any subsequent tests do not account for model selection.

**Source:** E-Views 10.0 output extract

From the results in table 4.4 above, government's capital investment in education (EDU) is statistically significant in relation to economic growth (GDP) of Nigeria over the study period. This is reflected in the co-efficient of 53.04008 and t-statistic value of 4.919555 at 0.0001 level of significance. Further, government's capital investment in education at lagged one period shows a positively insignificant influence on economic growth (GDP) as indicated by the co-efficient 13.17443 and t-statistic value of 1.558528 which level is 0.1341 thereby, failing at specified 0.05 level. Also, government's capital investments in education in lag 2 period evident a positively significant relationship with economic growth at 0.0229 level.

The results show that government capital investments in health have a negatively significant influence on gross domestic product (GDP) of Nigeria. The evidence in the co-efficient of -27.79543 and t-statistic value of -2.619492 at 0.0160 significance level supports this assertion. Further, while government's capital investment in health at lag 1 is significant with significance level of 0.0000, that of lag 2 has a significance level of 0.0527, which fails the 0.05 significance level test. On the whole, the negative relationship between public investments in health and growth in GDP might have resulted from inability of the government and health managers in Nigeria to ensure productive deployment of resources deployed to health sector with attendant leakages, which might have been induced by massive corruption in the Nigerian public sector as reflected in overinvoicing of public contracts.

In another development, government's capital investment on other social and community services (OSC) shows a negatively significant sensitivity on the

economic growth of Nigeria. This is reflected in the negative coefficient of 32.15885, t-statistic of -3.267793 and significance level of 0.0037 which is above specified minimum value of 0.05. these public services that are typically social in nature and could largely be said to be directly non-productive in terms of direct contribution to GDP. However, they tend to constitute serious expenditures especially for the political class, which on their own, do not positively influence the productive base. In the same vein, government's capital investment in agriculture (AGR) shows a significantly negative influence on the GDP of the country as revealed in the coefficient of -31.80408, t-statistic of -2.605673 at 0.0165 level of significance. The lagged 1 period further confirmed the negative significance of agricultural sector investments in promoting economic growth as visible in the negative coefficient of 36.96669, t-statistic of -3.263256 and significance level of 0.0037. These results might have emanated from the fact that the various levels of government have only on yearly, basis, budgeted and invested in agricultural projects as evidenced by provision of fertilizers to farmers etc. However, most of these farm inputs have been said to have been largely diverted to the market in place of the intended direct user farmers, who ended up buying them at commercial rates. These generally provide a strong indication that government investment in agriculture over the period has not been enough to provide food security for the country and could not translate to the desired economic growth, with attendant periodic food shortages witnessed in the country.

Government's capital investments in construction (CON) at current period have coefficient of -3.654103, t-value of -0.398907 at 0.6940 significance level while



that of lag 1 has coefficient of 40.17120, t-value of 2.913764 and 0.0083 level of significance. The positive relationship of public investments in construction at lag 1 with GDP confirms the multiplier effects of construction activities of Nigeria's economy which serves an engine of growth and potentially, provides an economic turnaround factor for various economic sectors in the country.

Government's capital investments on transport/communication show positive but insignificant influence on Nigeria's gross domestic product in the current period with a coefficient of 0.258643, t-value of 0.018057 and 0.9858 level of significance. However, public investments in transport/communication in the lag 1 period relates positively with economic growth which is confirmed by a co-efficient value of 50.99169 and t-statistic value of 2.522791 which is significant at 0.0198 level. This could have probably resulted from the the importance attached to the transport/communication sector as reflected in the extensive employment opportunities they create as well as the fact that they are largely private sector driven with higher efficiency in management.

Government's capital investment on other economic services (OES) has a positive but insignificant effect Nigeria's GDP as indicated by the coefficient value of 10.29419 and t-statistic of 1.947204 with probability value of 0.0650 at 0.05 level of significance. However, this sector is mainly service driven and its contribution to the economy could have been hindered greatly by usual leakages in public sector business.

The co-efficient of determination ( $R^2$ ) of 0.899487 indicates that about 89.95% of the variations in Nigeria's gross domestic product in the long term, is accounted for by variations in the study's explanatory

variables after adjustments for shocks in the system. This is a reflection of the resultant changes in the Nigeria's economy to changes in the capital investment outlays in the studied explanatory variables for overall economic growth. Further, the results reveal in strong terms, that both human and material capital investments activities embarked upon by the government significantly promote economic growth in Nigeria. On the whole, the probability value of 0.000000 for the F-statistic indicates a good line of fit in the long run, while the Durbin-Watson value of 1.528899 remains within the acceptable range even in the long run.

#### **Discussions, Conclusions and Policy Recommendations**

Government's capital investment on education (EDU) revealed positive and significant relationship with gross domestic product (GDP) of Nigeria.

During the current and lagged-two periods. However, education was insignificantly related with GDP in the lag-one period. In all, positive relationships exist between government's capital investments in education and Nigeria's economic growth.

Government capital investment in health (HEH) showed a negative and significant influence on gross domestic product (GDP) at the current, first and second lags. This is a clear reflection of the deficit of health infrastructural investments in Nigeria.

Government's capital investment on other social and community services (OSC) displayed negative and significant influence on gross domestic product (GDP). Further, government's capital investments in agriculture (AGR) demonstrated an inverse but significant influence on gross domestic product (GDP) at both current and first lags.

Government's capital investments on construction (CON) showed negative and insignificant sensitivity on gross domestic product (GDP) in the current period. However, a positive and significant influence was found between the variables in the subsequent period (lag one period). Also, a positive but insignificant relationship prevailed between government's capital investment on transport/communication and Nigeria's gross domestic product (GDP) in the current level while it showed positive and significant relations at lag one. This could result from implementation lag in the execution of transport/communication infrastructures which usually span several years before completion in Nigeria. Government's capital investment on other economic services (OES) revealed positive but insignificant influence on gross domestic product of Nigeria in the current period.

From the findings of this study, the following conclusions are reached in line with the model specified. The model expressed Nigeria's gross domestic product as a function of government's capital investment in education (EDU), government's capital investment on health (HEH), government's capital investment on other social and community services (OSC), government's capital investment on agriculture (AGR), government's capital investment on construction (CON), government's capital investment in transport/communication (TRC) and government's capital investment in other economic services (OES) respectively. These conclusions include:

- i. Nigeria's gross domestic product (proxy for economic growth) is most sensitive to variations in public investments in education among all the explanatory variables in the study.
  - ii. Among the explanatory variables employed in this study (government's investments in education, health, other social and community services, agriculture, construction, transport/communication and other economic services), government's investments in education, health, other social and community services, agriculture, transport/communication and construction are the most valuable in explaining variations in Nigeria's economic growth, while government's investments on other economic services remains the only factor which is not valuable.
- In the light of the above conclusions, the study recommends as follows:
- i. Government should increase investments in education for the enhancement of human capital development for overall economic growth in Nigeria.
  - ii. There should be strict budgetary control and financial discipline to ensure that the funds provided are properly channelled to projects and implemented wholly.
  - iii. Proper monitoring of the projects by the supervising agencies to safeguard these investments against abandonment.
  - iv. A national plan for agricultural development should be set up by The government as agriculture have potentials in generating huge employment for the country's economic growth.

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**Appendix 1**

**Gross Domestic Product (GDP), Government's Capital Investments on: Education (EDU), Health (HEH), Other Social and Community Services (OSC), Ariculture (AGR), Construction (CON), Transport/Communication (TRC) and Other Economic Services (OES) in Nigeria for the period 1981 to 2019 (N'b).**

Year	GDP	EDU	HEH	OSC	AGR	CON	TRC	OES
1981	15258.00	0.16543	0.08446	0.04486	0.01303	0.09666	0.03242	0.03354
1982	14985.08	0.18793	0.09595	0.05096	0.01480	0.10981	0.03682	0.03811
1983	13849.73	0.16215	0.08279	0.04397	0.01277	0.09475	0.03177	0.03288
1984	13779.26	0.19890	0.10155	0.05394	0.01566	0.11623	0.03897	0.04033
1985	14953.91	0.25860	0.13202	0.07013	0.02036	0.15111	0.05067	0.05244
1986	15237.99	0.26271	0.13412	0.07124	0.02069	0.15351	0.05148	0.05327
1987	15263.93	0.22501	0.04131	0.03121	0.04615	0.40908	0.18058	0.05886
1988	16215.37	1.45880	0.42280	0.23260	0.08300	0.69360	0.22720	0.21740
1989	17294.68	3.01180	0.57530	0.64300	0.15180	0.49100	0.29520	0.48100
1990	19305.63	2.40280	0.50070	0.49250	0.25800	0.63440	0.28780	0.43350
1991	19199.06	1.25630	0.61820	0.80240	0.20870	0.40680	0.23860	0.44930
1992	19620.19	0.29130	0.15016	0.89469	0.45597	1.14087	0.55239	0.93088
1993	19927.99	8.88238	3.87160	1.90584	1.80381	2.32346	2.02701	1.59558
1994	19979.12	7.38274	2.09398	0.60870	1.18329	1.14409	0.44550	1.13699
1995	20353.2	9.74640	3.32070	0.75370	1.51040	1.69910	1.08090	1.62750
1996	21177.92	11.49615	3.02371	1.46932	1.59256	0.93250	2.06847	0.15943
1997	21789.1	14.85354	3.89110	3.31549	2.05888	1.80798	1.57911	0.75443
1998	22332.87	13.58949	4.74227	3.10967	2.89170	5.63462	1.92149	1.12690
1999	22449.41	43.61065	16.63877	11.12178	59.31617	16.63877	11.12178	0.00000
2000	23688.28	57.9566	15.2181	11.6103	6.3358	4.9911	3.0347	14.2304
2001	25267.54	39.8826	24.5223	15.2255	7.0645	7.2020	33.9334	4.8085
2002	28957.71	80.5309	40.6214	31.0331	9.9936	7.4521	29.3871	6.1186
2003	31709.45	64.7822	33.2680	4.5574	7.5374	16.9514	22.6790	48.9030
2004	35020.55	76.5277	34.1985	23.6645	11.2566	14.8976	8.0722	24.5552
2005	37474.95	82.7971	55.6630	13.1865	16.3260	17.9154	8.0415	22.0257
2006	39995.5	119.0180	62.2536	12.8975	17.9190	20.0604	9.7723	31.9354
2007	42922.41	150.7793	81.9094	23.9852	32.4842	71.3618	32.1609	43.0650
2008	46012.52	163.9775	98.2193	70.7292	65.3990	94.4643	67.3855	86.5024
2009	49856.1	137.1160	90.2000	126.8700	22.4352	80.6285	90.0279	230.5155
2010	54612.26	170.8000	99.1000	281.0000	28.2179	57.0910	42.4060	435.0385
2011	57511.04	335.8000	231.8000	217.8361	41.2000	195.9000	13.1000	60.3000

<b>2012</b>	59929.89	348.4000	197.9000	243.7565	33.3000	83.3000	23.2000	90.3000
<b>2013</b>	63218.72	390.4248	179.9869	273.6556	39.4310	92.1896	18.5149	141.0991
<b>2014</b>	67152.79	343.7550	195.9768	235.0344	36.7000	116.3000	18.3000	95.1000
<b>2015</b>	69023.93	325.1900	257.7000	224.7000	41.2700	114.6000	24.3850	95.1000
<b>2016</b>	67931.24	339.2824	200.8240	235.4456	36.3045	97.9186	20.5677	100.9855
<b>2017</b>	68490.98	403.9571	245.1880	282.5346	50.2607	126.1942	29.9738	128.4658
<b>2018</b>	69810.02	465.3011	296.4428	321.9853	53.9877	150.1738	30.4714	137.9148
<b>2019</b>	71,387.83	593.3328	388.3671	411.8602	70.2745	189.0881	40.7490	178.9146

**Source:** Central Bank of Nigeria Statistical Bulletin (2019).