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ARTICLE

Government Capital Expenditure and Private Sector Investment in Nigeria: Co-integration Regression and Toda-Yamamoto Causality Analysis

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ABSTRACT

This paper analyzed the relationship between government capital expenditure and private investment in Nigeria using time series data spanning from 1981 to 2016. Government capital expenditure was disaggregated into different components and ADF unit root test was employed to establish the stationarity properties of the variables in the model. The result of Johanson co-integration test revealed that the variables have long run relationship. Co-integration regression results suggested that capital expenditure on physical assets and defense displaced private sector investment while government capital expenditure on human capital and public debt servicing promote private sector investment in Nigeria. The results of T-Y causality revealed the bidirectional causality between private sector investment and government capital expenditure in Nigeria. Based on these findings, the paper recommends that government capital expenditure should be channel to human capital in order to promote private sector investment in Nigeria. In addition, the Nigerian government should pay more attention to capital expenditure on physical assets since it has a significant impact on private sector investment. Lastly, Nigeria government should address the issue of budget delay, corruption, and mismanagement in Nigerian institutions.

Keywords: Government Capital Expenditure, Infrastructure, Defense and Internal Security, Human Capital and Private Sector Investment.

1 Introduction

Over the past decades, the relationship between government capital expenditure and private sector investment has formed part of the debatable issues in development economics (Xu and Yan, 2014). The debate is premised on the role of government capital expenditure in stimulating private sector investment. Since private investment is regarded as a panacea to economic difficulties such as unemployment and low productivity which almost crippled the progress of developing countries. Obviously, the debate has degenerated into two strands which centered on whether government capital expenditure substitute, complement or match private sector investment. These strands are known as "Crowd-out Hypothesis (Ricardian Equivalence theory)" and "Crowd-in Hypothesis". Besides, Adolf Wagner, a German Economist also submitted that the relationship between government capital expenditure and private sector investment is better explained by "Wagner Hypothesis".

The classical school of thought who propounded the "Crowd-out Hypothesis" argued that an increase in government capital expenditure depresses private investment which in turn retards economic growth (Xu and Yan, 2014). This is premised on the fact that interest rate rises as government capital expenditure rises and hence discouraged private investors from stepping up investment due to the decline in the amount of loanable fund. Furthermore, the Classical school of thought claimed that an increase in government capital expenditure financed through taxes exacerbates the economy by increasing the costs of inputs and hence discouraged private investors. These arguments are better summarized by the Ricardian Equivalent theory

which suggests that an increase in government capital expenditure financed by market borrowing or taxes posed a great danger to the private sector by reducing the availability of credit and increasing the real cost of capital (Adji and Alm, 2016).

Contrariwise, the Keynesian school of thought who pioneered the "Crowd-in Hypothesis" asserted that an increase in government capital expenditure elates private investment by promoting economic activities. Most especially, government capital expenditure on infrastructure (such as roads, communication services, electricity, among others) reduced the cost of production by allowing firms to produce and transport more efficiently. In addition, government capital expenditure on human capital (such as education and health) helps to increase firms' productivity and hence increases their returns or profitability. The Wagner hypothesis, in contrast, suggested that the relationship between government capital expenditure and private investment depends on the size of government. This view argued that government capital expenditure complements private investment at the initial stage and the relationship changes to being substitutive as government expands the scope of its activities (Foye, 2014). This lack of consensus in the theoretical literature gave rise to many empirical studies (Yovo, 2017; Makuyana and Odhiambo, 2018; Akinlo and Oyeleke, 2018) that are inconclusive. Consequence upon these arguments, the net effect of government capital expenditure on private investment is an empirical question.

This paper contributes to the existing studies in three different ways: Firstly, the paper disaggregated government capital expenditure into different categories such as capital expenditure on physical assets, defense and internal security, human capital and public debt servicing in order to ascertain the kind of government capital expenditure that promote or retard private investment in Nigeria. This is very important as most of the recent studies except Gbenga, Babatunde and Esther (2015) ignored the heterogeneous nature of government capital expenditure in Nigeria. Secondly and most importantly, the paper analyses the impact of defense spending (which has attracted much attention because of the rising activities of Niger-Delta Avengers, Boko-Haran insurgency and Headmen/farmer crisis) on private investment in Nigeria. Thirdly, the paper employs robust single equation techniques to determine the long run impact of government capital expenditure on private investment in Nigeria. These techniques are superior to the techniques used in the existing literature because they better addressed asymptotic bias and dealt with the problems of endogeneity and serial correlation of OLS. Importantly, single equation techniques produce statistic that better approximate standard normal density. Finally, the paper probes the direction of causality between government capital expenditure and private investment in Nigeria using Toda-Yamamoto (T-Y) causality test.

2 Literature Review

The relationship between government capital expenditure and private investment remains a major discourse in development literature. At the height of the discussions, two major hypotheses were propounded; these are the "Crowd-out and Crowd-in Hypotheses". The "Crowd-out Hypothesis" suggests that government capital expenditure retards private investment. According to Voss (2002), government capital expenditure financed by market borrowing lowered loanable fund and increase the real cost of capital to the private sector. In addition, government capital expenditure financed by taxation aggravates the economy and increase the cost of inputs, leading to a reduction in the expected output growth and private investment (Khan and Kumer, 1997). The "Crowd-in Hypothesis" on the other hand shows that government capital expenditure promotes private investment. This view argued that government involvement in economic activities is very crucial in the growth process of any nation. As a result, the theory encourages government involvement in economic activities through the use of deficit called fiscal policy. This Keynesian argument was based on the principle of multiplier where a change in government spending induces a greater change in output (Olweny and Chiluwe, 2012).

The empirical literature on the relationship between government capital expenditure and private investment are inconclusive. For instance, Afonso and Aubyn (2019) used a VAR analysis to investigate the effect of public investment on private investment in 17 OECD countries over the period 1960 to 2014. The result

of their impulse response functions indicated that public investment is positively related to economic performance in most countries and negatively related to economic performance in Finland, the UK, Sweden, Japan, and Canada. Furthermore, they reported that public investment hinders private investment in Belgium, Ireland, Finland, Canada, Sweden, the UK, and promotes private investment in the rest of the countries. On the contrary, Nguyen and Phong (2018) probed the effect of public expenditure on private investment and economic growth in Vietnam using a panel vector auto-regression combined with GMM from 1990-2016. Their findings revealed that public investment and state sector investment have a positive long-run effect on economic growth in most industries. In the same vein, they submitted that public investment is positively related to domestic private investment and foreign direct investment both in the short- and long-run.

Moreover, Akinlo and Oyeleke (2018) used error correction model to analyze the relationship between government expenditure and private investment in Nigeria over the period 1980 to 2016. Their findings indicated that inflation and interest rate have a significant adverse effect on private sector investment in the long run, while government expenditure is positively related to private investment. Furthermore, Akinlo and Oyeleke (2018) revealed that interest rate and government expenditure exerted a significant positive impact on private investment in the short-run, while GDP per capita and inflation deterred private investment. In a similar vein, Nguyen and Trinh (2018) explored the impact of public expenditure on private investment and economic growth in Vietnam from 1990 to 2016 using autoregressive distributed lag (ARDL) model. They reported that public investment boosts the level of private sector investment in the short-run, whereas it hinders private investment in the long run. Additionally, the results of their analysis indicated that private investment, state-owned enterprises, and foreign direct investment promote economic growth in the short while only state-owned capital stock has positive impacts on economic growth both the short and long run.

Furthermore, Makuyana and Odhiambo (2018) used a time series data spanning from 1970 to 2014 to examine the contributions of public and private investment to economic growth in Zambia. It is evident from their ARDL results that gross public investment, infrastructural public investment decreased private sector investment both in the short- and long-run. Additionally, Makuyana and Odhiambo (2018) reported that public investment in non-infrastructural discourages private investment in the short-run while a positive relationship exists between the two variables in the long-run. Also, the authors submitted that private investment contributes more to economic growth than public investment in Zambia in the short run and long run.

Borkovic and Tabak (2018) looked at the relationship between public investment and the productivity of Croatian firms over the period 2007-2015 using Ordinary Least Square (OLS) method. The results of their analysis indicated a significant plausible relationship between government investments and total factor productivity (TFP) at the firm level. Besides, Borkovic and Tabak (2018) reported that government investment harms state-owned enterprises in Croatia. Contrariwise, Yovo (2017) attempted to analyze the relationship between public expenditure, private investment, and economic growth in Tongo using time series data spanning from 1980 to 2013. The results of their two-stage least squares technique shown that any attempt to increase public expenditures in Tongo will crowd-out private sector investment in the country. Also, Yovo (2017) revealed a significant positive relationship between federal spending and economic growth.

Dreger and Reimers (2016) looked at the long run relationship between public and private investment in the euro area from 1991 to 2012 using econometric panel techniques. The study submitted that the error correction equation behaved as expected, and the error correction term was consistent with the a priori expectation. Moreso, Dreger, and Reimers (2016) reported that GDP, interest rate, and private investment are co-integrated in the long run. Similarly, Andrade and Duarte (2016) used ADL models to investigate the impact of public and private investment on economic growth in Portugal over the period 1960 to 2013. They submitted that public investment has a positive effect on output and private investment, whereas public debt harms public and private investments.

On the contrary, Dash (2016) who evaluated the relationship between public investment and private investment in India over the period 1970 to 2013 using ARDL model reported that public investment decreases private investment both in the long- and short-run. In addition, Dash (2016) revealed that public investment in infrastructure complements private investment in India. Teklay (2016) attempted to examine the impact of government capital expenditure on the growth of private sector investment in Ethiopia from 1981 to 2014. The multiple regression analysis and co-integration methods results revealed that capital expenditure promotes private investment in the long run. Similarly, Gbenga, Babatunde, and Esther (2015) analyzed the impact of public investment expenditure on private investment in Nigeria from 1980 to 2011. Using error correction framework, the study revealed that central government aggregate investment expenditure and expenditure on defense, health and transportation and, communications promote private investment while central government investment expenditure on education deters private sector investment.

Furthermore, Sinevicienea and Railieneb (2015) examined the nexus between government size, tax burden, and private investment in the European Union (EU) countries using cross-sectional data over the periods 2003 to 2012. The descriptive analysis method revealed that government size and the tax burden are not the only factors discouraging private investment in the EU countries. This finding arguably lent credence to Borkovic and Tabak (2018) and Andrade and Duarte (2016) who submitted that capital expenditure encourages private investment. Xu and Yan (2014) examined the relationship between government and private investment in China using time series data spanning from 1980 to 2011. The Structured Vector Auto-regressive model employed revealed that government investment in public goods has a significant positive impact on private investment while government investment in private goods, industry, and commerce has a significant negative effect on private investment in China. Also, Njuru et al. (2014) attempted to investigate the effect of government expenditure on private investment in Kenya over the periods 1963 to 2012. The study adopted the VAR technique, and the results suggested that both recurrent and development expenditure enhanced private sector investment. This finding contrasts the results of Afonso and Aubyn (2019), Yovo (2017) and Dash (2016). However, it corroborated Nguyen and Phong (2018), Akinlo and Oyeleke (2018) and Xu and Yan (2014). Foye (2014) employed Ordinary Least Square Model to probe the relationship between public capital spending and private investment in Nigeria from 1970 to 2006. The result of the study revealed that public capital spending crowd-out private investment while public capital spending lagged one-time crowd-in private investment

It is evident from the literature reviewed that there is no consensus on the relationship between government capital expenditure and private investment. Some researchers (see Nguyen and Phong, 2018; Akinlo and Oyeleke, 2018; Borkovic and Tabak, 2018 and Andrade and Duarte, 2016) provided evidence in support of "crowd-in hypothesis" while another group of researchers (see Afonso and Aubyn, 2019; Yovo, 2017 and Dash, 2016) found evidence supporting "crowding-out hypothesis". Few others (see Nguyen and Trinh, 2018; Makuyana and Odhiambo, 2018 and Xu and Yan, 2014) reported missed results. It is important to note that the relationship between government capital expenditure and private sector investment depends on the nature of capital expenditure examined and the technique of analysis used. Therefore, this study disaggregated government capital expenditure into different categories such as capital expenditure on physical assets, defense and internal security, human capital and public debt servicing to ascertain the part of government capital expenditure that promotes or retard private investment in Nigeria using co-integration regression.

3 Methodology and Sources of Data

The paper adopted Xu and Yan (2014) model to probe the relationship between government capital expenditure and private investment in Nigeria. Xu and Yan (2014) disaggregated government capital investment into government fixed asset investment in public goods and state infrastructure (Gpb) and, government fixed asset investment in private goods (Gpr). The model is expressed geometrically as follows:

$$PRI = f(Gpb, Gpr) \quad \text{.....1}$$

Considering the Nigerian economy, the study extended Equation 1 by disaggregating government capital expenditure into further categories. Importantly, the paper recognized the enormous attention given to defense and internal security in the country and technically incorporated government capital expenditure on defense and internal security in the model. The augmented version of Xu and Yan (2014) model expressed in Equation 1 is given presented in Equation 2:

$$PRI = f(GCEPA, GCEHC, GCEDS, GCEPD) \quad \text{.....2}$$

Taking the natural logarithms of the variables, Equation 2 is expressed in stochastic form as follows:

$$\ln PRI_t = \alpha_0 + \alpha_1 \ln GCEPA_t + \alpha_2 \ln GCEHC_t + \alpha_3 \ln GCEDS_t + \alpha_4 \ln GCEPD_t + \varepsilon_t \quad \text{.....3}$$

where PRI is private investment and it is measured by the difference between gross fixed capital formation and total government capital expenditure**,** GCEPA is government capital expenditure on physical assets measured by capital expenditure on economic service, GCEHC is government capital expenditure on human capital measured by capital expenditure on social and community service, GCEDS is government capital expenditure on defense and internal security proxied by capital expenditure on administration and GCEPD is government capital expenditure on public debt servicing proxied by capital expenditure on transfer.

ln denotes natural logarithms, t is time series, α_0 is intercept, α_1 to α_4 are the slope of the coefficient of independent variables and ε represents the error term. The a priori expectations are expressed geometrically as $\alpha_1, \alpha_2, \alpha_3$ and $\alpha_4 > 0$

3.1 Estimation Techniques

The paper employed both descriptive and econometric analysis using Eviews 9.0 econometric package to examine the characteristic and the dynamic relationship between government capital expenditure and private investment in Nigeria. The econometric analysis begins by determining the stationarity properties of the variables using Augment Dickey Fuller (ADF) test. This was done to avoid spurious estimates and causality results. The basic test statistic for ADF is presented below:

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{i=1}^{k} \beta \Delta Y_{t-1} + \varepsilon_t \quad \text{.....4}$$

$$\Delta Y_t = \alpha + \Psi_t + \beta Y_{t-1} + \sum_{i=1}^{k} \beta \Delta Y_{t-1} + \varepsilon_t \quad \text{.....5}$$

where Equation 4 and 5 represented untrended and trended ADF test statistic respectively. These two equations were used to determine the order at which the variables were integrated and a variable is said to be integrated at level or I(0) if the ADF test statistic is greater than the critical value at 5 percent otherwise, the variable is I(d) where d represents the number of times the variable is differenced before it becomes stationary.

Having found that all the variables were integrated of order one I(1), the paper determined the optimum lag. In addition, VAR Residual Serial Correlation LM test and Inverse Roots of AR Characteristic Polynomial were employed to test the residual for serial correlation and dynamic stability respectively. Moreover, Johanson co-integration method was used to probe the long run relationship between government capital expenditure and private investment. The basic test equation of Johanson co-integration is stated below:

$$Z_t = \sum_{i=1}^{m} A_i Z_{t-1} + E_t \quad \text{.....6}$$

Equation 6 is rewritten as:

$$\Delta Z_t = \sum_{i=1}^{m-1} \Gamma_i Z_{t-1} + \Pi Z_{t-m} + E_t \quad \text{.....7}$$

where Z_t comprises the n variables of the model and E_t is a vector of random errors. Γ_i and Π are expressed as $-I + A_1 + ... + A_i$ and $-(I - A_1 - ... - A_m) = \alpha.\beta$ respectively. I is a unit matrix, α and β are n×r matrix where α and β denote adjustment matrix (also known as feedback matrix) and co-integrating matrix respectively.

The study used T-Y causality approach to determine the direction of causality between government capital expenditure and private investment in Nigeria. The augmented Vector Autoregressive Model -VAR ($m+d_{max}$) for testing causality based on the Toda-Yamamoto approach is as follows:

$$y_t = \varphi_0 + \sum_{i=1}^{m} \varphi^{i}_{1i} y_{t-i} + \sum_{i=m+1}^{m+d_{\max}} \varphi^{i}_{2i} y_{t-i} + \sum_{i=1}^{m} \varphi_{1i} x_{t-i} + \sum_{i=m+1}^{m+d_{\max}} \varphi_{2i} x_{t-i} + \varepsilon_{1t} \quad \text{.....8}$$

$$x_t = \psi_0 + \sum_{i=1}^{m} \psi^{i}_{1i} x_{t-i} + \sum_{i=m+1}^{m+d_{\max}} \psi^{i}_{2i} x_{t-i} + \sum_{i=1}^{m} \psi_{1i} y_{t-i} + \sum_{i=m+1}^{m+d_{\max}} \psi_{2i} y_{t-i} + \varepsilon_{2t} \quad \text{.....9}$$

where y_t and x_t are the variables of interest, φ and ψ represent the coefficients, $d_{\max}$ represents the highest order of integration of the variables, ε_{1t} and ε_{2t} denote the error terms. The null hypothesis that y_t does not Granger-Causes x_t is rejected if φ_{1i} is different from zero. Also, the null hypothesis that x_t does not Granger-Causes y_t is rejected if ψ_{1i} is different from zero. Finally, bi-directional relationships exist if both φ_{1i} and ψ_{1i} are different from zero.

Furthermore, the paper adopted a non-stationary technique otherwise known as co-integration regression to investigate the relationship between government capital expenditure and private investment. The co-integration regression comprised Fully Modified Ordinary Least Square (FMOLS) developed by Phillips and Hansen (1992), Canonical Co-integrating Regression (CCR) introduced by Park (1992) and Dynamic Ordinary Least Square (DOLS) put forward by Saikkonen (1992) and, Stock and Watson (1993). These techniques addressed the asymptotic bias, and dealt with the problems of endogeneity and serial correlation in Ordinary Least Square model.

3.2 Data Sources

The study sourced for annual time series data for 36 years covering the periods 1981 to 2016 from the Central Bank of Nigeria Statistical Bulletin and World Bank Development Indicators. This time frame is considered because the Federal Republic of Nigeria experienced an increase in the level of capital expenditure and pays more attention to private investment in Nigeria. Figure 1 presents the natural logarithms of the dynamics of government capital expenditure and private investment in Nigeria.

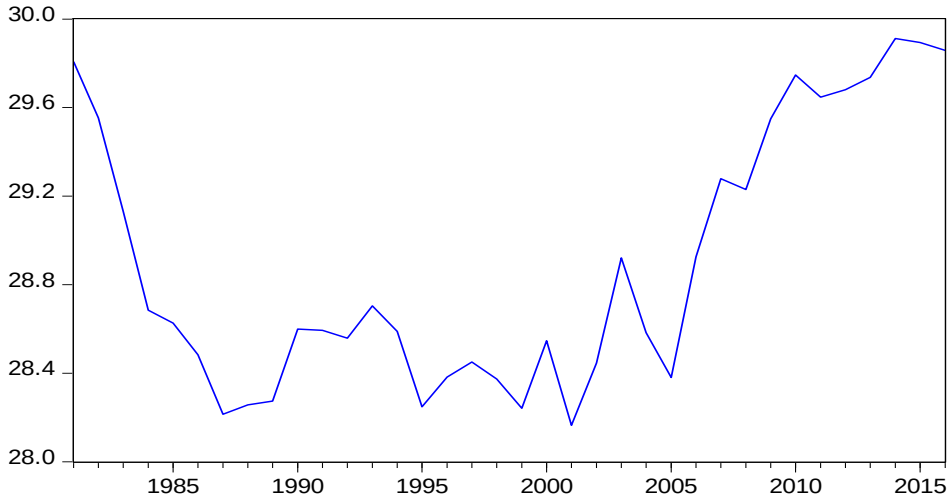

Figure 1: *Dynamic of private investment in Nigeria*

It can be observed from the figure 1 that the natural log of private investment trended downward between 1981 and 2002. However, a significant improvement was recorded in the level of private investment from 2005 to 2016.

4 Analysis and Discussion of Results

Table 1 presents the results of descriptive analysis and the Jarque-Bera statistics suggested that all the variables except LGCEPD are normally distributed. In Table 2, the results of untrended and trended ADF test revealed that all the variables are not stationary at level. However, they are all stationary at first difference. Hence, the paper concluded that all the variables are integrated at order one.

Table 1: *Descriptive Statistic*

	LPRI	LGCEPA	LGCEHC	LGCEDS	LGCEPD
Mean	28.89642	24.49855	23.24691	23.74362	23.62460
Median	28.61269	25.66904	23.72291	24.54931	23.99180
Maximum	29.91224	26.94982	25.76480	26.39885	26.30639
Minimum	28.16449	20.30213	19.28610	19.38652	16.24031
Std. Dev.	0.594070	2.325893	2.021702	2.355429	2.073650
Skewness	0.526093	-0.521428	-0.253861	-0.481516	-1.417176
Kurtosis	1.723398	1.580632	1.621749	1.832701	5.775767
Jarque-Bera	4.105210	4.653231	3.236033	3.435024	22.95189
Probability	0.128400	0.097626	0.198292	0.179512	0.000010
Obs.	36	36	36	36	35

Table 2: *ADF Test Results*

Series	At Level		Series	First Difference		Remark
	Intercept (t-stat)	Intercept and Trend (t-stat)		Intercept (t-stat)	Intercept and Trend (t-stat)	
LPRI	-0.429110	-1.942904	ΔLPRI	-3.216842*	-5.772429*	I(1)
LGCEPA	-0.925955	-1.500352	ΔLGCEPA	-6.144810*	-3.552973*	I(1)
LGCEHC	-0.852794	-1.500352	ΔLGCEHC	-9.293478*	-6.098915*	I(1)
LGCEDS	-1.177054	-0.021743	ΔLGCEDS	-9.878955*	-10.27086*	I(1)
LGCEPD	-1.376836	-1.434355	ΔLGCEPD	-12.31386*	-12.08428*	I(1)
5% Critical Values	-2.954021	-3.557759		-2.957110	-3.622033	

* denotes significance at 5 percent level

4.1 Pre-test Results

Furthermore, the results of the lag length selection criterion presented in Table 3 revealed that SC suggested 1 as optimal lag, LR suggested 2 while AIC, FPE and HG suggested 3. In order to identify the most appropriate lag length, the conducted VAR autocorrelation LM test. The results of the VAR autocorrelation LM test presented in Table 4 revealed that a lag order of 2 strongly rejected the null hypothesis of no serial correlation.

Table 3: *Optimum Lag Selection*

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HG**
0	-154.3350	NA	0.040737	10.98862	11.22436	11.06245
1	-60.26521	149.2142	0.000358	6.225187	7.639631*	6.668173
2	-21.02838	48.70779*	0.000159	5.243337	7.836484	6.055478
3	15.83228	33.04749	0.000115*	4.425360*	8.197210	5.606656*

Note: NA denotes non-applicable *indicates lag order selected by the criteria

Table 4: *VAR Residual Serial Correlation LM Tests*

Null Hypothesis: no serial correlation at lag order h Sample: 1981-2016 Included observations: 31		
Lags	LM-Stat	Prob
1	35.44306	0.0805
2	13.41831	0.9710
3	28.53580	0.2838

Probs from chi-square with 25 df.

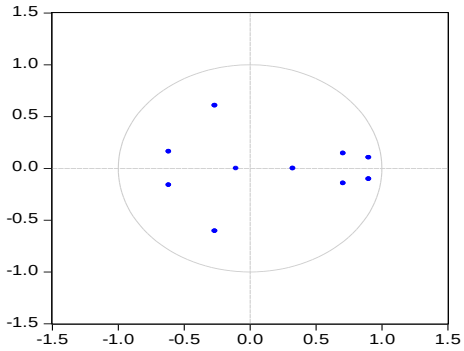

Figure 2: *Inverse Roots of AR Characteristic Polynomial*

Furthermore, the study employed Inverse Roots of AR Characteristic Polynomial to determine the stability of the model and result of the Inverse Roots of AR Characteristic Polynomial presented in Figure 2 indicated that the VAR autocorrelation model is dynamically stable as there was no root outside the unit circle.

4.2 Co-integration Results

Consequence upon the results of the VAR residual serial correlation LM tests, the paper estimated the Johanson co-integration test (which is capable of producing better long-run coefficient estimates compared to Engle-Granger based co-integration test) and T-Y causality tests with an optimal lag order of 2. The results of trace and the maximum eigen-value of the Johanson co-integration test presented in Table 5 suggested three co-integration equation at 5 percent level respectively.

Table 5: *Johnson Co-integration Results*

Sample (adjusted): 1983 2016 Included observations: 31 after adjustments Trend assumption: Linear deterministic trend Series: LOGPRI LOGGCEPD LOGGCEPA LOGGCEHC LOGGCEDS Lags interval (in first differences): 1 to 2 Unrestricted Co-integration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.841784	141.1145	69.81889	0.0000
At most 1 *	0.822753	87.64440	47.85613	0.0000
At most 2 *	0.575935	37.46825	29.79707	0.0054
At most 3	0.245064	12.59008	15.49471	0.1307
At most 4	0.141887	4.437551	3.841466	0.0351
Trace test indicates 3 co-integrating eqn(s) at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.841784	53.47012	33.87687	0.0001
At most 1	0.822753	50.17615	27.58434	0.0000
At most 2	0.575935	24.87816	21.13162	0.0141
At most 3	0.245064	8.152532	14.26460	0.3634
At most 4	0.141887	4.437551	3.841466	0.0351
Max-eigenvalue test indicates 3 co-integrating eqn(s) at the 0.05 level				

4.3 Co-integration Regression Results

Having established the log-run relationship between government capital expenditure and private investment, the study estimated the long-run impact of government capital expenditure on private investment in Nigeria. It can be observed from the results presented in Table 6 that the three techniques generated very similar results for each variable except for the slight difference in the estimates of DOLS. For the results of DOLS, government capital expenditure on physical assets has a significant negative effect on private investment in Nigeria. This implies that a one percent increase in government capital expenditure on physical assets lowers private investment by 0.38 percent, other things being equal. By implication, government capital expenditure on physical assets significantly deters private investment in Nigeria at 1 percent significant level. This finding contrasts *a priori* expectation, however, it corroborated Afonso and Aubyn (2019), Yovo (2017) and Dash (2016) who submitted that government capital expenditure hindered private sector investment.

On the contrary, government capital expenditure on human capital has a positive significant relationship with private investment at 1 percent level. This implies that a 1 percent increase in capital expenditure on human capital promotes private investment by 0.58 percent in Nigeria holding other variables constant. This finding conforms to theoretical prediction and the substantial part of the literature most especially Teklay (2016), Njuru et al. (2014) and Foye (2014) who reported a positive relationship between government capital expenditure and private investment in Nigeria. However, the results contradicted Gbenga, Babatunde and Esther (2015) who submitted that central government investment expenditure on education deters private sector investment in Nigeria. The results further revealed that government capital expenditure on defense and internal security and public debt servicing improved private investment in Nigeria although the impact was very small and insignificant at 10 percent level.

Table 6: *Co-integration Regression Results*

Dependent Variable: LPRIV									
Variables	**DOLS**			**FMOLS**			**CCR**		
	Coeff.	**t-static**	**Prob.**	**Coeff.**	**t-static**	**Prob.**	**Coeff.**	**t-static**	**Prob.**
C	24.86604	42.72100	0.0000*	23.74750	15.57395	0.0000*	23.39797	17.77552	0.0000*
LGCEPA	-0.38169	-12.9615	0.0000*	-0.28459	-1.80112	0.0825**	-0.28493	-1.73842	0.0931**
LGCEHC	0.580204	6.328482	0.0000*	0.713422	3.633092	0.0011*	0.754490	3.091355	0.0045*
LGCEDS	0.003483	0.038594	0.9698	-0.22379	-1.18618	0.2455	-0.26659	-1.15830	0.2565
LGCEPD	0.005484	0.186683	0.8550	0.041523	0.443038	0.6611	0.059528	1.061870	0.2974
R-Square		0.98		0.32			0.30		
Adjusted R-Square		0.96		0.22			0.20		

* and ** denotes significance at 1 and 10 percent level respectively.

For the results of FMOLS and CCR, government capital expenditure on physical assets exerts no positive influence on private investment in Nigeria despite the annual increase in the amount of money targeted at improving the infrastructural facilities in the country. This poor performance of capital expenditure on physical assets is attributable to the mismanagement, budget delay and the escalating rate of corruption in Nigeria. However, the coefficient is significant at 10 percent level. The result suggests that a 1 percent increase in government capital expenditure on physical assets reduces private investment by 28 percent *ceteris paribus*. This result contradicts theoretical reasoning but it conforms to the estimate of DOLS. The coefficient of capital expenditure on human capital significantly promotes private investment. This suggests

that a 1 percent increase in human capital improves private sector investment by about 0.75 percent *ceteris paribus*.

Furthermore, the results of FMOLS and CCR revealed that government capital expenditure on defense and internal security has a significant negative effect on private investment in Nigeria. This suggests that though the share of government capital expenditure on defense and internal security has been rising in Nigeria, it exerts no significant influence on private sector investment. This can be attributed to the use of outdated security measures, rising level of corruption, budget delay and mismanagement in Nigeria. Besides, the sign born by the coefficient of government capital expenditure on defense and internal security contrasts a priori expectation and the result of Gbenga, Babatunde, and Esther (2015. In addition, government capital expenditure on public debt servicing has an insignificant positive effect on private investment in Nigeria. The result of R square adjusted for DOLS suggested that the covariates explained a significant variation in private investment in Nigeria.

4.4 Toda-Yamamoto Causality Results

Empirical results of the Toda-Yamamoto Causality test presented in Table 7 revealed evidence of bidirectional causality between 1) private investment and government capital expenditure on physical assets 2) private investment and government capital expenditure on human capital and 3) private investment and government capital expenditure on defense and internal security in Nigeria. Meanwhile, the results indicated absence of causality between private investment and government capital expenditure on public debt servicing at 10 percent significant level.

Table 7: *Toda-Yamamoto Causality Results*

Null Hypothesis			Chi-Sq.	df	Prob.	Decision
LGCEPA	⟷	LPRI	13.52903		0.0012*	Bidirectional
LPRI	⟷	LGCEPA	4.708765	2	0.0950***	Causality
LGCEHC	⟷	LPRI	6.285844		0.0432**	Bidirectional
LPRI	⟷	LGCEHC	6.996917	2	0.0302**	Causality
LGCEDS	⟷	LPRI	5.883775		0.0528***	Bidirectional
LPRI	⟷	LGCEDS	7.862991	2	0.0196**	Causality
LGCEPD	⟷	LPRI	2.819925	2	0.2442	
LPRIV	⟷	LGCEPD	2.040344		0.3605	No Causality

*, ** and *** denote significance at 1, 5 and 10 percent respectively

5 Conclusions

This paper analyzed the relationship between government capital expenditure and private sector investment in Nigeria from 1981 to 2016. Co-integration regression was used to investigate the long run impact of government capital expenditure on private sector investment while the direction of causality between government capital expenditure and private investment was examined using T-Y causality test. The results of the Co-integration regression revealed that government capital expenditure on physical assets, defense and internal security crowd out private sector investment in Nigeria. Though these results contradicted theoretical reasoning, it is not totally unexpected. This is because corruption has eaten deep into the fabric of the institutions responsible for the provision of physical assets in Nigeria. Also, the security structure in Nigeria is characterized by massive fraud, corruption, and misappropriation of fund which made it difficult for them to employ recently developed security measures to address the security lapses in the country. Similarly, the National Assembly often delayed the passage of the budget for political gain and self-interest which slow down budget implementation and in most cases resulted to the return of unspent budget even

in the face of infrastructural deficit and unrest. Furthermore, government capital expenditure on human capital and public debt servicing strengthen the level of private sector investment in Nigeria. The results of the T-Y causality test indicated a bidirectional directional causality between government capital expenditure and private sector investment. Based on these findings, the paper recommends that capital expenditure should be channel towards human capital to promote private sector investment in Nigeria. Besides, the Nigerian government should pay more attention to capital expenditure on physical assets since it has a significant impact on private sector investment and address the issue of budget delay, corruption, and mismanagement in Nigerian institutions.

6 Competing Interest

The authors declared that no conflict of interest exist in this publication

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References

Adji, A. and Alm, J. (2016). Testing for Ricardian equivalence in Indonesia. *Journal of Contemporary Economic and Business Issues*, 3(1), 5-31.

Afonso, A. and Aubyn, M. (2019). Economic growth, public, and private investment returns in 17 OECD economies. *Portuguese Economic Journal*, 18(1), 47–65.

Akinlo, T. and Oyeleke, O. J. (2018). Effects of Government Expenditure on Private Investment in Nigerian Economy (1980–2016). *Emerging Economy Studies*, 4(2), 147-156.

Andrade, J. S. and Duarte, A. P. (2016). Crowding-in and Crowding-out Effects of Public Investments in the Portuguese Economy. *International Review of Applied Economics*, 30(4), 488-506.

Borkovic, S. and Tabak, P (2018). Public Investment and Corporate Productivity in Croatia. *Public Sector Economics*, 42(2), 171-186.

Dash, P. (2016). The Impact of Public Investment on Private Investment: Evidence from India. *The Journal for Decision Makers*, 41(4) 288-307.

Dreger, C and Reimers, H-E (2016). Does Public Investment Stimulate Private Investment? Evidence for the Euro Area. *Economic Modelling* 58, 154–158.

Foye V. (2014). The Impact of Public Capital Spending on Private Investment in Nigeria. *Journal of International Accademic Research for Multidisciplinary*, 2(2).

Gbenga, A., Babatunde, O. O. and Esther, L. (2015). The Effect of Sectoral Public Investment Expenditure on Private Investment in Nigeria: An Error Correction Analysis. *European Journal of Business and Social Sciences*, 4(04), 87-104.

Khan, M. S, and Kumar, M. S. (1997). Public and Private Investment and the Growth Process in Developing Countries. *Oxford Bulletin of Economics and Statistics*, 59(1), 69-88.

Magdalena, R. and Elena, D. (2014). The Impact of Fiscal Policy on Foreign Direct Investments. *Empiric Evidence from Romania, Economic Research-Ekonomska Istraživanja,* 27(1), 86-106.

Makuyana, G. and Odhiambo, N.M. (2018). Public and Private Investment and Economic Growth in Zambia: A Dynamic Approach. *Economia Internazionale/International Economics*, 71(4), 503-526.

Nguyen, C. and Phong, N. A. (2018). Effect of Public Investment on Private Investment and Economic Growth: Evidence from Vietnam by Economic Industries. *Applied Economics and Finance*, 5(2), 95-110.

Nguyen, C. T. and Trinh, L. T. (2018). The Impacts of Public Investment on Private Investment and Economic Growth: Evidence from Vietnam. *Journal of Asian Business and Economic Studies*, 25(1), 15-32.

Njuru, S. G., Ombuki, C., Wawire, N. and Okeri S. (2014). Impact of Government Expenditure On Private Investment In Kenya. *Researchjournali's Journal of Economics*, 2(8).

Olweny, T. and Chiluwe, M. (2012). The Effect of Monetary Policy on Private Sector Investment in Kenya. *Journal of Applied Finance and Banking*, 2(2), 239-287.

Park, Joon Y. (1992). Canonical Cointegrating Regressions," *Econometrica*, 60, 119-143.

Phillips, P. C. B. and Hansen, B. E. (1990). Statistical Inference in Instrumental Variables Regression with I(1) Processes. *Review of Economics Studies*, 57, 99-125.

Saikkonen, P. (1992). Estimation and Testing of Cointegrated Systems by an Autoregressive Approximation. *Econometric Theory*, 8, 1-27.

Sinevicienea, L. and Railieneb, G. (2015). The Nexus between Government Size, Tax Burden and Private Investment. *Procedia - Social and Behavioral Sciences*, 213, 485 – 490

Stock, J. H. and Watson, M. (1993). A Simple Estimator of Cointegrating Vectors In Higher Order Integrated Systems," *Econometrica*, 61, 783-820.

Teklay, B. (2016). Impact of Government Capital Expenditure on Growth of Private Sector Investment: The Case of Ethiopia. *Developing Country Studies*, 6(4):49-61.

Voss, G. M. (2002). Public and Private Investment in the United States and Canada. *Economic Modelling*, 19(4), 641-664.

Xiaoming Xu & Yanyang Yan (2014) Does Government Investment Crowd Out Private Investment in China? *Journal of Economic Policy Reform*, 17(1), 1-12.

Yovo, K. (2017). Public Expenditures, Private Investment and Economic Growth in Togo. *Theoretical Economics Letters*, 7, 193-209.