

An Analysis of the Macroeconomic Determinants of Public Capital Spending in Nigeria

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Abstract

This paper examines the macroeconomic determinants of public capital spending in Nigeria. It reveals the daunting challenge of poverty (poor roads and portable water, poor health care delivery system, inadequate power supply, low quality of education, unhygienic environment and unreliable security system for life and property) that Nigeria exhibits simultaneously with the declining trend and unstable pattern of public capital spending. Although, the nominal values of public capital spending over the years reveal huge allocations; the real values mirror an overwhelming decline, as four-fifths of Nigeria's spending is on consumption. Public capital spending plays an undeniable significant role in the growth and development of any nation since it spurs private investment and invariably the general productivity level. The need to reverse this persistent decline in public capital spending in Nigeria necessitates this study. This paper attempts to test for the macroeconomic determinants of public capital spending using Error Correction Mechanism (ECM). The ECM term revealed a significant long term relationship among the variables, with the coefficient being negative and large enough for a feedback of approximately 0.64. Real Gross Domestic Product, budget deficit, government debt, trade openness, public debt servicing, private investment, foreign direct investment and previous public capital spending were found to explain public capital spending while degree of urbanisation did not have any effect on public capital spending.

Keywords: Error Correction Mechanism, public capital spending, macroeconomic determinants

1. Introduction

The importance of public capital spending (PCS) in economic development cannot be overemphasised. Indeed, development economists opined that shortages of education and health human capital and infrastructure in Less Developed Countries (LDCs) can directly be improved by PCS (Rostow, 1960; Bhatia, 2003; Musgrave, 2005). Furthermore, empirical studies on LDCs have shown that PCS is complementary to private investment (Blejer and Khan, 1984; Greene and Villanueva, 1991). In fact, PCS increases per capita income because of its positive impact on economic growth (Hernandez-Cata, 2000; Seruvatu and Jayaraman, 2001; Borcharding et al, 2001; Dewett *et al*, 2005). However, one daunting challenge facing Nigeria in recent time is the chronic feature of underdevelopment that it exhibits (CBN, 2005) which could be ascribed to the fact that four-fifths of its national output is spent on consumption expenditure (Ebajemito *et al*, 2004).

Comparing Nigeria with other LDCs and DCs, Nigeria's Investment/GDP ratio of 12.5 per cent attained in 2006 is still below the benchmark of international investment/GDP ratio of 20 per cent that is believed to propel an economy to the path of growth and development (Usman, 2007). For instance, investment/GDP ratio has never gone below 20 per cent in some Asian countries that are experiencing growth at present. Statistics show that in the 70s, the average investment/GDP ratio was about 30.5 per cent in China; 28.4 per cent in Korea; 22.9 per cent in Malaysia; 40.5 per cent in Singapore and 25.8 per cent in Thailand. In the 80s these averages increased to 36.2 per cent; 30.4 per cent; 27.8 per cent; 42.5 per cent and 29.5 per cent, respectively. In the 90s the averages for these countries were 39.1 per cent; 35.4 per cent; 36.3 per cent; 35.3 per cent and 36.3 per cent respectively, while the averages for 2000-2005 period were 39.6 per cent; 30.0 per cent; 23.2 per cent; 22.9 per cent and 25.7 per cent respectively (World Bank, 2007).

On the other hand, investment/GDP outcome has not been encouraging in Nigeria, except for some years prior to the inception of Structural Adjustment Programme (SAP) which put the average in the 70s at 22.9 per cent. The average for the 80s was 16.5 percent while for the 90s was 19.8 per cent which were below the international benchmark. Although the average for the 2000-2005 period in Nigeria stood at 23.0 percent, it declined drastically to all time low 12.5 per cent in 2006 (Usman, 2007 and World Bank, 2007). A critical contrast shows that from 1970 to 2005, China, Korea, Malaysia, Singapore and Thailand have never had any year in which investment/GDP ratio was below the international benchmark while Nigeria has had an all time low investment/GDP ratio for good 15 years. Definitely, this explains the high growth rate of the Asian Tigers (World Bank, 2007 and Ebajemito *et al*, 2004). Underpinning this with statistics, the average growth rates over the years for China, Korea, Malaysia, Singapore and Thailand are 9.1 per cent, 7.0 per cent, 6.7 per cent, 7.6 per cent and 6.4 per cent respectively while for Nigeria is 4.0 per cent (World Bank, 2007).

One of the issues agitating the minds of researchers in this area is the persistent decline in the real value of PCS and even as a percentage of Gross Domestic Product since the 70s in LDCs (Sturm, 2001) which is often associated with decline in private investment and invariably with the general productivity growth rate. This

suggests an important role for PCS in economic growth (Aschauer, 1989; Levine and Renelt, 1992; Okoh, 1994; Okojie, 1995; Sturm, 1998; Sturm and De Haan, 2000; Adamu, 2002; Valila and Mehrotra, 2005). Auspiciously, the World Bank and the International Monetary Fund profoundly support policies that advance the economy through increase in PCS in LDCs, as there is a consensus theoretically that PCS aids economic growth if manipulated in a manner that crowds in private investment (Wilhelm and Fiestas, 2005). In essence, if economic growth and development are to be stimulated, investment is a requisite condition (Aschauer, 2000). Accordingly, the experience of the East Asian countries suggests that an investment/GDP ratio of between 20 and 25 percent could engender a growth rate of 7 to 8 percent (Englama and Kukah, 2004). However, in real terms, PCS has been on the decline, in spite of the efforts of fiscal management. This is reflected in its negative effects on the macroeconomic indicators (CBN, 2006), since Nigeria amongst all countries spends less on PCS (World Bank, 2007). For instance, the Nigerian economy mirrors poor roads and portable water, poor health care delivery system, inadequate power supply, low quality of education, unhygienic environment, unreliable security system for life and property (Okonjo-Iweala, 2004) which are impediments to high investment.

In summary, the issue that emanates from this discussion is how to reverse the ugly trend of PCS to address these bottlenecks, as this is the basis for the take-off of privatisation. This means that the macroeconomic environment of Nigeria is not adequate to mobilise private investment and also attract foreign investment to its full capacity (See World Bank, 2007). This results in increasing cost of production which discourages investment in Nigeria. This increase in cost of production is reflected in high prices of which 7 out of every 10 Nigerians who live on less than \$1 (N117) a day (NEEDS, 2004) have been struggling to afford. Hence, the attainment of economic growth and development is dependent on the macroeconomic environment of an economy. However, in many countries throughout the world, productive government services have declined since the 1970s. Although, consensus of opinions differs as to why PCS declined. While some studies emphasize politico-institutional variables, others stress private investment and foreign aid as determinants of public capital spending. Studies that focus on macroeconomic variables in determining PCS are sparse and cross-country in nature; hence, the use of panel data analysis, which is good and reliable nevertheless cannot account for country specific peculiarities. This means that some vital country specific facts may be eluded in cross-country studies (Ojo, 2008). Furthermore, earlier studies failed to recognise the fundamental complementarity relationship between PCS and private investment since most studies are on public expenditure which consists of both the capital (investment) which is just one-fifths of Nigeria's national output and the recurrent (consumption) spending which takes four-fifths of the same (Ebajemito *et al*, 2004). Hence, putting the two spendings together might yield erroneous result, leading to poor recommendation and adoption of ineffective and inefficient economic policies. Therefore, it is based on this milieu that this study critically examined and analysed the macroeconomic factors that determine PCS in Nigeria.

The next section of this paper is structured to examine the theoretical underpinnings of the determinants of PCS and review past literature, while Section 3 is on the research method and analysis of the macroeconomic determinants of PCS in Nigeria. Section 4 discusses the result and Section 5 contains the concluding remarks.

2. Literature Review and Theoretical Framework

According to (Dewett, 2005), between the two aspects of public finance, that is, public revenue and public expenditure, the latter received scant attention throughout the 19th century. Attention was almost exclusively focussed on public revenue, but now, the implications and bearing of public spending is very important, as it charts the path of growth and development of a nation. Furthermore, every empirical study has a theoretical basis on which the study builds on. This implies that areas of empirical research have to be tested by a relevant model and the model's conclusions have to be validated as well.

The studies by (Aschauer, 1985; 1988; Lynde and Richmand, 1992) examine how public capital explains the total factor productivity and consequently, private capital in the United States' non-financial corporate sector. They found that public capital has positive marginal product and that private investment can be improved by increasing public investment. According to (Lynde and Richmand, 1992), public and private capitals are complements rather than substitutes. The categories of public capital spending such as expenditure on research, roads and transports, water and power projects, education and health may enhance private sector's productivity and ultimately, the growth and development of an economy.

The developing nations are keen on rapid economic development which requires huge expenditure to be incurred in the various sectors of the economy. Meanwhile, the private sector is either unable to source these huge amounts or is unwilling to invest such amounts because the returns from these investments may be uncertain or delayed. Hence, economic growth and development have to depend almost entirely on public investment. Therefore, public capital spending plays a vital role in economic development of any economy and this confers the imperativeness of this study and hence, the review of the papers in the table below.

Table 1: Summary of Literature Review

Studies from Developed and Less Developed Countries					
Author	Number of Countries	Dependent Variable	Explanatory Variables	Econometric Method	Resulting Determinants
Randolph et al. (1996)	27 low and middle income	Public infrastructure spending in transportation and communication only	Economic and structural	pooled cross-national and time-series data analyses	Changes in the level of development, the urbanisation rate, the labour force participation rate, foreign direct investment and stock of infrastructure.
De Haan <i>et al.</i> (1996)	22 OECD countries	Public investment	Politico-economic	Panel-data analysis	Private investment
Boix (1999)	80 DCs and LDCs	Public investment	Politico-economic	Panel-data analysis	Trade openness and urbanisation
Sturm (2001)	123 LDCs	Public capital spending	Economic and politico-institutional	Panel-data analysis	Real GDP, public deficits, openness, lagged private investment and foreign aid
Heinemann (2002)	16 OECD countries	Public investment	Economic and politico-institutional	Panel-data analysis	Public debt and mobility of factors
Galí and Perotti (2003)	European Union countries	Public investment	Economic and institutional	Panel-data analysis	Gross Domestic Product
European Commission (2003)	European Union countries	Public investment	Economic and institutional	Panel-data analysis	Real Gross Domestic Product and EMU
Fan and Rao (2003)	43 LDCs	Public investment	Economic and structural	Panel-data analysis	Government revenue and structural adjustment
Turrini (2004)	European Union countries	Public investment	Economic and institutional	Panel-data analysis	Per capita trend GDP, public debt and EMU
Välilä and Mehrotra (2005)	European Union countries	Public investment	Economic	Panel-data analysis	National income, budgetary policies, fiscal sustainability
Quijano and Garcia (2005)	1	Public investment	Politico-economic	Stepwise multiple regression analysis	private investment, degree of openness, and people power movement
Mourao (2007)	1	Public investment	Economic	Cointegration and error correction mechanism	Number of unemployed people, number of public employees, rate of openness and current transfers per capita
Studies from Nigeria					
Author	Number of Countries	Dependent Variable	Explanatory Variables	Econometric Method	Resulting Determinants
Longe (1984)	1	Public expenditure	Economic	Ordinary Least Squares	Gross National Product and stage of development of public expenditure
Ologu (1992)	1	Public expenditure	Economic	Ordinary Least Squares	Interest rate
Garba (1997)	1	Federal non-debt capital expenditure	Economic	Ordinary Least Squares	Government revenue, external loans, external debt service, exchange rate depreciation and positive revenue shock.
Oluwatayo (2006)	1	Public Expenditure	Socio-political	Ordinary Least Squares	Bureaucracy, poor working conditions, inadequate supervision, improper record keeping and lack of commitment on the part of the workers.

In summary, all the studies on DCs and LDCs above are particularly on public investment and mostly cross-country studies; hence, the use of panel data analysis which is good but does not control for country specific peculiarities. On the other hand, the studies carried out on Nigeria are on public spending, which consist of both

4. Results

4.1 Trend and Pattern of Public Capital Spending (PCS) in Nigeria

There is no doubt that public capital spending has fallen considerably since the 70s. This is not revealed in the nominal values of public capital spending. However, the real values indicate this fall. This observation of a period of thirty-seven years adequately revealed the trend and pattern of PCS in Nigeria.

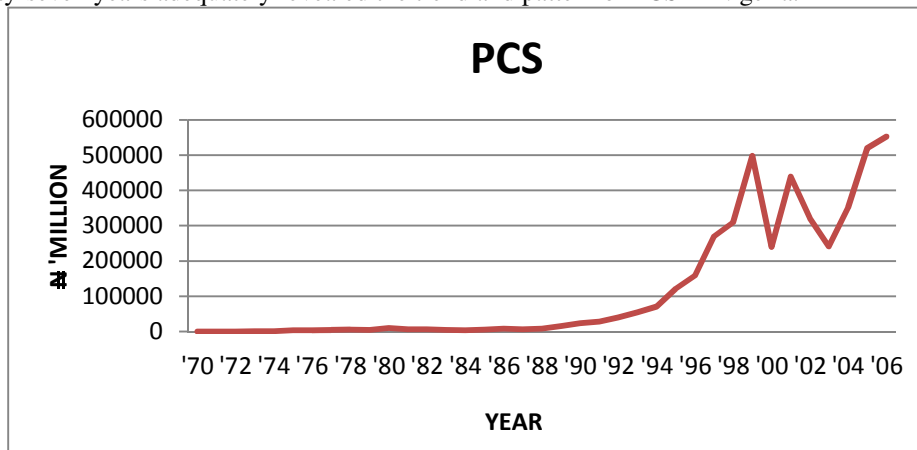


Fig. 1 Nominal public capital spending (PCS)
 Source: Central Bank of Nigeria Statistical Bulletin, 2008

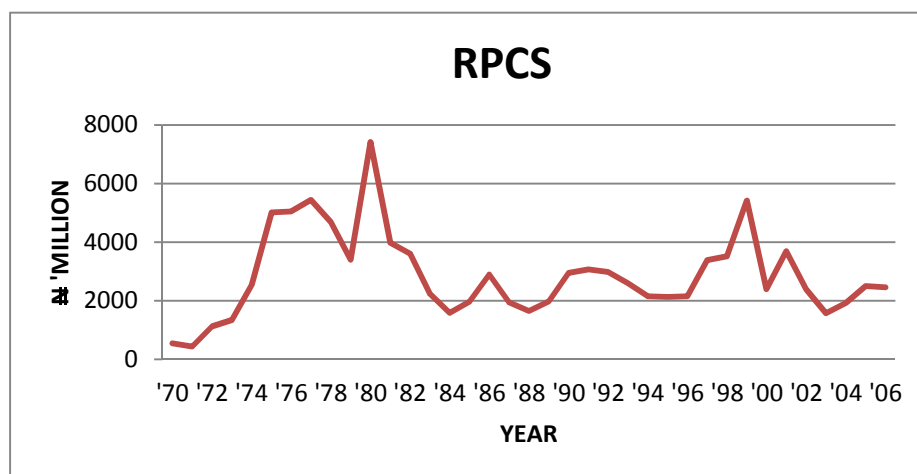


Fig. 2 Real public capital spending (PCS)
 Source: Central Bank of Nigeria Statistical Bulletin, 2008

Public capital spending has plummeted significantly since the 70s. Although, the nominal data on public capital spending between 1970 and 2006 made the decline unnoticeable. However, by relating PCS to inflation or the gross domestic product (GDP), the decline in public capital spending became evident. Looking carefully at Figure 1, the data on nominal public capital spending (PCS) showed an upward trend from 1972–1980; this might be as a result of the oil boom of the early 70s, as oil suddenly became the dominant sector of Nigerian economy. However, nominal PCS fell in the next four years (1981–1984) and began to oscillate until it reached its peak of ₦552.4billion in 2006, having started off with just ₦187.8million in 1970. This upward trend in the nominal public capital spending started off when Structural Adjustment Programme (SAP) was adopted in 1986. Although, it could have been a great improvement in the absence of inflation. However, when inflation was taken into consideration by dividing the nominal public capital spending through by consumer price index (cpi) of each respective year; the new values (Real PCS) reflected a declining trend and pattern of PCS. Of course, this revealed the actual worth of the nominal PCS. The real value of PCS in 1970 was ₦552.4million and it fluctuated until it got to a peak of ₦7.4billion in 1980 and continued to fluctuate till it declined to ₦2.5billion in 2006. (See Figure 2).

Although, public capital spending is expected to decline in the long run, as several infrastructural projects should have been completed (Treadgold 1992; Fallon and King 1995). Similarly, Nigeria's PCS has been on the decline, though with a vast of her infrastructure in a state of disrepair. The decline in PCS in Nigeria is not as a result of

several projects that have been completed but because four-fifths of its national output is spent on consumption expenditure (Ebajemito *et al*, 2004), as PCS is seen as an easy target for cuts since the effect of the cuts cannot be felt in the short run (Rouboni and Sachs, 1989; Oxley and Martin, 1991; De Haan et al, 1996 and Okoh, 1994). This resulted in the chronic features of underdevelopment exhibited by Nigeria; hence, there is urgent need to augment PCS, as these features discourage private investment, thereby reducing investment/GDP ratio and subsequently, leading to low growth rate.

Concisely, the size and structure of public expenditure determine the pattern and form of growth in output of the economy. Conclusively, according to the data collated, it is observed that Nigeria's PCS is not only small in size, but also inconsistent which revealed a declining and inconsistent trend and pattern, respectively.

4.2 Unit Root Tests Results

An attempt was made to test for the order of integration of the variables to characterise their time series property. In achieving this, the DF and ADF test were employed. The test took into consideration the null hypotheses of the presence of a unit root both in a random walk with a drift and a random walk with a drift and a trend term.

Using the DF test in levels, all variables were found to be non-stationary in levels for both the untrended and trended equations, except for budget deficit (BDEF) which is quite stationary at 5% significant level. The results of the DF and the ADF test in levels shown in Tables 2 and 3 are consistent with the presence of unit roots in all the variables investigated. Having discovered that all the variables were non-stationary, there was the need to bring them to stationarity by testing whether taking the first difference of the variables would bring them to stationarity. The results of the DF and ADF tests in first difference established that the variables are of the order I(1). This means that the stationarity of the variables were achieved by taking their first difference. In the ADF government debt (GDEBT) was only untrend stationary at first difference at 5% significant level. However, it was found to be stationary at first difference at 5% significant level without intercept and the trend term. Relating it to the DF test in first difference, it was concluded that GDEBT is stationary at first difference.

Table 2: Results of DF Tests in Level and First difference

SERIES	UNTRENDED	TRENDED	SERIES	UNTRENDED	TRENDED	REMARK
PCS	-3.268731	-3.283884	Δ PCS	-8.305925	-8.336213	I(1)
RGDP	1.024508	-1.251446	Δ RGDP	-5.321982	-5.530225	I(1)
BDEF	-3.816777	-3.840365	BDEF	-----	-----	I(0)
GDEBT	-1.519841	-0.981690	Δ GDEBT	-4.131977	-4.225344	I(1)
TROPEN	-2.464808	-2.469928	Δ TROPEN	-5.960541	-5.855019	I(1)
PDSERV	-2.678367	-3.447667	Δ PDSERV	-9.270994	-9.128184	I(1)
PINVT	-1.452103	-2.054434	Δ PINVT	-6.740787	-6.808422	I(1)
FDI	-1.261345	-2.863978	Δ FDI	-7.636747	-7.817846	I(1)
URBAN	-0.872568	-1.830106	Δ URBAN	-4.866731	-5.418411	I(1)
BCREDIT	-2.185450	-2.056538	Δ BCREDIT	-6.647541	-6.659353	I(1)
5% CRITICAL VALUES	-2.9446	-3.5386	5% CRITICAL VALUES	-2.9472	-3.5426	

Table 3: Results of ADF Tests in level and in first difference

SERIES	UNTRENDED	TRENDED	SERIES	UNTRENDED	TRENDED	REMARK
PCS	-2.684414	-2.816969	ΔPCS	-4.361965	-4.394792	I(1)
RGDP	0.809493	-1.556009	ΔRGDP	-3.625207	-3.830369	I(1)
BDEF	-3.208501	-3.107446	ΔBDEF	-6.320036	-6.263669	I(1)
GDEBT	-1.999386	-1.819888	ΔGDEBT	-3.213930	-3.316094	I(1)
TROPEN	-2.454146	-2.495738	ΔTROPEN	-4.511233	-4.405359	I(1)
PDSERV	-1.727184	-2.222602	ΔPDSERV	-5.841641	-5.742884	I(1)
PINVT	-1.080160	-1.797663	ΔPINVT	-4.079498	-4.204565	I(1)
FDI	-0.276254	-1.846333	ΔFDI	-4.683711	-4.930637	I(1)
URBAN	-1.008236	-1.9444457	ΔURBAN	-3.334722	-4.005357	I(1)
BCREDIT	-2.115621	-1.908463	ΔBCREDIT	-3.919201	-3.941184	I(1)
5% CRITICAL VALUES	-2.9472	-3.5426	5% CRITICAL VALUES	-2.9499	-3.5468	

4.3 Cointegration Tests and Results

The ADF result suggested that all the variables adopted in this study are I(1). Therefore, cointegration was tested for among these variables. The model is multivariate and there are probable cointegrating vectors linking PCS to the identified explanatory variables. First, the long run relation of determinants of public capital spending by Ordinary Least Square (OLS) method was estimated in log form except for budget deficit because it is negative. Then, the residual of the estimated result was taken, lagged by 1 and tested for its stationarity. The DF and ADF tests were used to determine whether the residual was stationary or non-stationary.

The specified model is:

$$LOGPCS = \beta_0 + \beta_1 LOG(RGDP) + \beta_2 BDEF + \beta_3 LOG(GDEBT) + \beta_4 LOG(TROPEN) + \beta_5 LOG(PDSERV) + \beta_6 LOG(PINVT) + \beta_7 LOG(FDI) + \beta_8 LOG(URBAN) + U_t \dots\dots\dots (4)$$

Generating residual series from the estimated model below, we have

$$LOG(PCS) = 2.31 + 0.54LOG(RGDP) - 0.028BDEF - 0.41LOG(GDEBT) - 0.42LOG(TROPEN) - 0.46LOG(PDSERV) + 0.34LOG(PINVT) + 0.11LOG(FDI) + 2.71LOG(URBAN) + \hat{U}$$

$$\hat{U} = LOG(PCS) - (2.31 + 0.54LOG(RGDP) - 0.028BDEF - 0.41LOG(GDEBT) - 0.42LOG(TROPEN) - 0.46LOG(PDSERV) + 0.34LOG(PINVT) + 0.11LOG(FDI) + 2.71LOG(URBAN))$$

Performing DF and ADF test on the residual above yielded the result below

Table 4: Results of Cointegration Test

	DF (NIT)	ADF (NIT)
\hat{U}	-3.924329	-3.636959
5% CRITICAL VALUE	-1.9514	-1.9521

*NIT = No intercept and trend term

Given the DF and ADF critical values above, the results showed that the variables are cointegrated at 5%, as the residual was found to be stationary. Therefore, the null hypothesis of no cointegration was rejected. This simply implies that there is a long term relationship among the variables, hence the lagged residual/error term can be treated as the equilibrium error and can be used to tie the short run disequilibrium of PCS to its long run value.

4.4 Error Correction Modelling

In view of the fact that cointegration of variables was established, the relationship was expressed as Error Correction Mechanism (ECM). We included the lagged residual which is the error correction term in the specified over-parametised model below. The number of lag lengths was determined by Akaike Information Criterion (AIC), as smaller values are preferred in model selection. The AIC for the models with one and two lag lengths were 0.516827 and -0.948732, respectively. Therefore, the model with two lag length is selected for its smaller value. Running with the objective of obtaining a compact and interpretable result that accords with our

theoretical underpinnings, we eliminate systematically the most insignificant variables to obtain a parsimonious model which is an abstract of the over-parametised one. The standard error of regression (S.E), the Akaike information criterion (AIC) and Schwarz criterion (SC) were used as guides to parsimony. The table with the least values of the guides is the most reliable; hence the table below is taken as the parsimonious result.

Table 5: Result of the parsimonious ECM model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
constant	-0.008416	0.029565	-0.284672	0.7841
DLOG(RGDP)	0.524991	0.182835	2.871391	0.0239
D(BDEF)	-0.027124	0.008597	-3.155198	0.0160
D(BDEF(-1))	0.013543	0.013929	0.972303	0.3633
D(BDEF(-2))	0.034085	0.013336	2.555975	0.0378
DLOG(GDEBT)	-0.402617	0.173869	-2.315630	0.0537
DLOG(GDEBT(-1))	-0.257737	0.183287	-1.406197	0.2025
DLOG(GDEBT(-2))	0.631126	0.189794	3.325317	0.0127
DLOG(TROPEN)	-0.422776	0.271016	-1.559965	0.1627
DLOG(TROPEN(-1))	0.612248	0.283495	2.159641	0.0676
DLOG(TROPEN(-2))	1.915586	0.342118	5.599199	0.0008
DLOG(PDSERV(-1))	0.324956	0.080621	4.030687	0.0050
DLOG(PDSERV(-2))	0.173063	0.073500	2.354614	0.0507
DLOG(PINVT)	-0.170184	0.122342	-1.391050	0.2068
DLOG(PINVT(-1))	-0.447916	0.113735	-3.938254	0.0056
DLOG(PINVT(-2))	-0.356815	0.104748	-3.406416	0.0113
DLOG(FDI)	0.203938	0.075914	2.686430	0.0312
DLOG(FDI(-1))	0.257531	0.090786	2.836675	0.0252
DLOG(FDI(-2))	-0.061242	0.086708	-0.706304	0.5028
DLOG(URBAN)	-1.541978	0.930906	-1.656427	0.1416
DLOG(PCS(-1))	0.350867	0.123930	2.831160	0.0254
DLOG(PCS(-2))	0.592590	0.186151	3.183377	0.0154
ECM(-1)	-0.638160	0.178634	-3.572452	0.0091
R-squared	0.97	Mean dependent var	0.04	
Adjusted R-squared	0.86	S.D. dependent var	0.34	
S.E. of regression	0.13	Akaike info criterion	-1.18	
Sum squared resid	0.12	Schwarz criterion	-0.11	
Log likelihood	40.77	F-statistic	9.13	
Durbin-Watson stat	2.54	Prob(F-statistic)	0.00	

Note: 5% level of statistical significance.

Source: Extracted from computer regression output

This parsimonious result revealed that most of the coefficients are statistically significant at 5 per cent and the fits are very tight. The Adjusted R^2 value of 0.86 means that 86 per cent of the variation in PCS is explained by the significant coefficient values of the explanatory variables in this study. The Durbin Watson (DW) statistic revealed the fact that there is no serial correlation. A 'd statistic' of 2.544 is greater than both the lower and upper bounds of 0.854 and 2.141 respectively, given the number of observations and the explanatory variables for this empirical study. However, this result is not effective because the underlying assumptions on carrying out 'Durbin Watson d test' have been violated because the regression model in this study included the lagged value of the dependent variable as an explanatory variable and the residual of the regression is generated from higher order autoregressive scheme, as opposed to first order autoregressive scheme for DW. Therefore, 'Breusch-Godfrey test' which can handle higher order autoregressive schemes was used and the result revealed 0.716840 insignificant p -value of the F -statistic at 5 per cent level. This implies that there is no higher order serial correlation in the residual of the estimated equation.

All explanatory variables were lagged twice and the model was difficult to interpret. Therefore, a parsimonious model was derived and Table 4 was obtained. The fall in the resulting standard error (S.E), Akaike information criterion (AIC) and Schwarz criterion (SC) was the guide to the parsimonious model, as smaller values suggest better model. The result of the parsimonious model clearly showed a highly significant feedback relationship between PCS and resulting significant explanatory variables. The estimated coefficient of the error term is approximately 0.64. The effect of this error correction is large, statistically significant at 5 per cent and is negatively signed as expected. The significance of the coefficient of error term agrees with the earlier finding that PCS is cointegrated with the identified explanatory variables.

The structural variable included in this study was found not to have any effect on PCS as the coefficient of the

variable was insignificant at 95 per cent confidence interval. These findings can be summarised and put thus:

- RGDP improves public capital spending.
- Public capital spending is determined by its previous value and largely financed by government debt.
- Trade openness in Nigeria engendered double (infinitely elastic) increase in public capital spending, confirming (Sturm, 2001).
- The lags of private investment and public capital spending behave as substitutes.
- Foreign direct investment is able to produce approximately a quarter positive changes in PCS.
- Public debt servicing reduces public capital spending over time, corroborating (Oxley and Martin, 1991; Fosu, 1996 and Sturm, 2001).
- Urbanisation does not have effect on PCS.

Conclusively, the determinants of public capital differ across countries as it has been revealed in the literature review of this study. Hence, according to the peculiarity of Nigeria; the changes in public capital spending are best explained by Real Gross Domestic Product, budget deficit, government debt, trade openness, public debt servicing, private investment, foreign direct investment and previous public capital spending.

4.5 The Relative Effect of Resultant Determinants on Public Capital Spending

Following the beta-coefficient which measures the change in public capital spending corresponding to a unit change in each explanatory variable, holding other explanatory variables constant and measuring all changes in standard deviation units. The beta coefficients were obtained using the following equation:

$$\dot{\beta} = \hat{\beta} (S_x / S_y)$$

where

- $\hat{\beta}$ = Estimated beta- coefficient.
- S_x = Standard deviation of xth explanatory variable
- S_y = Standard deviation of the dependent variable

Table 5: Relative Effect of Resultant Determinants of PCS

Explanatory Variables	$\hat{\beta} = \beta (S_x / S_y)$	$\dot{\beta}$
RGDP	= 0.54(158144/1468.13)	58.18
GDEBT	= -0.41(16027.57/1468.13)	4.48
PINVT	= 0.34 (2760.45/1468.13)	0.64
PDSERV	= -0.46(911.81/1468.13)	-0.29
URBAN	= 2.71(0.63/1468.13)	0.0011

The beta-coefficient of approximately 58.18 revealed that Real Gross Domestic Product (RGDP) has the largest influence on public capital spending. Government debt is the next, as its beta-coefficient is also approximately 4.48 while private investment's beta-coefficient is 0.64. Public debt servicing and urbanisation have the least effect on public capital spending, with beta-coefficients of 0.29 and 0.0011 respectively. The other variables' P-values were found to be insignificant at 95 per cent confidence interval.

5. Summary, Conclusion and Policy Recommendation

The empirical analysis of the study followed the model of (Kirchgassner and Pommerehne, 1997). The analysis started with the determination of the order of integration---the unit root properties of the employed series i.e. (public capital spending, real gross domestic product, government budget deficit, government debt, trade openness, public debt servicing, foreign direct investment, private investment, degree of urbanisation and lagged public capital spending.). Based on the ADF test, it was clearly observed that the results accepted the null hypothesis of non-stationarity for all variables and taking the first difference brought each variable to stationarity, confirming their random walk properties. Furthermore, cointegration analysis was carried out by estimating the non-stationary series by Ordinary Least Square (OLS). The residual was taken, lagged by a year and tested for stationarity. Evidence of stationarity was established and the error correction model (ECM) was developed on this basis. The over-parametised ECM model was lagged twice, guided by the Akaike Information Criterion. Finally, a parsimonious model was arrived at after the eliminations of insignificant variables. The parsimonious model revealed Real Gross Domestic Product, budget deficit, government debt, trade openness,

public debt servicing, private investment, foreign direct investment and previous public capital spending as macroeconomic determinants of public capital spending while degree of urbanisation did not have any effect on public capital spending. The ECM term revealed a significant long term or equilibrium relationship among the variables, with the coefficient being negative and large enough for a feedback of approximately 0.64. This authenticated the initial cointegration result. Diagnostic and stability tests were carried out on the parsimonious model in chapter four. The results showed that the Jarque–Bera normality test for the distribution of the residuals, the serial correlation LM test for autocorrelated residuals, the ARCH test for heteroscedastic errors and the Ramsey reset test for functional misspecification are not significant as indicated by the p-values of the F-statistic results. Consequently, these tests validated the parsimonious equation result arrived at in this study.

Following the results of the parsimonious equations, it is of great importance to transform the structure of public capital in Nigeria, in order to improve private investment and ultimately put the economy in the path of sustainable growth and development. Public capital spending as the engine of growth and development has been empirically discovered to be stimulated by Real Gross Domestic Product, foreign direct investment, previous public capital spending, budget deficit, government debt, trade openness and private investment in this study. Contrary to (Sturm, 2001)' empirical result, budget deficit only explained a very negligible portion of PCS. The result of this empirical study revealed that 63 per cent of government borrowing is channelled towards PCS. Then, it follows that more of the borrowing should be channelled into PCS via budget deficit. The result of the empirical analysis of this study revealed that trade openness is able to stir PCS tremendously, as it opens the economy for foreign competitions which always result in the provision of infrastructure among other things. Hence, liberalisation of the economy's trade barrier should be explored to increase PCS. However, care should be taken in matters of health and safety, labelling requirements, and weight and measure regulations. Also, it is expedient to improve on the productivity of the economy by increasing the quantity and value of the goods and services produced yearly to encourage international trade. Also, the Nigerian government should endeavour to improve the macroeconomic environment of the nation for a proper take-off of privatisation. Conclusively, to achieve sustainable economic growth and development, the present decline in public capital spending must be addressed without delay.

Although, the main objective of this study was to analyse the determinants of public capital spending; it was eventually discovered in the course of the study that there exists a long run relationship between public capital spending and the explanatory variables with a significant feedback. This result has important policy implications for policy makers, as it showed that increase in productivity and trade openness can improve public capital spending to a very great extent. This implies that improvement in public capital spending creates a good macroeconomic environment that can make an economy like Nigeria attract foreign direct investment to its full capacity. In addition, the empirical result revealed that borrowing is not bad provided it is channelled towards building economic structures that will increase productivity and put the country in the path of growth and development

Irrefutably, the implications for policymakers seem to be systematically very clear: public capital spending should go up to give a boost to the economy. Generally, the result of this study showed that some of the variables that have effect on PCS included both contemporaneous and the lagged values. Hence, to put Nigeria in the path of growth and development, policy makers should endeavour to make use of both values as necessitated by this study to avoid inefficient and ineffective policies and results.

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