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Public Investment in Nigeria. Does External Debt Matter?

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Abstract *This paper investigates the effects of external debt on public capital investment in Nigeria from 1970 to 2013 using autoregressive distributed lag (ARDL) bound testing approach. The empirical results reveal that external debt and debt service exert a negative impact on public capital investment, but the current real GDP is positive. In general, our empirical evidence suggests that external debt does not influence public investment over the period under study. At longer horizon, it is confirmed that the nature of poor domestic savings and investment causes higher debt service payments and crowd out available resources for investment in economic and social sectors. The study, therefore, suggests that the policy makers should adhere strictly to the appropriate use of debt through efficient investment, so that the debt service payments should not exceed the country's payment capacity.*

Key words External debt, debt service; FDI, public capital investment, Nigeria

JEL Codes: E33, H54

1. Introduction

The growing needs for investment in public infrastructure in developing countries, has some time been thought to be of vital importance, particularly in terms of its impact on growth and creation of employment opportunities (Ghali, 1998). Government expenditure on public investment in infrastructure development and maintenance of public institutions is the third rationale for the existence of state after the provision of other services such as defense, law and order (Smith, 1776). These infrastructures also called public capital goods are usually financed through debt and are supposed to be provided on a larger scale for the benefit of the entire society. Some categories of these services such as health services and education directly enhance the living conditions of the citizenry and their shortages can lower social welfare. Others like transport, communication, energy to mention but a few are supplement to private sector investment, and their shortages could crowd-out private sector investment and growth potentials. These services are non-exclusive and sometimes are considered non-profitable to be provided by the private sector. Failure of governments to provide such

services could lead to a decline in economic activities (Hulten and Peterson, 1984; Tatom, 1991).

Inadequate public capital,[1] has been a common problem in Nigeria regardless of her position as the largest oil exporter in Africa and sixth position among the top oil exporters in the World (Smith, 2009). Added to that, the country throughout the period under study had accumulated enormous external debt with the aim of promoting infrastructure services. Unfortunately, numerous infrastructure gaps keep on existing, which discourage development in economic and social sectors. In a nutshell, the priority infrastructure services remained inadequate and the existing ones are of poor quality by any standard (United States Agency for International Development, 2006). This clearly show that Nigeria is lagging behind in such areas of infrastructure development compared to its counterparts in developing countries of the world such as South Africa, Malaysia, Thailand and a host of others. It is based on these assertions; this paper seeks to investigate empirically whether or not the nation had benefited from the huge external debt contracted and the recent debt relief granted by the Paris club of creditors in 2006.

The contributions of this study are threefold. First, we incorporate foreign direct investment and domestic savings in the investment model, which have not been deal with in the previous literature (see, for example, Akomolape *et al.,* 2015; Abdullahi *et al.,* 2016). Foreign direct investment promotes physical capital through its inter-linkages with trade and technological capabilities, which promotes infrastructure development (Rasiah, 1995). On the other hand, domestic savings also have a substantial impact on investment, hence, investment must be supplemented by savings. Inadequate savings may increase the current account deficit and reduces investment (Feldstein and Bacchetta, 1991). Second, unlike Abdullahi *et al.,* (2016), this study extend the period covering 1970 through 2013 in order to capture the possible effects of 1973/1974 oil boom, which might contribute to public investment in Nigeria. Third, relatively few studies have been conducted on external debt and public investment as compared to external debt and growth relations (see, for example, Adamu and Rajah, 2016; Adegbite *et al.,* 2008; Ayadi and Ayadi, 2008) among others. Therefore, it appears important to examine the external debt-public investment relations in order to find out their impact in shaping the pace for long term economic growth in Nigeria.

The decision of taking Nigeria as a case study is spurred by long years of debt overhang as the country relies substantially on foreign borrowing for financing of economic and social infrastructure. Given the fact that the level of indebtedness was

[1] Henceforward, public capital, public capital investment, public investment and public capital formation are used interchangeably throughout the text. This follows the studies by Cavallo and Daude (2011) and Checherita-Westphal and Rother (2012).

high in the past decades, and suddenly the nation benefited from a debt relief in 2006. Upon that, a sensitive factor like debt relief may certainly affect the level of debt stock (Lora, 2007). Therefore, it is expected that a reduction in debt stock would release more resources for investment, particularly in infrastructure services.

2. External Debt and Public Investment in Nigeria, 1970-2013

In the last three decades, the interactions between external debt and public capital investment have not yielded impressive results. Table 1 provides a clear trend of the external debt and public investment over the period 1970 to 2013. It can be seen clearly that in the early 1970s and until quite 1980s, the stock of external debt were minimal at 6.1 per cent in1975 and the highest ratio was 14 percent in 1980 and the growth of capital infrastructure was impressive from 25 to 31.2 per cent between 1970 and 1980. Though, this could be financed through income from the oil boom of 1973/74. The collapse in the oil prices in 1978, and the sudden international debt crisis of 1982 reversed the trend whereby growth in public investment begin to decline substantially from 33.3 per cent in 1981 to 11.3 per cent in 1985, respectively. This scenario forced the government into foreign borrowing from International Financial Market (ICM) in her effort to bridge the widening shortfall in foreign earnings and enhance infrastructure development. This marked the beginning of increased in debt to GDP ratio of 65.7 per cent in 1985. Despite the increase in the external borrowing, especially in mid 1980s to early 2000, Nigeria's public investment (measured as a share of GDP) did not show satisfactory improvement to the nation's infrastructure development objectives. Because, the external debt stock had increased without accompanying increase in public investment. For example, it grew from 7.0 per cent, 5.4 per cent and 11.4 per cent between 1995, 2006 through 2013. While the debt to GDP ratio grew from 65.7 per cent in 1985, 117.4 per cent in 1990 and later fall to 2.41 percent in 2013 after the debt relief. This indicates that prior to 1978; the public capital investment was financed largely from oil revenues. While the decline in the public investment can be attributed to the debt crisis in 1982, and continue to remain very low throughout the periods until quite after the debt relief in 2006, the trend begins to improve.

Table 1. External debt and public capital investment in Nigeria (1970-2013)

Variable	1970	1975	1980	1985	1990	1995	2000	2005	2013
External debt (% GDP)	-	6.1	14.0	65.7	117.4	121.3	68.7	19.9	2.4
Public investment (% GDP)	25	32.5	31.2	17.3	14.6	7.0	7.2	5.4	11.4

Source: World Bank (2013) and World Macroeconomic Research (2013).

Table 2 provides various allocations to both economic and social sectors of the economy into which external debt disbursement was channeled in 2008, 2010 and 2013. It reveals that, in recent times the bulk of Nigeria's external debt was utilized to support infrastructure and human capital development which comprises of nations essential services in such areas like water, energy, transportation, housing, education, health, social welfare among others (DMO, 2013). The sectoral allocations are in line with the developmental objectives and priorities of the government to improve economic and social infrastructure towards the achievement of Sustainable Development Goals (SDG) by the year 2020.

Table 2. Allocation of external debt by sectors for selected years (US$ million)

Sectors	2008	2010	2013
Agriculture*	592.4	657.1	832.5
Transport	468.5	316.7	1,254.8
Education and Training	312.5	433.1	575.1
Electricity and Energy	467.3	396.8	1,516.2
Environment	176.0	214.8	352.8
Health and Social welfare	590.8	730.7	1,029.6
Housing and Urban Development	67.5	126.7	130.6
Industrial Development	58.2	5.2	-
Investment	27.3	-	-
Policy support	50.6	103.8	147.1
Rural Development	48.2	510.3	150.9
Scientific and Technical Equipment	206.8	187.1	511.7
Telecommunications	128.6	69.1	11.8
Water Supply	482.7	-	509.6
Multi sector and others	146.6	827.4	1,799.3
General	105.7	-	-
Total	**3,720.4**	**4,578.8**	**8,821.9**

Notes: * Subsidiary sectors such as air, rail and road are merged under the transport.

Source: Debt Management Office, Nigeria, Annual Reports and Statement of Accounts (2008, 2010 and 2013).

3. Literature review

The Golden rule of public sector borrowing has been widely recognized as a conventional public finance theory that supports government deficits for (Musgrave, 1939). The golden rule of deficit financing permits public borrowing for public investment. Kellerman (2007) and Truger (2015) viewed the golden rule as an inter-temporal principle of pay-as-you-use hypothesis in a condition where the current public expenditure may produce planned income for the economy in the future. It permits the

expenditure on infrastructure development projects through public borrowing, and promote inter-generational equity. The Golden rule of public sector borrowing is more credible and understandable despite its operationalization is burdensome. The majority of the studies emphasizes on the future economic returns in terms of higher productivity. The question pertaining the potentiality of the viable public capital project remain a point of contention on whether it will provide the public social capital with the goal that the rate of returns would be larger or at most equivalent to the costs in terms of interest payments and probably the aggregated costs. Preferably, if the returns from the invested capital are sufficient enough, then debt sustainability would not be an issue and automatically induces investment and promote growth (IMF, 2015).

Besides deficits financing through borrowing, indebted poor countries also are prone to liquidity constraints as well. A situation where a country generates enough foreign exchange earnings, still struggle with high trade deficits and servicing a large debt burden, which undermine government expenditure (Taylor, 1993; Were, 2001). In view of this, Corden (1988) and Callier (1989) proposed liquidity constraints theory to justify the effect of debt service obligations on investment when a considerable portion of country's resources accrues to creditor institutions leading to disincentive on investment. Callier (1989) made a point that cheap access to export credit agencies allows the majority of developing countries in the late and early 1970s to accessed loans at different maturity. High accumulated debt implies an increase in debt service obligations, and the debt turn against the expected contribution from the investment. Also, if an economy is unable to access the foreign loans, in other words, it is bounded by budget constrain, thus, consumption and government investment have to be independent. In such situation, the economy can finance productive investment up to a point the where the Marginal Productivity of Capital (MPC) assumed indifferent with the rate of interest at which the loan was obtained. The crowding out effect cause by debt servicing, which carried away domestic resources for capital investment remain to be a problem for the indebted poor economies. A reduction in the debt service payments is an important determinant for influencing investment that would provide the expected returns in the indebted countries (Cohen, 1993).

In recent years, specifically from the early 1990's, the contribution of overseas borrowing on public investment in the indebted developing countries has attracted significant attention. To date much study has not been done in the field. Basically, there are two groups of studies: The first group encompasses studies that claim a positive effect of external debt on public investment. For instance, Akomolafe *et al.,* (2015) used VECM to examine the relationship between public debt and investment in Nigeria from 1980 through 2010. The result indicated external debt is positively related to domestic investment in the long run. Using 22 transition countries, Mileva (2008) found foreign debt and foreign direct investment flows stimulate public investment. Chaudhry *et al*.,

(2009) used Pakistan annual data to investigate the contribution of external debt on domestic savings and investment spanning from 1973 to 2006. They found partial evidence that foreign debt affects investment expenditures and savings positively. Also, Ali (2013) examined the causal relation between foreign capital and investment in Pakistan. He concluded that external debt affects investment positively in the long run.

However, the second groups include studies that alleged a negative effect of external debt on public investment. Among these studies include Abdullahi *et al.,* (2016), investigated the effect of external debt on capital formation spanning from 1980 to 2013 using autoregressive distributed lag approach. The empirical results indicated that external debt affects capital formation negatively. In the case of Turkey, Javed and Sahino (2005) examined the interlinkages among debt sustainability indicators, exports, growth and investment from 1983 to 2002. They found negative effects of debt stock on investment. In the same phase of study, Borensztein (1990) found external debt reduces domestic investment in Philippines from 1970 to 1990. The author advocates for debt reduction in order to induce domestic investment. Cohen (1993) used 81 developing countries to test the impact of debt ratios on investment to GDP ratio. The study revealed a negative, but insignificant effect of external debt on investment. Deshpande (1997) examined 13 severely indebted poor countries (SIPC's) between 1971 to 1991, and found a positive effect of external debt on investment between 1971 to 1984 and turn to negative in the second period between 1984 and 1991. Leipziger (2001) confirmed that an increase in debt service payments has been the reason behind poor investment, which hamper economic growth and increases poverty in Latin America and the Caribbean. For a group of low and middle income countries, Udomkerdmongkol *et al*., (2007) investigated the relationship between external debt and domestic investment over the period 1995 to 2001. The study revealed that, in the period of stability, countries experienced adverse effect of external debt on domestic investment, whereas in the regime of instability, the role of played by foreign direct investment declined compared to domestic investment.

Using unbalanced panel data for 50 developing countries over the time span 1985 to 2003, Lora and Olivera (2007) examined the role of played by public debt stock in promoting expenditure on social capital. The results indicated that higher debt ratios reduce social expenditure, but defaults might affect the social expenditure positively. Using part of the data and econometric method used by Lora and Olivera (2007), Lora (2007) estimated a panel regression of 7 Latin American countries from 1987 through 2001, and found a negative effect of the IMF adjustment loans on infrastructure expenditures. The study concluded that no evidence to show that debt default contributes to public investment. While Fosu (2010) used a regression model involving a five year panel data for 35 African countries from 1974-1994 period. Findings reveal that external debt servicing is a poor predictor of public expenditure allocation. Also,

Clements *et al*., (2003) studied external debt, public investment and growth relation in the low income countries. They confirmed that burden of external debt discourages domestic investment and impede output growth when debt service to export ratio obligation is above the threshold of 50 percent and 25 percent of debt to GNI ratio. Using panel data analysis for 28 Highly Indebted Poor Countries (HIPCs) from 1991 to 2004, Cassimon and Van (2007) established that multilateral debt relief contributes to public investment negatively in the heavily indebted poor countries, but after two years, it turns positive and promote public investment. Quattri and Fosu (2012) estimated the relationship between debt service, external aid and public spending in Sub-Saharan African countries. They concluded that debt service affects social sector negatively, most especially expenditure on education, which is affected by crowding out of resources due to debt service payments. On one hand, a multilateral aid contributes to domestic investment positively.

4. Methodology of research

Conventionally, external borrowing by the developing countries is justified on the ground that it provides capital by bridging the gap between domestic savings and desired investment (Chenery and Bruno, 1966; Eshaq, 1983). As such, a key feature of the debt is largely obtained from both bilateral and multilateral export credit agencies, which in most cases; they guided the investment plans in developing countries for a better economic viability. It is assumed that if the borrowed funds are fully utilized, would support public investment, hence, stimulating growth. To investigate the contribution of external debt on public investment in Nigeria, the study adopts an investment model suggested by Gourinchas and Jeanne (2013) that an open economy can issue external debt. Meanwhile, capital flows take the form of external debt. Thus, the country's aggregate resource constraints are specified as:

$$C_t + I_T + R^* D_t = Y_t + D_{t+1,}$$
$$I_t = K_{t-1} - (1-\delta)K_{t,} \qquad (1)$$

Where I_t, δ, R^* R* and D_t represents the investment, depreciation rate, interest rate, and country's external debt, respectively. And, K_t is the capital owned by residents. The country service its external debt as default is not anticipated. The external debt inflow in particular period *t,* D_{t+1} - D_t, is equal to public investment, I_t, minus domestic savings, Y_t - $(R^*-1)D_t$ - C_t with both terms playing a significant role in the analysis. This study follows the studies by Fosu (2010), and Quattri and Fosu (2012), and specifies the following investment model in order to assess the Nigerian economy.

Model I:

$$\ln ing_t = \alpha_0 + \alpha_1 \ln edy_t + \alpha_2 \ln ry_t + \alpha_3 \ln fdy_t + \mu_{t,1} \quad (2)$$

An increase in the debt service payments on outstanding external debt lead to higher interest and budget deficits, but lower government savings, this is in turn crowd out a considerable share of public investment (Clements *et al*., 2003). A change in domestic savings could also have implications on public investment (see, Feldstein and Horioka, 1980). To estimate the possible impact of debt service to export ratio (*dsx*) and domestic savings to GDP ratio (*gds*) on public investment, we re-write equation (2) as follows:

Model II:

$$\ln ing_t = \beta_0 + \beta_1 \ln dsx_t + \beta_2 \ln gds_t + \beta_3 \ln ry_t + \mu_{t,2} \quad (3)$$

where ing_t is the public investment to GDP ratio, *edy* is the external debt to GDP ratio, ry_t is the real GDP and fdy_t is the foreign direct investment to GDP ratio, *dsx* and *gds* are debt service to export ratio and gross domestic savings to GDP ratio. α and β are the parameters to be estimated, while, *t* and *u* are the time period and stochastic error terms. This study employs annual time series data on public investment (proxy for gross fixed capital formation), external debt, real GDP, FDI, debt service and gross domestic savings spanning from 1970 to 2013. The details of the variables and sources are described in Table 3.

Table 3. Description of variables

Variables code	Definition	Source/Database
ln*ing*	Log of public investment as percentage of GDP (proxy for gross fixed capital formation)	WDI, WB; WMR
ln*edy*	External debt as percentage of GDP	WDI, WB
ln*ry*	Real GDP	WDI, WB
ln*fdy*	Foreign direct investment as percentage of GDP	WDI, WB
ln*dsx*	Debt service as percentage of exports	WDI, WB
ln*gds*	Domestic savings as percentage of GDP	WDI, WB

Notes: WDI, WB = World Development Indicators, World Bank; WMR = World Macroeconomic Research.

Testing the order of integration is a common practice in applied economics studies since the majority of the time series data are non-stationary. We, therefore, begin by

testing the orders of integration in order to have an appropriate methodology that will fit the data. Three conventional unit root tests are chosen - Augmented Dickey Fuller (Dickey and Fuller, 1981), Phillips-Perron (Phillips and Perron, 1988) unit root tests and Kwiatkowiski, Phillips, Schmidt and Shin (1992) stationarity test. Table 4 reports the unit root tests using the natural log transformation of the data in level and first difference of the variables. As can be seen from the results, there are mix of *I*(0) and *I*(1) order of integration. The variables - ln*ing*, ln*edy*, ln*dsx* and ln*ry* are not stationary at level or *I*(0), but become stationary after the first difference, *I*(1), while ln*gds* and ln*fdy* are stationary at level, *I*(0).

*Table 4***.** Unit root tests

Variable	ADF	PP	KPSS
	At level form		
ln*ing*	-2.366 [0]	-2.545 [1]	0.240 [1]
ln*edy*	-0.702 [0]	-0.766 [3]	0.282 [3]
ln*ry*	-1.962 [0]	-1.988 [6]	0.245 [2]
ln*fdy*	-1.796 [1]	-3.123 [1]	0.132 [4]***
ln*dsx*	-0.931 [0]	-1.126 [0]	0.490 [1]
ln*gds*	-2.885 [5]**	-9.513 [6]***	0.135 [1]***
	At first difference form		
∆ln*ing*	-6.642 [1]***	-6.623 [9]***	0.088 [8]***
∆ln*edy*	-5.395 [0]***	-5.315 [6]**	0.085 [5]***
∆ln*ry*	-6.157 [0]***	-6.157 [1]***	0.086 [2]***
∆ln*fdy*	-10.717[0]***	-11.523 [7]***	0.087 [3]***
∆ln*dsx*	-5.765 [5]***	-5.819 [3]***	0.103 [1]***
∆ln*gds*	-8.115 [0]***	-17.369 [21]***	0.050 [3]***

Notes: ***, ** and * indicate 1%, 5% and 10% significance level respectively. Constant and the trend were included. An automatic maximum lag is used by the Akaike Inion Criterion (AIC) for ADP, and Newey-west bandwidth using Bartlett kernel for PP tests. The figures in square bracket [.] represent the lag selected.

One of the shortcomings in applying the aforesaid unit root tests is that their results are biased and inconsistent in the presence of structural break (Baum, 2004). To overcome such shortcomings, we employ the endogenously determined innovational outlier test for structural breaks developed by Perron (1997). Table 5 reports the unit root test with structural breaks. As seen from the results, the order of integrations conforms to the results in Table 4. Likewise, the break points revealed that the Nigerian economy has been subjected to numerous structural changes and policy shifts such as the 1980-1985 economic crises following the global debt crisis, declining foreign exchange resulting from accumulated debt and the fall in oil prices. These had led to economic

recession. Between 1986 to 1995, Nigeria embarks on a series of economic reforms, for instance, the Structural Adjustment Progam, which aimed at revamping the economy. While the year 2006, witnessed the period when Nigeria's negotiation with Paris club creditors on debt relief was concluded. About 83% of the Nigerias external debt was forgiven under the Highly Indebted Poor Countries (HIPCs) and Multilateral Debt Relief (MDR) initiatives.

Table 5. Perron innovational outlier unit root test for structural Break

Variable	At level		At First difference	
	t-statistics	Break period	*t*-statistics	Break period
ln*ing*	-5.005[9]	1982	-8.360[9]**	1984
ln*edy*	-4.119[0]	2005	-7.311[1]***	2006
ln*ry*	-1.953[0]	1986	-6.893[0]**	1995
ln*fdy*	-4.551[0]**	1986	-5.501[0]***	1988
ln*dsx*	-3.171[0]	2004	-6.894[4]***	2006
ln*gds*	-4.791[3]**	2009	-9.124[1]***	1985

Notes: Notes: ***, ** and * indicate 1%, 5% and 10% significance level respectively. The figures in square bracket [.] represent the lag selected.

Since there are mix of *I*(0) and *I*(1) order of integration, it is concluded that the ARDL bound testing to cointegrating approach (Pesaran *et al.,* 2001) is more appropriate as compared to other cointegration tests such as Engle and Granger (1987) and Johansen and Juselius (1990) that requires all the variables to be *I*(1) order of integration. ARDL approach has the following advantages. Firstly, it is applied irrespective of whether the underlying regressors are integrated of order one, i.e. *I*(1), *I*(0) or both. Second, it provides reliable results of the long run coefficients that are asymptotically normal. Third, ARDL approach takes a maximum number of lags to capture the data generation process. Finally, it estimates both long run and short run coefficients simultaneously, which reduces the endogeneity problems (Pesaran *et al.,* 2001).

A cointegrating relationship could be estimated using the ARDL bound test of unrestricted error correction models corresponding to equations (2) and (3) in the following form:

Model I:

$$\Delta \ln ing_t = \alpha_0 + \alpha_1 \ln ing_{t-1} + \alpha_2 \ln edy_{t-1} + \alpha_3 \ln ry_{t-1} + \alpha_4 \ln fdy_{t-1} + \sum_{i=1}^{p} \alpha_{5,i} \Delta \ln ing_{t-1} + \sum_{i=0}^{p} \alpha_{6,i} \Delta \ln edy_{t-1} + \sum_{i=0}^{p} \alpha_{7,i} \Delta \ln ry_{t-1} + \sum_{i=0}^{p} \alpha_{8,i} \Delta \ln fdy_{t-1} + \mu_{t,1} \quad (5)$$

Model II:

$$\Delta \ln ing_t = \beta_0 + \beta_1 \ln ing_{t-1} + \beta_2 \ln dsx_{t-1} + \beta_3 \ln gds_{t-1} + \beta_4 \ln ry_{t-1} + \sum_{i=1}^{p} \beta_{5,i} \Delta \ln ing_{t-1} + \sum_{i=0}^{p} \beta_{6,i} \Delta \ln dsx_{t-1} + \sum_{i=0}^{p} \beta_{7,i} \Delta \ln gds_{t-1} + \sum_{i=0}^{p} \beta_{8,i} \Delta \ln ry_{t-1} + \mu_{t,2} \quad (6)$$

where Δ is the first difference operator, p is the lag length and α_i β_i are the coefficients of the variables corresponding to the long run relationship and the error correction representation of the models. t and μ are time dynamic and the Gaussian error term to capture unobserved variables in the model. The null hypothesis for Model I is H_0: $\alpha_{ing} = \alpha_{edy} = \alpha_{ry} = \alpha_{fdy} = 0$, against the alternative hypothesis, H_1: $\alpha_{ing} \neq \alpha_{edy} \neq \alpha_{ry} \neq \alpha_{fdy} \neq 0$. While for Model II is H_0: $\beta_{ing} = \beta_{dsx} = \beta_{gds} = \beta_{ry} = 0$, against the alternative hypothesis of H_1: $\beta_{ing} \neq \beta_{dsx} \neq \beta_{gds} \neq \beta_{ry} \neq 0$.

5. Empirical results

Having found all the variables in both models I and II are stationary, we proceed to find out whether or not the variables are cointegrated. Beginning with the maximum lag selection. A number of lags from 1 to 4 have been tested. A maximum lags structure of 3 for both Models I and II has been selected taking into account Akaike Information Criteria (AIC) for a predetermined ARDL (2, 0, 2, 0) of Model I, and for ARDL (2, 0, 0, 1) of Model II. Table 6 presents the ARDL bound testing to cointegration. The computed *F*- statistics are 4.488 for Model I, and 4.960 for Model II are greater than the upper critical values provided by Pesaran *et al.,* (2001) and Narayan (2005) at the 5% and 10% significant levels. This provides evidence that all the candidate variables are cointegrated in both models.

Table 6: ARDL Cointegration Test Results

Model			Max. Lag	*F*-statistics
Model I, ARDL (2, 0, 2, 0), *k* = 3				
F_{lning} (ln*ing*|ln*edy,* ln*ry,* ln*fdy*)			3	4.488
Model II, ARDL (2, 0, 0, 1), *k* = 3				
F_{lning} (ln*ing*|ln*dsx,* ln*gds,* ln*ry*)			3	4.960
Asymptotic critical values:				
	Pesaran *et al*., (2001)		Narayan (2005)	
Significance level	LB, *I*(0)	UB, *I*(1)	LB, *I*(0)	UB, *I*(1)
1%	4.29	5.61	5.920	7.197
5%	3.23	4.35	4.083	5.207
10%	2.72	3.77	3.330	4.347

Notes: Asymptotic critical values are taken from Pesaran *et al.,* (2001), Table CI (iii) Case III: Unrestricted intercept and no trend and Narayan (2005), case III, unrestricted intercept and no trend.

Since our sample size is small, n = 44, which range from 40 to 45, we used 45 as the landmark, respectively. k is the number of regressors LB and UB stand for the Lower and Upper Bound critical values.

Table 7 presents both long run and error correction representations. The empirical results provide a reasonable support for *a priori* expectation that the respective variables have their expected sign and statistically significant, with relative low p-values ranging at most 10% level. The estimated long run coefficient of external debt, lnedy_t is (-0.531), and for debt service, lndsx is -0.197. They are statistically significant at the 1% level, and had a negative implication on the Nigerian public investment. This implies that a 1% increase in either external debt or debt service payments would reduce the Nigerian public investment by 0.531% and 0.197%, respectively. This suggests that increasing external debt might reduce public investment in infrastructure development through the outflow of resources in debt servicing obligations. These findings are similar to those studies by Jave and Sohino (2009), Deshpande (1997), Quattri and Fuso (2012) among others. However, the results contradict the studies by Ali (2013) and Chaudry *et al.,* (2009), respectively.

The estimated coefficients of gross domestic savings (lngds_t) and foreign direct investment (lnfdy_t) are statistically insignificant. They have no explanatory power on public investment in the long run. This contrast with the view by Kohpaiboon (2003) that foreign direct investment may not necessarily influence public investment as most of the investment is capital intensive and developing countries have no comparative advantage. In line with this, Rajah *et al.,* (2010) made a point that due to inflation, transaction costs and political instability when motivated by specific interest such as investment in oil and gas industry may also be an obstacle to stimulate the required operation at full capacity. The long run estimated coefficient of real GDP, lnry_t is 0.118 and 0.134 for both Models I and II, respectively. They are statistically significant at the 1%. Or to say, a 1% rise in real GDP would promote public investment by 0.118% and 0.134% respectively.

Table 7. Long run and error correction results, dependent variable, public investment

Variable	Model I (equation 5) ARDL (2, 0, 2, 0)	Model II (equation 6) ARDL (2, 0, 0, 1)
Long run coefficients		
Constant	6.388 (8.284)***	7.955 (7.884)***
lnedy_t	-0.531 (-3.635)***	-
lndsx	-	-0.197 (-3.550)***
lngds_t	-	-0.239 (-0.971)
lnry_t	0.118 (4.311)***	0.134 (2.908)***
lnfdy_t	-0.117 (-0.866)	-

Error correction representation		
$\Delta \ln ing_{t-1}$	0.319 (2.303)**	0.394 (2.655)**
$\Delta \ln edy_t$	-0.254 (-3.512)***	-
$\Delta \ln dsx_t$	-	-0.088 (-2.606)**
$\Delta lngds_t$	-	-0.107 (-0.896)
$\Delta \ln ry_t$	0.227 (1.386)	0.372 (1.856)*
$\Delta \ln ry_{t-1}$	0.321 (1.851)*	-
$\Delta \ln fdy_t$	-0.056 (-0.372)	-
ect_{t-1}	-0.479 (-4.218)***	-0.448 (-3.799)***
R^2	0.812	0.902
Adjusted R^2	0.776	0.884
DW	1.869	1.913
Short run diagnostic tests		*F*-statistics [*p*-value]
χ^2*Serial*	0.730 [0.398]	0.024 [0.875]
χ^2*Normal*	2.087 [0.352]	1.209 [0.546]
χ^2*ARCH*	0.197 [0.659]	1.760 [0.192]
χ^2*Ramsey*	1.403 [0.244]	0.368 [0.715]

Notes: ***, ** and * indicate 1%, 5% and 10% level of significance. Figures in bracket (.) are the *t*-statistics. *DW, χ^2Serial, χ^2Normal, χ^2ARCH, and χ^2Ramsey* are Durbin-Watson, LM tests for serial correlation, Jaque-Bera normality test, Heteroscedasticity and functional form (Ramsey RESET), respectively.

Turning to the short run estimates, i.e. the error-correction models, interestingly, the one year lagged public investment variable, $\Delta \ln ing_{t-1}$ is positive and statistically significant at the 5% and 10% level. The coefficients of these variables with respect to both Models I and II are 0.319 and 0.394. A 1% rise in previous year public investment would increase public investment by 0.319% and 0.394%, respectively. This implies that past year public investment is a good predictor of the current public investment in Nigeria. The estimated coefficient of external debt (-0.254) and debt service (-0.088) remained negative and statistically significant at most 5% level. In the short run, their estimated coefficients are less in power than those in the long run. This suggests that an increase in external debt and debt servicing obligations by 1% might decrease public investment by 0.254% and 0.088%, respectively. The coefficient of current real GDP growth is positive and statistically significant at the 10% level in both Models. The estimated coefficients are (0.321) for Model I and (0.372) for Model II. For instance, a 1% growth in real GDP would increase public investment by 0.321% and 0.372%, respectively. This shows the extent to which growth drives have achieved in supporting

the development of public capital formation. This finding contradict Akomolafe *et al.,* (2015), who claimed negative effect of real GDP on public investment in Nigeria.

On the other hand, both the growth of domestic savings and foreign direct investment exerted negative sign, but statistically insignificant. This is attributable to a number of problems inhibiting the transfer of technology and good investment atmosphere in the economy. Among the examples, are the levels of technological know-how, poor infrastructure facilities such as transport, telecommunication and energy supply, remains grossly inadequate with the few most available being in epileptic condition. The Boko Haram and the Niger-Delta terrorist activities have been part of the integral factors. Again, fear of political instability that has been a threat to viable business environment as viewed by Rasiah *et al*., (2010), also discouraged the inflow of foreign direct investment. This finding was found to be contradicted to those of Ali (2013), and Mileva (2008).

More importantly and lastly, the one lagged error correction terms, ect_{t-1} of Models I and II are in the expected negative sign, and statistically significant (at the 1% level). They are -0.479 and -0.448. These values reaffirmed the cointegration relation among the underlying variables in the respective equations (5) and (6). They imply that the deviation from long run equilibrium in responding to the previous periods is approximately corrected by 45% and 48%.

The test statistics of diagnostic testing are presented at the bottom of Table 6. The serial correlation test, Jaque-Bera's normality test of residuals, ARCH test for heteroskedasticity, and Ramsey RESET for functional form, confirmed the fitness of the short run models, in particular they are free from the mis-specification. Both the CUSUM and CUSUMSQ tests suggested for the stability of the estimated parameters of the above mentioned ARDL equations (see Figures 1 and 2) as indicated by the test statistics are within the 5% confidence interval.

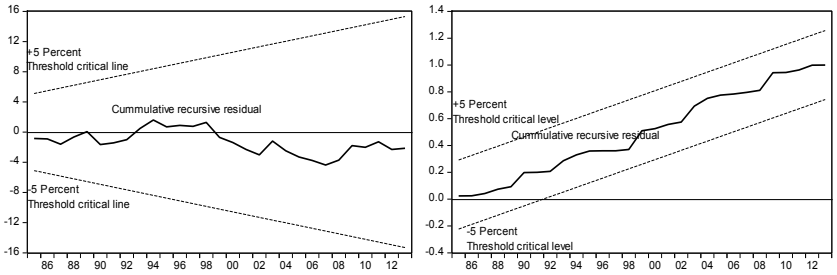

Figure 1. Residual Plots for CUSUM and CUSUMSQ: Model I, Equation (5)

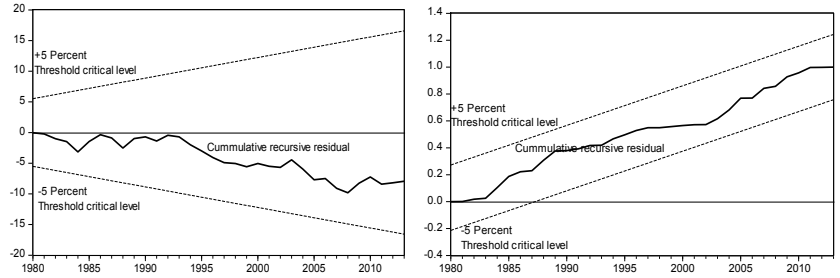

Figure 2. Residual Plots for CUSUM and CUSUMSQ: Model II, Equation (6)

6. Conclusions

This paper investigates empirically the effects of external debt on public capital investment in Nigeria over the annual period 1970 to 2013. Following the confirmation of the order of integration, the analysis is based on ARDL bound testing to cointegrating approach. The empirical results indicated that all the variables in both Models (I and II) exhibit a long run relationship, in other word they are cointegrated. The econometric estimation of the short run and long run coefficients was reported. It was observed that external debt and debt service are negative and statistically significant. This is clearly shown that despite the recent debt relief granted to Nigeria under the Highly Indebted Poor Countries (HIPCs) and Multilateral Debt Relief Initiatives (MDRI) have not yielded any positive change in public investment in Nigeria. On the other hand, domestic savings and foreign direct investment are negative, but statistically insignificant, that is they have no effect on public capital investment while the economic growth is positive and statistically significant. This indicates that real GDP contributes to the growth of public investment in Nigeria. Therefore, Nigeria should develop an effective policy measures towards an efficient investment of the borrowed funds, and provides an enabling environment for foreign investors, and thereby increasing the savings rate for future infrastructure development and sustainable debt stock.

References

Abdullahi, M. M., Hassan, S. B., and Abu Bakar, N. A. (2016), "Analysing the impact of external debt on capital formation in Nigeria: an autoregressive distributed lag approach," *Mediterranean Journal of Social Sciences,* 7(1), 173-183.

Adamu, I. M. and Rasiah, R. (2016), "External debt and growth dynamics in Nigeria," *African Development Review,* 28(3), 291-303.
Adegbite, E. O., Ayadi, F. S., and Ayadi, O. F. (2008), "The Impact of Nigeria's External Debt on Economic Development," *International Journal of Emerging Markets,* 3(3), 285-301.
Ali, S. (2013), "External debt and Domestic investment in Pakistan: A cointegration analysis," *Journal of Managerial Sciences,* 10(2), 181-191.
Akomolafe, K. J., Bosede, O., Emmanuel, O., and Mark, A. (2015), "Public debt and private investment in Nigeria," *American Journal of Economics,* 5(5), 501-507.
Ayadi, F. S., and Ayadi, F. O. (2008), "The impact of external debt on economic growth: A comparative study of Nigeria and South Africa," *Journal of Sustainable Development in Africa,* 10(3), 234-263.
Baum, C. F. (2004), "A review of Stata 8.1 and its time series capabilities," *International Journal of Forecasting, 20*(1), 151-161.
Borensztein, E. (1990), "Debt Overhang, Debt Reduction and Investment: The Case of the Philippines," *IMF Working Paper No. WP/77, International Monetary Fund 1-27.*
Callier, P. (1989), "Debt Relief and Adjustment Incentives in a Financially Open Economy, Comment on Corden," *IMF staff papers* June, 1989, 213-225.
Cassimon, D., and Van Campenhout, B. (2007), "Aid effectiveness, debt relief and public finance response: evidence from a panel of HIPCs," *UNU-WIDER working paper* No. 2007/59, United Nations University World Insititute for Development Economics Research, Helsinki, Finland, 1-18.
Cavallo, E., and Daude, C. (2011), "Public investment in developing countries: A blessing or a curse?" *Journal of Comparative Economics*, 39, 65-81.
Chaudhry, I. S., Malik, S., and Ramzan, M. (2009), "Impact of Foreign Debt on Savings and Investment in Pakistan," *Journal of Quality and Technology Management,* 5(11), 101-115.
Checherita-Westphal, C. D., and Rother, P. C. (2012), "The impact of high government debt on economic growth and its channels: An empirical investigation for the Euro area," *European Economic Review,* 56(7), 1392-1405.
Chenery, H. B., and Strout, A. (1966). Foreign assistance and economic development. *American Economic Review,* 56(4), 679-733.
Clements, B., Bhattarcharya, R., and Nguyen, T. Q. (2003), "External debt, public investment, and economic growth in low income countries," *IMF Working paper* No.WP/03/249, 1-24.
Cohen, D. (1993), "Low Investment and Large LDC Debt in the 1980's," *The American Economic Review,* 83(3), 437-449.
Corden, W. M. (1988), "Debt Relief and Adjustment Incentives," *IMF staff papers, Palgrave Macmillan,* 35(4), 628-643.

Deshpande, A. (1997), "The debt overhang and the disincentive to invest," *Journal of Development Economics,* 52, 169-187.

Dickey, D. A., and Fuller, W. A. (1981), "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root," *Econometrica,* 49(4), 1057-1072.

DMO (2008). Annual Reports and Statement of Accounts. Debt Management Office, Abuja, Nigeria. Retrieved from www.dmo.gov.ng/.

DMO (2010). Annual Reports and Statement of Accounts. Debt Management Office, Abuja, Nigeria. Retrieved from www.dmo.gov.ng/.

DMO (2010). Annual Reports and Statement of Accounts. Debt Management Office, Abuja, Nigeria. Retrieved from www.dmo.gov.ng/.

Engle, R.F., and Granger, C.W.J. (1987), "Co-integration and Error Correction: Representation, Estimation, and Testing," *Econometrica,* 55(2), 251-276.

Eshaq, E. (1983), Fiscal and Monetary Policies and Problems in Developing Countries, Cambridge University Press, London.

Feldstein, M., and Bacchetta, P. (1991), National Saving and International investment, in Bernheim, B.D. and Shoven, J.B. (eds), National Saving and Economic Performance, Chicago, University of Chicago Press.

Feldstein, M., and Horioka, C. (1980), "Domestic saving and international capital flows," *The Economic Journal,* 90, 314-329.

Fosu, A. K. (2010), "The External Debt-Servicing Constraint and Public-Expenditure Composition in Sub-Saharan Africa," *African Development Review,* 22(3), 378-393.

Ghali, K. H. (1998), "Public investment and Private capital formation in a Vector Error Correction Model of Growth," *Applied Economics,* 30(6), 837-844.

Gourinchas, P. O., and Jeanne, O. (2013), "Capital Flows to Developing Countries: The Allocation Puzzle," *Review of Economics Studies,* 80(4), 1484-1515.

Hulten, C. R., and Peterson, G. E. (1984), "The Public capital stock: Needs, Trends, a Performance," *The American Economic Review,* 74(2), 166-173.

IMF (2015), "Fiscal Policy and Long-Term Growth," *IMF policy paper*, June 2015. International Monetary Fund, Washington, D.C.

Javed, Z. H., and Sahinho, A. (2005), "External Debt: Some Experience from Turkish Economy," *Journal of Applied Sciences,* 5(2), 363-367.

Johansen, S., and Juselius, K. (1990). "Maximum likelihood estimation and inference and cointegration with application to the demand for money," *Oxford Bulletin of Economics and Statistics,* 52(2), 169-201.

Kellerman, K. (2007). Debt Financing of Public Investment: On a popular misinterpretation of " The Golden Rule of Public Sector Borrowing". *European Journal of Political Economy*, 23, 1088-1104.

Kohpaiboon, A. (2003), "Foreign trade regimes and the FDI-Growth Nexus: a case study of Thailand," *Journal of Developing Studies,* 40(2), 55-69.

Kwiatkowiski, D., Phillips, P. C. B., Schmidt, P., and Shin, Y. (1992), "Testing the Null of Stationarity against the alternative of a unit root: how sure are we that the economic time series have a unit root?" *Journal of Econometrics,* 54(1-3), 159-178.

Leipziger, D. M. (2001). The unfinished poverty agenda.Why Latin America and the Caribbean Lag Behind. *Finance and Development, 38*, 25-37.

Lora, E. (2007), "Public Investment in Infrastructure in Latin America: Is debt the culprit," *Working paper* No. 595/2007, Inter-American Development Bank, Research Department, Washington, DC.

Lora, E., and Olivera, M. (2007), "Public Debt and Social Expenditure. Friends or Foes?" *Emerging Market Review,* 8, 299-310.

Mileva, E. (2008), "The impact of capital flows on domestic investment in transition Economies," ECB *Research Working Paper* No. 871, Frankfurt am Main, Germany, 1-34.

Musgrave, R. A. (1939), "The nature of budgetary balance and the case for a capital-budget," *American Economic Review,* 29, 260-271.

Narayan, P. K. (2005), "Testing the unit root hypothesis when the alternative is a trend break stationary process: an application to tourist arrivals in Fiji," *Tourism Economics,* 11(3), 351-364.

Perron, P. (1997), "Further evidence on breaking trend functions in macroeconomic variables," *Journal of Econometrics, 80*, 355-385.

Pesaran, M. H., Shin, Y., and Smith, R. J. (2001), "Bounds Testing Approaches to the Analysis of Level Relationships," *Journal of Applied Econometrics,* 16, 289-326.

Phillips, P., and Perron, P. (1988), "Testing for a Unit Root in Time Series Regression," *Biometrica,* 75(2), 335-346.

Quattri, M., and Fosu, A. K. (2012), "On the Impact of External Debt and Aid on Public Expenditure Allocation in Sub-Saharan Africa after the Launch of the HIPC Initiative," UNU-WIDER, *Working Paper* No. 2012/42, 1-32.

Rasiah, R. (1995), Foreign capital and industrialization in Malaysia, Basingstoke, Macmillan.

Rasiah, R., Gammeltoft, P., and Jiang, Y. (2010), "Home government policies for outward FDI from emerging economies: lesson from Asia," *Journal of Emerging Markets,* 5(3/4), 333-357.

Smith, A. (1776), *An Inquiry into the Nature and Causes of the Wealth of Nations*, The Electric Book Company Ltd 20 Cambridge Drive, London SE12 8AJ, UK.

Smith, J. L. (2009), "Association of World Oil: Market or Mayhem?" *The Journal of Economic Perspectives,* 23(3), 145-164.

Tatom, J. A. (1991), "Should Government Spending on Capital Goods be Raised?" *Federal Reserve Bank of St. Louis Review*, 73(2), Pp 3-15.

Taylor, L. (1993), "Gap models". *Journal of Development Economics"* 45, 17-34.

Truger, A. (2015), "Implementing the Golden Rule for Public Investment in Europe Safeguarding Public Investment and Supporting the Recovery," *Working Paper*-Reihe der AK-Wien Nr.138/2015. Materialien zu Wirtschaft und Gesellschaft, 1-64.

Udomkerdmongkol, M., Gorg, H., and Morrissey, O. (2007), "Investment and Sources of Investment Finance in Developing Countries," Research Paper No. 16/2007. Leverhulme Centre for Research on Globalization and Economic Policy, 1-29.

USAID (2006), "Nigerias Economic Performance Assessment," Nathan Associates Inc. Retrieved from *nairametrics.com/wp-content/.../03/Nigeria_Economic_Performance_ Assessment2.pdf*

Were, M. (2001), "Impact of external debt on economic growth in Kenya: Am empirical assessment," *WIDER Discussion Papers* // World Institute for Development Economics (UNU-WIDER), No. 2001/116, 1-23.