Effect of Public Debt on Public Investment in Nigeria: 1985-2018

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Authors' contributions

This work was carried out in collaboration among all authors. Author CKO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author OUN managed the analyses of the study. Author CBU managed the literature searches. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

This study examined the effect of Nigeria public debt on public investment from 1985-2018. Data for the analysis was obtained from Central Bank of Nigeria Statistical bulletin and the study chooses Nigeria as its sample. ARDL Auto-regressive Distributed lag models was used to test the effect of the independent variables (Public Debt, Budget Deficit, Debt Servicing, Public Debt to GDP Ratio) on the dependent variable (Public Investment). The cointegration test found the existence of long-run relationship among the investigated variables. The short run result shows that public debt has insignificant effect on public investment in Nigeria. The study therefore recommends among others that Federal government should be fiscal responsible by channeling borrowed funds to investments that will bring growth in the economy. Government should tackle waste and corruption by making sure that funds borrowed and allocated for investment should be transparently and judiciously utilized in the provision of infrastructure. Debts should be taken only when necessary and should be for investment and not for payment of salaries.

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1. INTRODUCTION

According to Mankiw [1], every country's economy requires an amount of capital for investment and to sustain economic development. In a situation when government expenses surpasses its tax collection, it has a budget deficit. When a government incurs a deficit, it can meet this deficit by the following means (a) it can run down its cash reserves (b) It can sell its assets like properties (c) It can print more currency and use it (d) It can borrow and spend [2]. Note that the second method of meeting the deficit does not at all increase the indebtedness of the government though a government seldom adopts this approach. The first and third methods increase the supply of currency of the government in the market while the fourth increases the outstanding public debts. To finance fiscal deficit government has various ways to raise fund for that purpose. One way to finance fiscal deficit is to print money which is equivalent of borrowing money from Central Bank of a country. Another alternative way is to borrow from domestic deposit money banks, from non deposit money banks in the country and from external sources. Each of these method has its consequences on different sectors of the economy. Government usually combines these methods and uses a number of alternatives at the same that will be more beneficially to the country at a particular time. In essence governments can raise more funds by rising taxes, printing money, domestic or external borrowing and using previous budget surplus. When a government choose to borrow instead of setting up additional tax measures to fund its budget deficit, it creates a liability on itself known as "public debt" or "national debt". Public debt can be classified as sum of external debt and domestic debt.

As far as the connection between external debt and economic growth is concerned, a reasonable level of borrowing is likely to enable economic growth, through capital accumulation and productivity growth [3]. As the government raise much of its revenue from population, public debt is seen as an indirect debt of the taxpayers. Public debt is a significant aspect of economies all over the world. It has an important influence on economic growth both in the short-run and long-run [4]. Its effect on the economy has become a typical issue and debate among scholars all over the world [5]. According to Cecchetti [6], debt is a two-edged sword. In other words, it can improve welfare when used appropriately, but can also be devastating when used carelessly. This affirmation indicates that borrowing is only suitable under definite circumstances and government needs to exercise caution while designing their debt policies. For example, a number of people believes that if the government increases its borrowing during recessions, it will help the economy by sustaining the income and spending levels. Such borrowings are embarked upon to take care of tax receipt arising from recession and the increased need for the government to advance the economy via infrastructural financing and other ventures that encourage growth. Ogunjimi [7], opined that if government undertakes realistic public debts it will most likely improve economic activities and so, economic growth. However, the direction of government spending will determine, to a large extent, if public debt will lead to economic growth or not. For instance, borrowing to carry out development projects, increase capital expenditure and rational investment in productive ventures will, in the long run, lead to economic growth. Unfortunately, many developing countries borrow for other reasons other than as expressed above, which is why their debt profile keeps increasing, investment keeps falling, unemployment rises, national output falls and majority of her citizens wallow in poverty.

In recent times, the Nigerian economy has been having persistent fiscal deficit and adverse balance of payment problems. This is occasioned by incessant fluctuations in the price of crude oil in the international market since Nigeria is a monocutural economy. These inconsistencies in the price of crude in the international market plunged the country's economy into recession in the economy in 2016. To stimulate the economy, the government is left with no choice than to engage in borrowing (internal and external). Nigeria's public debt stock stood at N29.7trillion as at December 2019. This represents a 16.9% (N3.79 trillion) increase over the N22.43 trillion recorded in the corresponding period of 2018. The total public debt stock, when compared to the level of four years ago (that is as at September 2015), has doubled; and when compared to the level as at September 2013 has tripled. Each year, since 2013, the additional debt the Nigerian Government incurred in the first nine months was

more than N2 trillion. The only exception was in the period September 2015 when the government raised a debt stock of N1.52 trillion. Indeed, in three of these six years (2016, 2017, and 2019), the increase in public debt stock as at September of each year ranged from N3.5 to N4.5 trillion. The N26.7 trillion debt stock is equivalent to $85.39billion, comparing to $26.94 billion external and $58.45billion domestic debt. The $85.39 billion total public debt as at September 2019 is 84.8% ($39.2 billion) higher than the country's total public debt of $46.2 billion as at 2006, prior to Nigeria's exit from the Paris Club through a debt buy-back deal. In April 2020 National Assembly approves the loan request of Federal government thereby allowing the Federal government to borrow a sum of $850 million from IMF the question still remains is borrowing the only option for Nigeria to increase its public investment and achieve economic growth and development.

From 2010 to date Nigeria public debt has been increasing due to revenue challenge being faced by the country as result of decline in oil price and revenue base of the country. In a bid to finance human capital development, agriculture and infrastructure development in the areas of roads, railways, waterways and power which will help ensure growth of the economy Nigeria government has continued to borrow funds for these projects. It is believed that with the increase in public debt, government will invest the borrowed fund on projects that will help in the development of the economy reduce the unemployment rate and generate enough funds in order to repay the loans. Various research work has been carried out on this subject matter and results shows that public debt has significant effect on public investment while other results shows insignificant effect. Their finding are contradictory and is on this background that the study was motivated to fill the knowledge gap on the effects of public debt on public investment in Nigeria. As such the study seeks to find out if public debt has helped to increase public investment in the country. The study also introduces debt to GDP ratio which compares a nation's debt to its economic output in the country. In addition to the introduction, section two presented a review of related studies while section three discussed the methodology on which this study is based. Section four presented the analysis of empirical results while section five discussed summary and policy recommendations.

2. LITERATURE REVIEW

Investment has been defined as an asset or item obtained with the aim of generating income or appreciation. Also is the procurement of goods that are not consumed today but used in the future to generate wealth. Ajayi [8] also defined investment as monetary asset acquired with the idea that the asset will provide income in the future or will be sold later at a higher price for a profit. He also opined that public investment involves funding and allocating resources for projects and services that the private sector cannot effectively deliver on its own. These projects are usually large in scale and the private sector does not get involved in most of them. Tsoulfidis [9] explains the difference between private and public investment: Private investment means putting your own money at risk in anticipation of realizing a gain later while public investment means taking and spending someone else's money to support your idea of how you think they should live or to satisfy the special interests that help get you re-elected. Hoag and Hoag [10] also emphasized that public investment is the key channel through which the government development goals can be met which will help grow the economy. In essence it involves government spending today in order to grow the economy. UN [11] defined public investment to any expenditure whose productive life expands into the future.

Hence, much public investment takes the form of infrastructural outlays – for road and rail networks, ports, bridges, energy-generating plants, telecommunications structures, water and sanitation networks, government buildings – which can have a productive life of several decades. Such outlays range from small, one-off, limited infrastructural projects that can be implemented within a year to more complex projects that take place over decades. However other types of outlays, some of a more current form, can also contribute to capital formation. Remarkably, government expenditure on health and education contributes not only to an individual's human capital development but also to that of society, with benefits that can extend for a lifetime.

One of the most significant determinants of the rate of growth in an economy is the rate on investment. Countries with high rate of investments experience high rate of growth, while countries with low investment rate are slow in their growth process Tawiri [12]. An economy

grows as her investment grows. The need for a more and secured economic growth has made developing countries seek to improve their human, institutional and infrastructural capacity. This has often resulted in the increase of government expenditures and with insufficient revenue generation, debt burden is expected to increase. According to Ajayi [8], developing countries usually obtain debts because they are in the stage of development, and need additional support. Therefore, public debt is a way of linking the saving-investment gap and provide extra investment needed for achieving the needed economic growth. As noted by Mohammad and Sabahat [13], many developing countries have policies to attract foreign capital through loans and other means to improve growth. Also, Ahmad [14] opined that foreign debt is used to generate a continuous growth for the economy that might have been impossible within the pool of domestic resources and level of technology available for the country. This was also echoed by Siddiqui and Malik [15] that foreign borrowing improved resource availability and contributed to economic growth in South Asia. The rationale behind public debt is discussed in what is known as the debt cycle theory. There are three stages in the debt cycle. In the first stage, countries borrow to create additional resources needed for growth. This enables them to stand on their own feet. By the time they are in the second stage, they continue to borrow because the surplus is perhaps not enough to offset interest payments. In the third stage, they would have generated adequate surplus resources with which they can repay the debts. Thus, the aim of public debt is to help the beneficiary countries develop, sustain and accelerate their economic growth and pay back the loans from its returns. However, if the purpose of debt is to be attained, it has to be well managed and the resources directed to where it will be carefully and efficiently used.

However, public debt if not properly managed could lead to more problems than good. It might result to debt threshold or public debt overhang which can result to high interest rates, higher inflation and crowding out private investment [16]. Taking higher interest rate for example, creditors might set higher interest rates due to low confidence in the ability of the country to settle its debts. As a result, higher interest rates stimulate high debt cost, forcing government to impose additional tax on the citizens [10], inducing the likelihood of economic depression and lower government

expenditure in other areas. Most importantly, higher interest rates may result in low investment, leading to sluggish economic growth in the rest of the economy. This can concurrently stimulate current account deficit and decline in economic growth forcing the country to borrow more thus increase its debt service [17]. Additionally, when the debt is accumulated, the cost of servicing this debt would come from taxes on future production. As a result, investment would be discouraged, hence crowding out of investment [18]. When used correctly, public debts improve the standard of living in a country. It allows the government to construct new roads and bridges, improve education and job training and provide pensions. This encourages citizens to spend more now instead of saving for retirement. This spending by private citizens further boosts economic growth.

2.1 Theoretical Framework

Three theories are ascertained as suitable for this study. Three of which are supporting theories for public debt.

2.1.1 Dual gap theory

The theory supports external borrowings to finance capital investment. According to dual-gap theory, domestic saving is not sufficient to finance investment for economic development. To fill the gap external sources of capital for investment are sought to complement the deficit [19]. The theory believes developing economies face two gaps in their economy which they must fill. The first gap is that between savings and investments in the economy. A developing country with a low savings will need to engage in big activities by investing heavily and this will be possible by engaging external borrowings. The second gap to fill is that between exports and imports, thus there should be excess of import over export (i.e. M>E). That is, Investment – Savings = Import – Export (I–S = M–E). In the national income accounting, surplus of investment over domestic saving is equal to surplus of import over export. Income = Consumption + Import + Savings; while Output = Consumption + Export + Investment Income. This is the basis for dual gap analysis; it indicates that savings investment gap exists when domestic saving is less than the required level necessary to achieve the target growth rate. In a similar vein, if the maximum import requirement necessary to realize the growth target is larger than the

maximum possible level of export, then there is an export- import exchange gap [20].

2.1.2 The crowding out theory (Neo-classical school)

The crowding out effect is an economy theory arguing that rising public sector spending drives down or even eliminates private sector spending. Crowding out effect begins with inability of domestic creditors (mostly the government through central bank as a lender of last resort) to meet investors' needs because of higher external debt servicing because of liquidity constraints [21]. Current higher debt servicing implicates higher future taxes of which private investors escape by being reluctant to invest. This is the view of the neo-classical school.

2.1.3 The debt overhang theory

Debt overhang is the condition where an entity debt burden is so large that it cannot take on additional debt to finance future projects. The burden is so large that all earnings pay off existing debt rather than fund new investment projects making the potential for defaulting higher [22]. This theory is established on the principle that if the level of debt exceeds the country's capacity to refund with some imminent likelihood, expected debt service is anticipated to be an increasing function of the country's economic growth level [20].

2.2 Empirical Review

Various empirical studies have been carried out to study the effect of public debt on investments. This section attempts a review of some of the past studies which were conducted both within the country and abroad whose topics were related to the current subject.

Omodero [23] investigated external debt financing and its effect on public capital investment in Nigeria. Data for the study was obtain from World Bank and Central Bank of Nigeria Statistical Bulletin 1996 to 2018. The dependent variable is government capital expenditure, while the key independent variables are external debt accumulation and debt servicing cost. The moderating variables used in the study were Inflation and exchange rates. Ordinary least squares multiple regression method was used as method of data analysis. The regression results indicates a significant negative impact between external debt and capital investment while debt servicing cost has a strong and significant positive effect on capital investment. Under this conditions, there is no significant relationship between controlling variables and capital investment. Consequently, the study suggests that if external borrowing must be embarked upon emphasis should be on profitable capital investments. In order words emphasis should be on the establishment of industries, revival of abandoned industries and development of untapped natural resources in other to help in debt repayment.

Ogwuma, Orikara and Uruakpa [24] ascertained the effect between capital expenditure, recurrent expenditure and domestic public debts on Nigerian economic growth for the period (1980-2016). Proxies for public expenditure were recurrent expenditure and capital expenditure and gross domestic product (GDP) represent economic growth. The study made use of OLS of multiple regressions. The study indicates insignificant and negative effect between domestic public debt and recurrent expenditure on economic growth in Nigeria while there is significant but positive between capital expenditure on economic growth in Nigeria. The emphasis was on domestic public debt the current study tends to look at both external and internal debts of the government which was not covered in the study.

Ibrahim [25] investigated the effects of external debt on public capital investment in Nigeria spanning from 1970 to 2013. Autoregressive distributed lag (ARDL) bound testing approach was used as method of data analysis. The result revealed a negative inpact between external debt and debt service on public capital investment, while having positive impact on current real GDP.

Ma'ale [26] studied the effect of public investment and public debt on economic growth in Jordan covering 1990-2017. The hypotheses was tested multiple linear regression. The research discovered that public debt has statistically significant impact but negative effect on economic growth in Jordan. While public investment has a statistically significant impact and positive effect on economic growth in Jordan. The current study assessed the impact of public debt and its servicing on public investment instead.

Wambui [27] did a study on the effect of public debt on private investment and economic growth in Kenya for the period 1980 to 2013. The causal

relationship between public debt, private investments and economic growth was determined with the use of granger causality test. Ordinary least squares method was used in the estimation of the model. The result of granger causality test revealed that there is unidirectional causality between debt to private investment and GDP growth. Also the study indicates that debt has negative effect on private investments but positive effect on economic growth.

Ogunjimi [7] investigated the impact of public debts on the various forms of investment in Nigeria from 1981-2016. Autoregressive Distributed Lag (ARDL) was used as a method of data analysis. The result of the analysis revealed that domestic debt improves both private and public investment in the short-run and long-run that is, domestic debt crowds-in both private and public investment but it does not attract FDI. The analysis also showed that external debt crowds-in private investment both in the short-run and the long run; crowds-out public investment; and does not influence FDI. However, in his model he did not regress debt service on investment which this study sets to achieve alongside others.

Ncanywa and Masog [28] examined the influence of public debt on public investment and economic growth from 1995 to 2016.Structural analysis (granger causality, variance decomposition and impulse response function) and autoregressive distributive lag were applied to achieve the objectives. Cointegration test showed that public debt and investment has a long-run relationship. The result shows that public debt and investment has negative relationship in the long run. Given that investment and economic growth has direct link, public debt economic growth nexus has inverse relationship. The error correction mechanism confirmed that the system can adjust to equilibrium at a speed of 17%. There is bidirectional causual relationship between public debt and economic growth. The impulse response function indicates that, one standard deviation shock in public debt inversely affect economic growth. Variance decomposition results indicate that economic growth fluctuatiuons account for 16.39% shock in public debt.

Akomolafe et al. [29] studied the effect of public borrowing on Nigeria private investment from 1980 to 2010. Johnasen Co-integration test and Vector Error Correction Model (VECM) were used as method of data analysis. The result of

the analysis revealed that domestic investment in both short run and long run is crowd out by domestic debt. Nevertheless, the result shows that domestic investment in the long run is crowed out by external debts.

Kasele et al [30] investigated the impact of public debt on investment: Case of ECGLC (Economic Community of the Great lakes countries) and its member states, after preliminary tests (individual effects tests and Hausman specification test) which led to private investment estimation through the Folly-modified Ordinary Least Square and Ordinary Least Square; and to public investment estimation by the Generalized Least Square, it appears from this study, that public investment positively impacts private investment and vice versa, the government-backed stock of public debt, on the other hand, has a negative impact on private investment, contrary to its positive relationship with the public investment. Public debt servicing has negative influence on private and public investment on the long-term.

Picarelli, Vanlaer and Marneffe [31] did a study on Does public debt produce a crowding out effect for public investment in the EU? The study uses a panel data for 26 Countries in EU, to investigate the degree to which decrease in public investment was caused by increased levels of public debt, the supposed debt overhang hypothesis. To deal with the endogeneity concerns, instrumental approach based on GMM estimation was used.. Our outcome confirms the debt overhang hypothesis and continue to be rigorous across different evaluation techniques. The GMM specification with year dummies revealed that 0.03% decrease in public investment was caused by 1% increase in public debt in EU countries within the period of the study. Furthermore, the study indicates that (1) high-debt countries largely influence the result'; (2) the negative impact of debt on investment is slightly smaller in the Eurozone than in the entire EU; (3) both the stock and flow of public debt play a role in reducing public investment with the impact of the latter that is found to be more profound.

Adamu [32] did a study on the effects of external debt on public capital investment in Nigerian from 1970 to 2013. Autoregressive distributed lag (ARDL) bound testing approach was used as a method of data analysis. The result indicates a negative impact between debt service and external debt on public capital investment while current real GDP has positive impact. Generally, the empirical evidence revealed that external

debt does not influence public investment within the period of the study. At longer horizon, it was established that poor domestic savings and investment in the country causes higher debt service payments and crowds out available resources for investment in economic and public sectors

Richard., Sebulime and Enoch [33] studied an empirical analysis of the effect of public debt on economic growth of Uganda from 1980-2016. The study discovered a negative relationship between public debt and economic growth in the short run. In the long run debt has a mixed effect, Gross debt as a share of GDP has a positive impact while total debt service has a negative impact on the economy. The result shows that public debt has positive effect on Uganda's economic growth in long run but negative on the short run. Again, the study didn't cover the impact of public debt on public investments which sets a gap this current study will fill.

3. METHODOLOGY

The study used secondary data sourced from Central bank of Nigeria statistical bulletin from 1985 to 2018. Autoregressive distribution lag (ARDL) and structural analysis was employed in the study in order to explore the effect of public debt on public investment in Nigeria.

In order to achieve the objective of the study, the model from the work of Ncanywa and Masog [28] who investigated if public debt can influence public investment and economic growth in South Africa from 1995 to 2016 were adopted and modified. The model used was:

$$INV = f(PD,BD,RE,RI)$$

Where, INV represents fixed investment measured by total assets of public investment corporation, PD public debt, BD budget deficit, RE ratio of exports to GDP and RI ratio of imports to GDP.

To capture the specific characteristics of Nigerian economy the model was modified to

$$PUINV=(PD,BD,DS,PDGDP)$$
$$PUINV = a_0 + a_1PDs_{it} + a_2BDs_{it} + a_3DSs_{it} + a_4PDGDPs_{it} \qquad (3.1)$$

$$PUINV = a_0 + a_1logPDs_{it} + a_2logBDs_{it} + a_3logDSs_{it} + a_4logPDGDPs_{it} + e_{it} \qquad (3.2)$$

Where, PUINV represents public investment, PD public debt, BD budget deficit, DS debt servicing, PDGDP public debt to GDP ratio.

4. DATA ANALYSIS AND INTERPRETATION

In this section we presented the analysis and interpretation of the result of econometrics analysis adopted in this work. The first step in this analysis is to describe the variables used in the study before we proceed to carry out stationarity test. Stationarity test was conducted using ADF test and PP test. The result of the ADF and PP test is shown in Tables 2 to 5.

The characteristics of the data series used in the analysis are presented in Table 1. The table shows the summary of descriptive statistics used in the analysis. The mean value was shown to be 475.7244 for PUINV, 4557.242 for PD, 576.2450 for BD, 383.7515 for DS and 33.46775 for PDGDP. The median value was shown to be 336.3400 for PUINV, 3107.870 for PD, 119.1250 for BD, 159.6150 for DS and 27.07250 for PDGDP. The maximum and minimum of the series are 1682.100 and 5.460000 for PUINV, 20533.60 and 45.25000 for PD, 3628.100 and -32.05000 for BD, 2161.370 and 1.610000 for DS, 76.58900 and 7.261800 for PDGDP. The series standard deviations are 441.5376 for PUINV, 5160.965 for PD, 970.1946 for BD, 535.9267 for DS, 22.49433 for PDGDP. All the variables are positively skewed towards normality as shown by the positive sign of the skewness. The Jarque-Bera suggests that all the variables are normally distributed as the p-values of these variables (PD, BD, DS) are in excess of the 5% level of significance except PUINV and PDGDP which will be tolerated as its still consistent with the behaviour of most economic and financial time series.

The result in Table 2 revealed that PD and DS are stationary at level but PUINV, BD and PDGDP are not stationary at level. Based on this we difference the variable's to see their outcome.

From the result of ADF test shown in Table 3 it shows that PUINV, BD and PDGDP are stationary at 1st difference. This shows that the variables used in the study are integrated in order 1(0) and 1(1). In other to confirm the stationnarity of the variables the study also adopted Phillips-Perron (PP) unit root test at intercept.

The result of Phillips-Perron (PP) unit root test confirms that the variables are stationary at level 1(0) and order one 1(1) which necessitated the use of Autoregressive distribution lag (ARDL) as method of data analysis.

4.1 ARDL Co-integration Relationship

The affirmation of the non-stationarity of the data through the unit root test of ADF and PP permit for the determination of the co-integration relationship between the dependent and explanatory variables in the models. Subsequently, we carry on with the bounds test as it can estimate variables both at level and of first order of integration [34].

Table 6 presents cointegration results of the bounds test. The public debt–investment model has five variables. Therefore, there are four independent variables in the model, hence k=4.The calculated F-statistics is 5.236177, which is greater than the lower bounds critical value of 3.74 and the upper critical value of 5.06 at 1% level of significant. Therefore, there is cointegration among the variables, meaning in the long run the variables are co-moved [34].

4.2 Nature of Long Run Relationship/ARDL Error Correction Model

The ARDL result has proven that public investment, public debt, budget deficit, debt servicing, public debt to GDP ratio are co-integrated/related in the long run through the bounds testing. Consequently, the determination of short and long run relationship becomes necessary as well as the speed of the adjustment to equilibrium.

Table 7 shows the short and long-run coefficients of the model. The result of the analysis showed a positive and insignificant long-run relationship between public investment and public debt within the period of the study. This positive long-run relationship is consistent with the finding of Akomolafe et al. [29] and Ogwuma, Orikara and Uruakpa [24]. The argument to the positive relationship is that public debt enables nations to borrow to carry out development projects, increase capital expenditure and rational investment in productive ventures will, in the long run, lead to economic growth. Unfortunately, many developing countries borrow for other reasons other than as expressed above, which is why their debt profile keeps increasing, investment keeps falling, unemployment rises,

national output falls and majority of her citizen's wallow in poverty.

Table 7 also shows that the error correction term denoted by ECM has a negative sign, indicating that the system will eventually revert to equilibrium. Thus, long-run disequilibrium will be corrected through short run adjustments, and will lead the system to equilibrium in the short run at a speed of 76%.

4.3 Diagnostic Test

4.3.1 Normality test

The normality test was done using the Jarque-Bera Normality test, which requires that for a series to be normally distributed; the histogram should be bell-shaped and the Jarque-Bera statistics would not be significant. This implies that the p-value given at the bottom of the normality test table should be greater than the chosen level of significance to accept the Null hypothesis, that the series is normally distributed [35].

The result of the normality test shows that the probability value of is 0.500113 is greater than 0.05.Based on this however we accept H_0 and reject H_1. We then conclude that the residuals are normally distributed and random.

4.3.2 Serial correlation LM test

From Table 8, the p-value is greater than the chosen level of significance of 5%, indicating the absence of autocorrelation in the models. The result of the serial correlation shows that the probability value is 0.0584 which is greater than 0.05 implying that we accept H_0 and reject H_1. We then conclude that there is no serial autocorrelation in the model and that the model is appropriate for the study.

4.3.3 Cusum tests of stability

The CUSUM test is the test used to check stability within the model. The results of stability test show evidence that the model is stable. This is indicated by a movement of blue lines located within the critical lines (two-red dotted lines) in the figures. Therefore, at 5% level of significance, the CUSUM stability test confirms good performance of the model.

Table 1. Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Jarque-Bera	P-value	Obs
PUINV	475.7244	336.3400	1682.100	5.460000	441.5376	0.778256	2.838084	3.469337	0.176459	34
PD	4557.242	3107.870	20533.60	45.25000	5160.965	1.631200	5.185048	21.84173	0.000018	34
BD	576.2450	119.1250	3628.100	-32.05000	970.1946	2.157008	6.823890	47.07991	0.000000	34
DS	383.7515	159.6150	2161.370	1.610000	535.9267	1.924626	6.079847	34.42811	0.000000	34
PDGDP	33.46775	27.07250	76.58900	7.261800	22.49433	0.385146	1.747180	3.064122	0.216090	34

Source: Output Data from E-views 9.0

Table 2. ADF result at level

Variables	ADF test statistic	1%	5%	10%	Order of integration
PUINV	0.258470	-3.646342	-2.954021	-2.615817	Non-stationary
PD	4.130880	-3.646342	-2.954021	-2.615817	Stationary
BD	2.185354	-3.646342	-2.954021	-2.615817	Non-stationary
DS	6.087666	-3.646342	-2.954021	-2.615817	Stationary
PDGDP	-1.285129	-3.646342	-2.954021	-2.615817	Non-stationary

Source: Researcher's E-view result

Table 3. ADF result at 1st difference

Variables	ADF test statistic	1%	5%	10%	Order of integration
PUINV	-5.408692	-3.653730	-2.957110	-2.617434	Stationary
PD	-2.250074	-3.653730	-2.957110	-2.617434	Non-stationary
BD	-3.543039	-3.653730	-2.957110	-2.617434	Stationary
DS	-2.523121	-3.653730	-2.957110	-2.617434	Non-stationary
PDGDP	-4.570132	-3.653730	-2.957110	-2.617434	Stationary

Source: Researcher's e-view result

Table 4. PP result at level

Variables	ADF test statistic	1%	5%	10%	Order of integration
PUINV	1.914329	-3.646342	-2.954021	-2.615817	Non-stationary
PD	4.130880	-3.646342	-2.954021	-2.615817	Stationary
BD	4.479749	-3.646342	-2.954021	-2.615817	Stationary
DS	7.428264	-3.646342	-2.954021	-2.615817	Stationary
PDGDP	-1.506249	-3.646342	-2.954021	-2.615817	Non-stationary

Source: Researcher's E-view result

Table 5. PP result at 1ˢᵗ difference

Variables	ADF test statistic	1%	5%	10%	Order of integration
PUINV	-5.412265	-3.653730	-2.957110	-2.617434	Stationary
PD	-2.272741	-3.653730	-2.957110	-2.617434	Non-stationary
BD	-3.393819	-3.653730	-2.957110	-2.617434	Stationary
DS	-2.500347	-3.653730	-2.957110	-2.617434	Non-stationary
PDGDP	-4.494792	-3.653730	-2.957110	-2.617434	Stationary

Source: Researcher's E-view result

Table 6. ARDL bounds test results 1985-2018

Null hypothesis: No long-run relationships exist		
Test Statistic	**Value**	**k**
F-statistic	5.236177	4
Critical value bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Researcher's e-view result

Table 7. ARDL Long Run Form for PUINV→PD+BD+DS+PDGDP

| Original dependent variable: Public investment				
Short run coefficients				
Variable	**Coefficient**	**Std. error**	**t-Statistic**	**Prob.**
D(PUINV(-1))	0.474039	0.225135	2.105575	0.0481
D(PUINV(-2))	0.507735	0.233964	2.170143	0.0422
D(PD)	0.026740	0.029863	0.895444	0.3812
D(BD)	0.216881	0.132408	1.637969	0.1171
D(BD(-1))	-0.422958	0.173839	-2.433049	0.0245
D(DS)	-0.487308	0.362045	-1.345987	0.1934
D(PDGDP)	-2.516600	2.918673	-0.862241	0.3988
Coint Eq(-1)	-0.765550	0.183623	-4.169148	0.0005
Cointeq = PUINV - (0.0349*PD + 0.6215*BD -0.6365*DS -9.6879*PDGDP + 632.1662)				
Long run coefficients				
Variable	**Coefficient**	**Std. error**	**t-Statistic**	**Prob.**
PD	0.034930	0.035813	0.975321	0.3411
BD	0.621486	0.249995	2.485991	0.0219
DS	-0.636547	0.438787	-1.450697	0.1624
PDGDP	-9.687869	2.093718	-4.627113	0.0002
C	632.166215	121.232293	5.214503	0.0000

Source: Output data from e-views 9.0
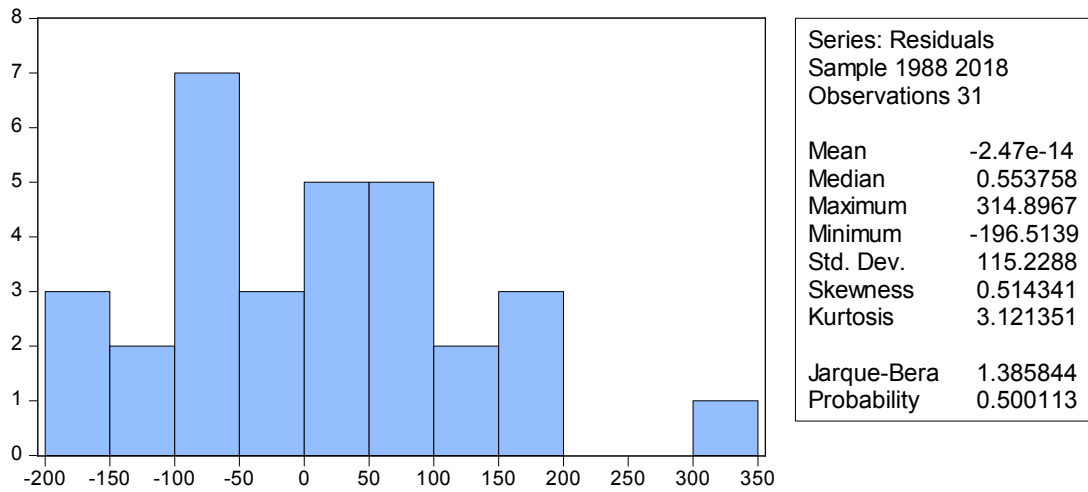
Fig. 1. Normality text
Source: E-views 9.0 version data output

Table 8. Serial correlation LM test

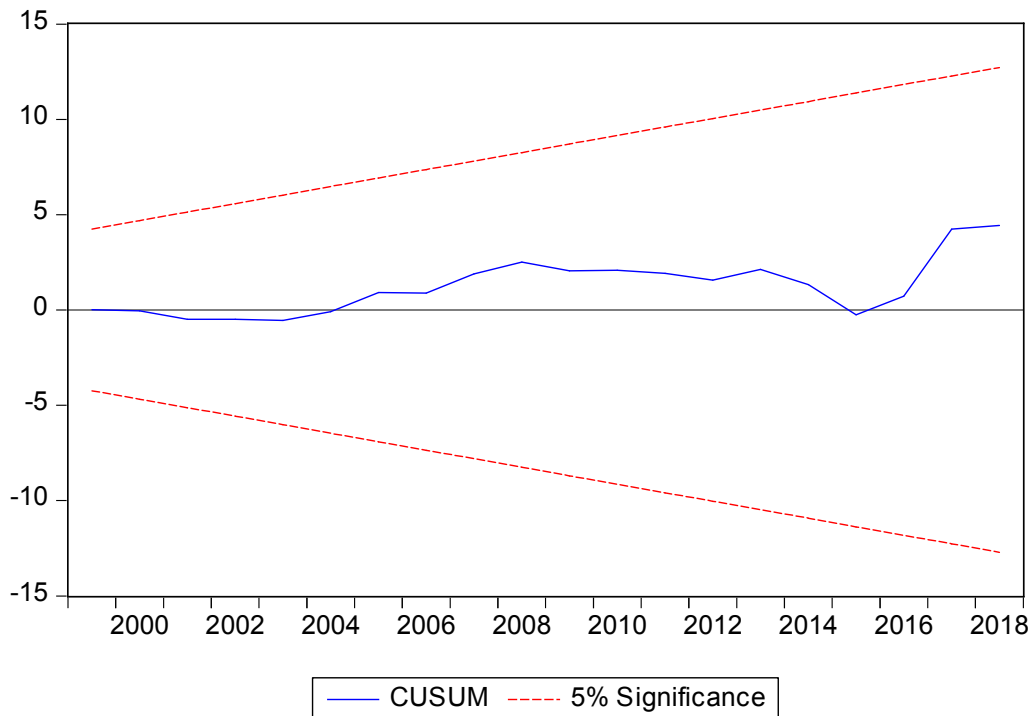| Breusch-Godfrey serial correlation LM test:			
F-statistic	3.340832	Prob. F(2,18)	0.0584
Obs*R-squared	8.392123	Prob. Chi-Square(2)	0.0151

Source: E-views 9.0 version data output

Fig. 2. Cusum text
Source: E-views 9.0 version data output

4.4 Short Run OLS Relationship

In estimating the short run nexus between public debt and public investment, the OLS regression was applied and the result depicted in Tables 9. The outputs were interpreted using the coefficients of the individual variables, Adjusted R-square, f-statistic and Durbin Watson.

Table 9 shows that in the short run public debt has negative and insignificant effect on public investment in Nigeria.

The result is in line with the study of Omodero [23]; Ibrahim [25]; Ogwuma, Orikara and Uruakpa [24]; Ncanywa and Masog [28] and Akomolafe et al. [29]. This goes to show that the huge debt incurred by Nigeria has been used on recurrent expenditure and on wasteful projects instead of investing it in capital projects or infrastructure that will help increase the tax base and revenue to the government. Equally the huge debt means that the resources that would have been used for investment are diverted to

meeting debt service obligations. The debt servicing and the adjustment policies required to address the debt burden have also worsened social welfare in the area of education, health, communication, etc. The most serious implication of debt overhang is that, it has reduced the amount of foreign exchange available to finance the importation of raw materials and capital goods needed for rapid economic development. This means that the debt burden has denied the industrial and agricultural sectors the needed inputs, holding back new investments and even the maintenance of capital stock. This has put pressure on the tax authority to raise enough revenue that will be used to service the debt and restore the confidence of international community on Nigeria economy. According to Iyoha [17] heavy debt burden payments have inevitably put great pressure on budget leading to rising fiscal deficits in the heavily indebted countries, the implication of this impact are: It has to increase tax to service the debt and reduce the deficit, it equally has the effect of depressing investment on the debt over hung effect.

Table 9. OLS regression: Public investment and public debt

Dependent variable: PUINV
Method: ARDL
Dynamic regressors (3 lags, automatic): BD DF PD PDGDP
Fixed regressors: C
Number of models evaluated: 1024
Selected model: ARDL(3, 2, 0, 1, 0)

Variable	Coefficient	Std. error	t-Statistic	Prob.*
PUINV(-1)	1.089028	0.160389	6.789922	0.0000
PUINV(-2)	-0.514208	0.215365	-2.387613	0.0269
PUINV(-3)	0.633074	0.160218	3.951338	0.0008
BD	0.230830	0.238184	0.969124	0.3441
BD(-1)	0.447031	0.283667	1.575901	0.1307
BD(-2)	-1.073070	0.336322	-3.190605	0.0046
DS	-0.973387	0.657769	-1.479832	0.1545
PD	-0.063798	0.074954	-0.851163	0.4048
PD(-1)	0.155454	0.089449	1.737911	0.0976
PDGDP	-419.0587	364.4292	-1.149904	0.2637
C	232.1185	202.6419	1.145462	0.2655
R-squared	0.983506	Mean dependent var		1287.445
Adjusted R-squared	0.975258	S.D. dependent var		1556.516
S.E. of regression	244.8314	Akaike info criterion		14.11044
Sum squared resid	1198848.	Schwarz criterion		14.61927
Log likelihood	-207.7118	Hannan-Quinn criter.		14.27631
F-statistic	119.2534	Durbin-Watson stat		1.952689
Prob(F-statistic)	0.000000			

Source: Output data from e-views 9.0

Meanwhile, the coefficient of multiple determinants (R^2) showed a coefficient of 0.983506 ≈ 0.98 which implies a 98% explanation of the behaviour of Public Investment by the totality of the explanatory variables: (Public Debt, budget deficit, Debt servicing and Public Debt-GDP) on the short-run. The Adjusted R^2 further prove this with the adjusted value of 0.975258 ≈ 0.97 which implies that 97 percent explanation of the behaviour of employment rate by the totality of the explanatory variables with the remaining 3 percent behaviour attributed to other variables outside the model otherwise referred to as the stochastic variables.

The F-statistic indicates that the model is well fit for the estimation because F-stat for the model is 119.2534 which is greater than F-critical value of 2.60 at 95 percent significance level. However, the Durbin Watson Statistic value of 1.952689 is not symptomatic of auto correlation. As a result, there is no auto correlation problem in the model and could be used for statistical inference like hypothesis testing and forecasting.

4.5 Structural Analysis

4.5.1 Granger causality test

Table 10 shows that there exist unidirectional relationship between public debt and debt servicing on public investment with causality flowing from public debt and debt servicing to public investment. Also there is bidirectional causality between budget deficit and public investment.

This goes to show that a country with low investment is likely to run into large government deficit while unidirectional relationship shows that if the borrowed funds are used properly it will be channeled to productive investments which will help in the growth of the economy Rajan [36]. From the result 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 non causality of debt to GDP ratio also revealed that Nigeria has not invested the borrowed fund to projects or investments that can generate enough funds for the country to repay the borrowed fund. Since debt to GDP ratio compares what a country owes

with what it produces and its ability to pay back its debts.

4.5.2 Variance decomposition

Variance decomposition helps to show which of the variables of public debt (PD, BD, DS and PDGDP) which most influences the variable of public investment in Nigeria.

The variance of the forecast error in public investment is attributable to innovations to its own innovations, as well as to public debt, government deficit, debt servicing and debt to GDP ratio.

As shown in Table 11, ten quarters have been chosen to explain variance decomposition. Firstly, when the variance of the forecast error in public investment is attributable to its own innovations, public investment accounts for 83.89328% variation of the fluctuation in public investment (own shock) in the second quarter. In the tenth quarter, shock in the public investment account for 30.05327% fluctuations. Table 11 also indicates that debt servicing explains about 28% of the variation in PUINV in the 10th period. This indicates that the more a country borrow the more it might spend more money on debt service which might lead to debt overhang. This is followed by public debt which explains about 25% changes in PUINV in the 10th period. However, about 23.9% and 1.6% of the future changes in PUINV were attributable to changes in budget deficit and public debt to GDP.

4.5.3 Impulse response function

The result of impulse response function indicates how on standard deviation shock to the residual induces the reaction of variables toward each other [37]. It is also used to trace the responses of the system to the innovations in public investment using impulse analysis.

Fig.3 shows that public debt and debt service have the highest shock impact on PUINV among the variables. The effect of public debt impulses is positive on PUINV from 3rd to 10th period while making its full impact on the 9th and 10th period.

Table 10. Pairwise granger causality test on input variables

Null hypothesis	Obs	F-Statistic	Prob.	Decision
PD does not Granger Cause PUINV	32	3.81910	0.0346	Reject the Null Hypothesis
PUINV does not Granger Cause PD		1.74776	0.1933	Accept the Null Hypothesis
BD does not Granger Cause PUINV	32	4.97064	0.0145	Reject the Null Hypothesis
PUINV does not Granger Cause BD		4.53892	0.0200	Reject the Null Hypothesis
DS does not Granger Cause PUINV	32	6.98338	0.0036	Reject the Null Hypothesis
PUINV does not Granger Cause DS		0.65591	0.5270	Accept the Null Hypothesis
PDGDP does not Granger Cause PUINV	32	1.45659	0.2508	Accept the Null Hypothesis
PUINV does not Granger Cause PDGDP		2.91459	0.0714	Accept the Null Hypothesis

Source: Granger causality test output data using e-views 9

Table 11. Variance decomposition of PUINV

Period	S.E.	PUINV	PD	BD	DS	PDGDP
1	159.7816	100.0000	0.000000	0.000000	0.000000	0.000000
2	208.8563	83.89328	1.304232	0.021749	6.050671	8.730069
3	236.8428	71.84765	1.201944	0.667977	5.687763	20.59467
4	253.9089	64.85552	1.526266	1.146942	8.760785	23.71049
5	267.7397	59.06049	4.117513	1.067674	11.76745	23.98687
6	282.3792	53.47745	6.592278	1.476370	15.58184	22.87206
7	298.0520	48.18027	9.541333	1.668157	18.75364	21.85660
8	317.6292	42.42410	13.39590	1.477019	22.04441	20.65858
9	346.4624	36.02789	18.97559	1.280897	25.14324	18.57238
10	387.0660	30.05327	25.02579	1.032126	28.25938	15.62943

Source: Output data from e-views 9.0

Accumulated impulse response functions for Fig.3 shows that debt service and public debt impact the highest shock on PUINV among other variables making its full impact from second period to the tenth period. DS has a positive effect on PUINV from the 2nd period to the 10th period and PD has a positive effect on PUINV from 4th to 10th period while PDGDP has a negative effect from 1st period to 10th.
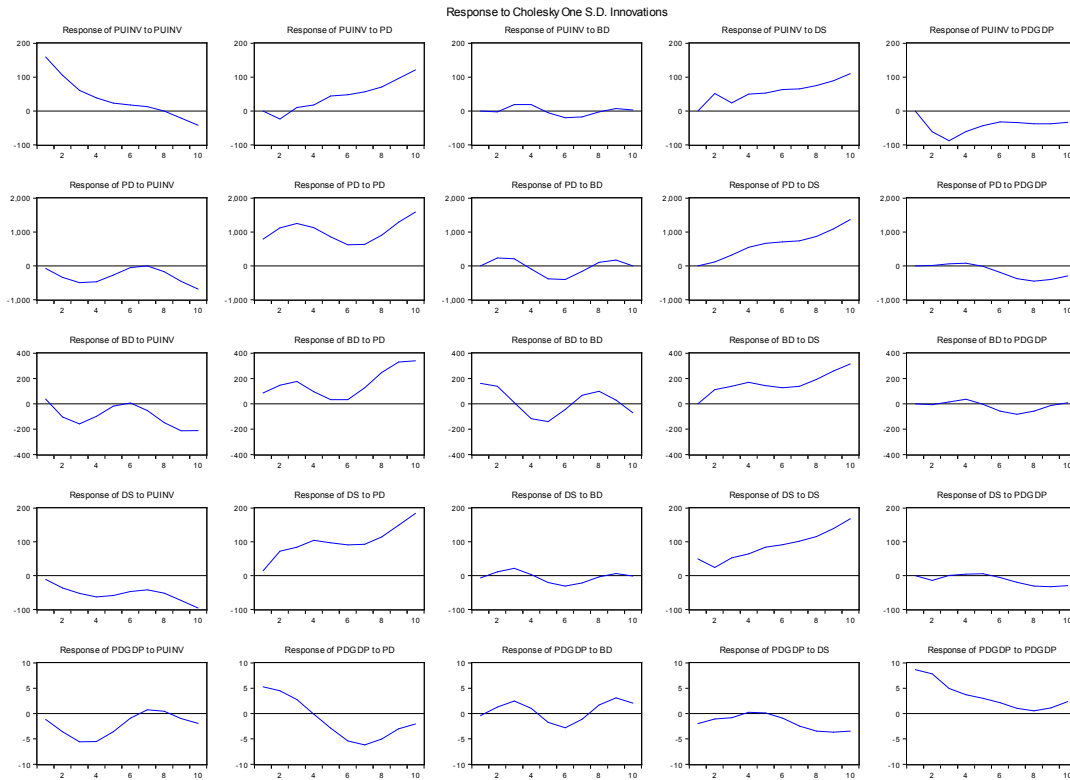
Response to Cholesky One S.D. Innovations

Fig. 3. Impulse response function of PUINV to shocks in PD, BD, DS and PDGDP

5. SUMMARY, CONCLUSION AND POLICY IMPLICATION

5.1 Summary and Conclusion

The study ascertained the effect of public debt on public investment in Nigeria. The ARDL, Granger causality, impulse response and variance decomposition have been used in the analysis. To achieve objective of the research annual time series data from CBN statistical bulletin for period 1985 to 2018 was used. The cointegration test shows long run relationship between the investigated variables. The long run relationship shows that public debt and investment has a positive relationship. The ECM confirmed that the system can adjust to equilibrium at a speed of 76%. There is uni-directional Granger causality relationship between public debt and public investment. The impulse response function discovered that one standard deviation shock in public debt positively affects public invest with public debt and debt service having the highest shock impact. Variance decomposition results indicate that a shock to public debt account for 25% fluctuations in public investment. The short run relationship shows that public debt and public

investment has negative and insignificant relationship between in Nigeria. The insignificant effect has shown that public debt incurred in Nigeria has been used for consumption which do not generate income in the future rather than on investment. Also the result shows that in Nigeria the huge debt has been used on recurrent expenditure and on wasteful projects instead of investing it in capital projects or infrastructure that will help increase the tax base and revenue to the government. Equally the huge debt means that the resources that would have been used for investment are diverted to meeting debt service obligations. The debt servicing and the adjustment policies required to address the debt burden have also worsened investment in such areas as social welfare in the area of education, health, communication. Therefore the researcher anchores this work on Neo-classical theory which states that high debt servicing crowds out investment in the country.

5.2 Policy Implication

Dual gap theory believes that borrowing especially external borrowing will help finance investment in a developing economy. But Nigeria

case seems to be the other way round, despite the huge debt or public debt incurred by Nigeria and huge amount allocated to infrastructural facilities there is no much improvement in public investment in Nigeria. Our infrastructure facilities like roads, rail, power, education and health has been in a deplorable condition. as such the study makes the following recommendations. Federal government should be fiscal responsible by channeling the borrowed funds to investments that will bring growth in the economy and restore the confidence of international community in Nigeria economy. Government should tackle waste and corruption by making sure that funds borrowed and allocated for investment should be transparently and judiciously utilized in the provision of infrastructure and public goods and services so as to accelerate economic growth, development, employment and wealth creation. Debts should be taken only when necessary and should be for investment and not for payment of salaries. Since public debt crowds-out investment in Nigeria as such government should strive to reduce her debt profile by improving its revenue base through diversification of the economy.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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