INFRASTRUCTURE – ECONOMIC GROWTH NEXUS: THE ROLE OF GOVERNANCE IN NIGERIA

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Abstract

Infrastructure-economic growth nexus and its effect on human capital have been widely discussed by scholars. Much of the literatures on infrastructure dwelled mostly on the financing challenges (i.e. how to generate funds for infrastructure projects), neglecting the governance dimension. Thus, this paper seeks to investigate the mediating effect of governance on the impact of infrastructure provision on economic growth in Nigeria. Governance is proxy by government effectiveness, voice and accountability and corruption control. The autoregressive distributed lag model is adopted, given that the variables are integrated of order zero (0) and order one 1 (1). The data for the study covers a period of 28 years from 1990 to 2017. The results show that infrastructure (education, health and transportation) has positive effect on economic growth. Allowing for the indirect effect of infrastructure via interaction with governance, we discover that poor governance mediate the effect of infrastructure on economic growth. We therefore recommended improvement in the quality of governance in Nigeria as to strengthen the infrastructure- growth nexus.
Keywords: Infrastructure, Governance and Economics Growth.

Introduction

Infrastructure is the mainstay of economic capacity; nonetheless it also impacts directly on human capital and environmental sustainability because of this development of infrastructure is of utmost concern to both governments and citizens. This is the case regardless of the stage of development of a country, or of the prevailing economic culture and practice.

This reawaken is as a result of the crucial and positive role infrastructure plays in economic growth (Felix, 2016). Todaro and Smith (2003) gave credence to the above as they asserted that a country's level of infrastructural investment is a key factor in determining the pace and diversity of development .Infrastructure is one of the most critical factors for economic growth because it interacts with the economy through the production processes and changes in the quality of infrastructure available for production will greatly impact the production and performance of an organisation's levels of output, income, profits and employment creation in the economy. This is because of its direct link with productivity (Obokoh & Goldman, 2016, Adenikinju 2005;). In spite of the direct link between the availability and quality of infrastructure – electricity, portable water and road maintenance to economic development (Oseni & Pollitt 2013) – the availability of infrastructure in most developing

countries especially in the sub-Saharan African region leaves much to be desired (World Bank 2013, 2014).

World Bank (1994) asserted that the dividing line between a country's success or failure in diversifying production, expanding trade, coping with population growth, reducing poverty or improving environmental conditions, lie in the adequacy of infrastructural investment. Nannan and Jianing (2012) affirmed that the basic driving force behind a nation's economic growth and better quality of life is adequate infrastructural investment.

Given the critical role adequate infrastructural investment play in economic growth, it is pathetic to note that Nigerian scenario mirror a case of inadequate infrastructure and the decay of the few existing ones. Sanusi (2012) captured the Nigerian ugly infrastructural investment scenario thus:

> *The current level of infrastructure deficit in Nigeria is the major constraint towards achieving the nation's vision of becoming of the 20 largest economies in 2020 because about 70 percent of 193,000 kilometers of roads in the country is in poor condition; the power outages the nation experiences amount to over 320 lost days a year; over 60 percent of the population lack access to electricity; over $13 billion is spent annually to fuel generators, and Nigeria which once had one of the most extensive railway systems in Africa could now barely boast of a functional route either for passenger or freight.*

Given, the deficiency in infrastructural investment in Nigeria and the poor maintenance culture of the government, vision 2020 will be a mirage and the hope to sustained growth a mere wishful thinking.

Much of the literatures on infrastructure in Nigeria focused on infrastructure-growth nexus (Babatunde, 2018, Babalola, 2015, Ekung, 2014 and Edame & Fonta, 2014) and financing of infrastructure (Buchi, 2017, Fatai, Omolara, Taiwo & Adesoye, 2014). The public governance dimension has been neglected, hence the need to investigate infrastructure-economic growth nexus: The role of governance in Nigeria which is thrust of this paper.

The rest of the paper is organized as follows; immediately after the introduction is the conceptual clarification. This is followed by the theoretical framework, and afterward the empirical literature review. The next is the methodology of the paper and after that presentation and discussion of results from where we draw our conclusion.

Conceptual Clarification
Infrastructure: - The basic systems and service that are necessary for a country or an organization to run smoothly, for example building, transport and water and power supplies. Basic structural foundations of a society or enterprise, road, bridges, sewers, telecommunication, education etc. regarded as a country's economic foundation and permanent installations as a basis for military etc operations. It means bases or structure before activities to start the development.

Economic growth: This simply means a sustained increase in national production in a given period of time usually one year.

Governance: There is no generally acceptable definition of governance by scholars. World Bank (2010c) defines governance as "...the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and

social interactions among them". In order to evaluate the quality of governance, the World Bank has developed a methodology used to rank countries of the world according to their governance quality. World Bank employs six categories of variables as an input into their evaluation of governance quality: (i) Voice and Accountability; (ii) Political Stability and Absence of Violence; (iii) Government Effectiveness; (iv) Regulatory Quality; (v) Rule of Law; and (vi) Control of Corruption (Kaufmann, Kraay & Mastruzzi 2003; Kaufmann, Kraay & Mastruzzi 2009). Among these categories of variables, government effectiveness and regulatory quality were chosen to capture governance in this paper. The justification for the choice of the two selected variables is based on their relevance to the subject matter under investigation.

Government effectiveness: This includes the perception of the quality of public services, civil service and their degree of independence from political pressure. It also captures the quality of policy formulation and implementation and the credibility of governments' commitment to policy making.

Voice and Accountability: Captures, inter alia, the extent to which citizens are able to participate in elections, freedom of expression and liberty to form free association and to run free media.

Control of Corruption: Captures the extent to which public power is exercised for private gain and the influence on states by elites and private interests.

Theoretical Framework

Fiscal Illusion Theory: The theory of fiscal illusion originates from the work of Puviani (1903) (as cited in Mourao, 2008) and with additional impetus from Buchanan (1967). Fiscal illusion is about the misperception of fiscal parameters. According to Oates (1985), fiscal illusion implies persistent views and biases about public budgetary decisions in any direction based on imperfect information. Afonso (2014) argues that the benefits of government programmes appear to be remote and unrecognised by citizens, while citizens feel more directly the impact of sources of financing the budget, such as taxes. The essence of the theory is to expose the fact that sometimes the real programme of government is concealed to accommodate unnecessary spending. This theory is relevant to this study because the real benefits of infrastructure spending may not necessarily translate into economic growth in the same expectation because of the element of illusion in the system. Oates (1985) argues that the misconception of fiscal parameters could considerably distort economic choices. This study explains the findings based on this theory as an opportunity to show the direction of fiscal illusion in the cost and benefits analysis of government spending on infrastructure towards the ideology of economic growth.

Empirical Literature

Zainah (2009) explored the relationship between public infrastructure investment and economic performance in Mauritius from 1970 to 2006. He adopted the reduced form of Solow growth model. The results showed that public infrastructure investment have significant effect on Mauritian economic performance, while private capital accumulation and openness showed indirect effects on economic growth.

Ekpung (2014) investigated the effect of public expenditure on infrastructure on economic growth in Nigeria from 1970 to 2010. The result of the study shows that Public expenditure on transport/telecommunication, water supply, housing/environment, road

construction and electricity supply is very low especially in the short-run and long-run; equilibrium is static and showed weak adjustment. The resulted expenditure on public investment has not yielded expected results, and this has shown in the dilapidated of public infrastructures in Nigeria during the period reviewed.

Siyan and Adegoriola (2017) investigated the nexus between infrastructural development and Nigerian economic growth using data from 1981 to 2014. The data was tested for stationarity followed by co-integration, and Vector Error Correction Model (VECM) was employed for the analysis. The results show that there is long run relationship between infrastructure development and Nigerian economic growth. Infrastructural development on road and communication show a positive relationship with the Nigerian economic growth for the period under review, while private investment, degree of openness and education produced negative relationship with economic growth.

Ijaiya and Akanbi (2009) empirically analysed the long run effect of infrastructure on industrialisation in Nigeria using the error correction mechanism. The model used a non-linear production function of Cobb-Douglas to determine the influence of infrastructure on industrial development in Nigeria and found that long-run relationship exists between infrastructure and industrialisation. It also found that transportation converges faster than any other facility, and that communication facilities and electricity supply diverged from the long-run equilibrium position, thus negating the initial apriori expectation.

Amarachi and Mesagan (2016) examined the role of economic and social infrastructure in manufacturing sector performance in Nigeria. The main concern of the study was to ascertain the degree of impact of economic and social infrastructure variables on manufacturing sector performances in Nigeria .The results showed that teledensity had positive impact on manufacturing performance in Nigeria. Also, growth of government capital expenditure and growth of government expenditure on education positively and significantly enhanced the manufacturing value added while growth of government expenditure on health, electricity generation, electricity consumption, inflation rate and prime lending rate had insignificant negative effects on manufacturing value added.

Seethepalli, Bramati, and Veredas (2008) in their study how relevant is infrastructure to growth in East Asia. Their result established that a significant positive relationship exist between infrastructure and economic growth in all infrastructure indicators. They also investigated if the relationship between infrastructure and growth was influenced by five variables: the degree of private participation in infrastructure, quality of governance, extent of rural–urban inequality in access to infrastructure, income levels, and geography. Only telecommunications and sanitation supported a priori hypothesis, while a contradictory result was found for roads.

Agu and Ogwo (2016) examined transport infrastructure, manufacturing sector performance and gross domestic product in Nigeria. Their result showed that the state of road infrastructure in Nigeria has negative effect on the marketing performance of the manufacturing sector. The quality of road infrastructure in Nigeria does not influence manufacturing capacity utilization significantly while it affects manufacturing production index significantly. Again, the annual budgetary allocation to the transport sector has significant influence on the contributions of the transport and manufacturing sectors to the growth of the nation.

Babatunde (2018) examined the relationship between government spending on infrastructure and economic growth in Nigeria. The result from the study show that government spending on transport and communication, education and health infrastructure has significant effects on economic growth; while spending on agriculture and natural resources infrastructure has a negative and significant effect on economic growth in Nigeria. An element of fiscal illusion was established in the government spending on agriculture and natural resources signifying that government is not contributing as much as the private sector in spending on agriculture and natural resources infrastructure in Nigeria.

Sunday and Okon (2013) investigated infrastructure investment, institutional quality and economic growth in Nigeria: an interactive approach. Their results established that infrastructure investment has positive effect on economic growth, while institutional quality proxied by corruption has a negative and significant impact on economic growth. The interaction in infrastructure investment and institutional quality on economic growth is not significant.

Methodology
Data

The data for the study emanates from secondary sources; the Central Bank statistical Bulletin various issues and the World Bank data bank. Government expenditure on health, education and transport are from Central Bank statistical Bulletin, while governance indicators are from the World Bank. The pioneering work on world governance indicators was initiated by World Bank in 1996.

This implies that available data started from 1996, but it will not give the study a sense of fairness if the period of study covers only the civilian regime, because the work is not centered on civilian regime. We therefore extend the study period to 1990 as to encompass at least 10 years of the military junta. The question then is how to generate data from 1990 to 1995? But thanks to econometric software package that can interpolate data. To filling in the missing data because of non-availability, we carry out data interpolation and the formula is given as: $IV = (1 - \measuredangle) P_{t-1} + \measuredangle P_{t-1}$

Where;

P_{t-1}	=	Previous missing value
P_{t+1}	=	The next non missing value in a row
$\measuredangle$	=	The relative position of the missing value divided by the total number of missing value in a row

Estimation Method and Model Specification

This paper adopted the autoregressive distributed lag model (ARDL) bound tests propounded by Pesaran and Shin (1995) and Pesaran, Shin and Smith (2001) to examine infrastructure-economic growth nexus: the role of governance in Nigeria. The justification for this method is that it takes into consideration the time lag in government expenditure and can be used even is the variables are mixture of 1(0) and 1(1). The next is that this approach can be used even if the sample size is small (Ahmad & Hasan, 2016).

We use the bound test to test for the existence of long run relationship among the variables. This is followed by the short run dynamic error correction model.

Model Specification

There are two sets of model specification in this paper. The first model only incorporate infrastructural variables, while the second model incorporate both infrastructure and governance indicators.

Model Specification 1:

$$GDP_t = a_o + a_1 GDP_{t-1} + a_2 GHE_{t-1} + a_3 GEE_{t-1} + a_4 GTP_{t-1} + U_t \quad - \quad - \quad - \quad (1)$$

Where:

GDP	=	is proxy for economic growth
GHE	=	Government health expenditure
GEE	=	Government education expenditure
GTP	=	Government expenditure on transport
U	=	Error term

Model Specification 2:

$$GDP = a_o + a_1 GDP_{t-1} + a_2 GEE_{t-1} + a_3 GHE_{t-1} + a_4 GTP_{t-1} + a_5 VOA + a_6 GOE_{t-1}$$
$$+ a_7 COC_{t-1} + U_t \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad (2)$$

Where;

VOA	=	Voice and Accountability
GOE	=	Government effectiveness
COC	=	Corruption control
U_t	=	Error term

Results Presentation and Discussion

We report the results of the data analyzed and also discuss the findings in this section.

Table 1: ARDL Bound Test Result for Model 1
Null Hypothesis: No long-Run Relationship Exist

Test Statistic	V	K
F-Statistics	140.6107	3
Critical Value Bounds	1(0)	1(1)
10%	2.37	3.2
5%	2.79	3.67
2.5%	3.15	4.08
	3.65	4.66

Source: Author's Computation Using E view 10.0 2018

Table1 above shows the bound test result, the computed F-Statistic value is 140.61 which is greater or higher than the upper bound critical value of 4.66. Thus, we can reject the null hypothesis of no long run relationship among the variables, and accept the alternative

hypothesis. This buttress that a long run relationship exist between economic growth and infrastructure in Nigeria

Table 2: Estimated Long Run Coefficient of ARDL (1, 4, 3, 4) Model 1 Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GEE	0.586050	0.798039	-3.734362	0.0037
GHE	0.767604	0.563094	-2.363190	0.0099
GTP	0.984595	0.188720	5.217235	0.0008
C	-3545.310	3083.969	-1.149593	0.2835

EC = GDP - (0.5860*GEE 0.7676*GHE + 0.9846*GTL - 3545.3104)

The estimated long run coefficient result is shown in table 2 above. The result from table 2 indicates that all the variables have positive coefficient and are significant at 5 percent significance level. This implies that a direct relationship exist between economic growth and infrastructure proxy by government expenditure on health, education and transportation.

A percentage change in government expenditure on education will result to 0.58 per cent change in economic growth. This is because education helps to develop the cognitive and psychomotor domain (human capital) which results to improvement in output. One per cent change in government health expenditure improves economic growth by 0.77 per cent. The reason for this may be attributed to the fact that government expenditure on health improves the health of the workers. Thus, they take fewer sick leaves, because they are healthier, they are more productive and may also invest in training and education that enhances their productivity. A percentage change in government expenditure on transportation give rise to 0.98 per cent change in economic growth. This may be attributed to the role transportation play in making the goods available to the final consumer.

Table 3: Estimated Short-Run ARDL Model 1 Result (1, 4,3,4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GHE)	-0.033692	0.018121	-1.859316	0.1000
D(GHE(-1))	0.053945	0.024439	-2.207334	0.0083
D(GHE(-2))	0.073574	0.018933	3.886014	0.0046
D(GEE)	0.013486	0.015552	-0.867162	0.4111
D(GEE(-1))	0.015723	0.023202	-2.677650	0.0171
D(GEE(-2))	0.047834	0.024879	-3.922667	0.0007
D(GEE(-3))	0.074037	0.017617	-4.202604	0.0030
D(GTP)	0.086106	0.017679	-4.870657	0.0012
D(GTP(-1))	0.041771	0.012532	3.333235	0.0103
D(GTP(-2))	0.052626	0.017682	-2.976253	0.0177
D(GTP(-3))	0.073366	0.017850	4.110193	0.0034
ECM(-1)*	-0.437738	0.004241	32.47430	0.0000

		Mean dependent var	4646.09
R-squared	0.982438		1
			3477.85
Adjusted R-squared	0.966339	S.D. dependent var	6
			16.0616
S.E. of regression	638.0838	Akaike info criterion	7
			16.6507
Sum squared resid	4885812.	Schwarz criterion	0
		Hannan-Quinn	16.2179
Log likelihood	-180.7400	criter.	4
Durbin-Watson stat	2.090492		

Table 3 reports the estimated short run model result using ARDL (1,4, 3, 4). From the result government health expenditure at lag period1 and 2 have positive coefficient and are significant. The same is applicable to government expenditure on education and transportation. The error correction (ECM) which explains the speed of adjustment is correctly sign and it is significant. This indicates that about 44 percent disequilibrium is corrected yearly.

The sensitivity test confirmed the robustness of the model; these sensitivity tests considered are Breusch-Godfrey serial correlation LM test, Jacque-Bera normality test and the hetroskedasticity test.

Table 4: Sensitivity (Diagnostic) Tests

Serial Correlation	F (2, 6) 0.014507	0.9856
Hetroskedasticity	F (14, 8)1.534	0.4315
Normality	0.156212	0.9989
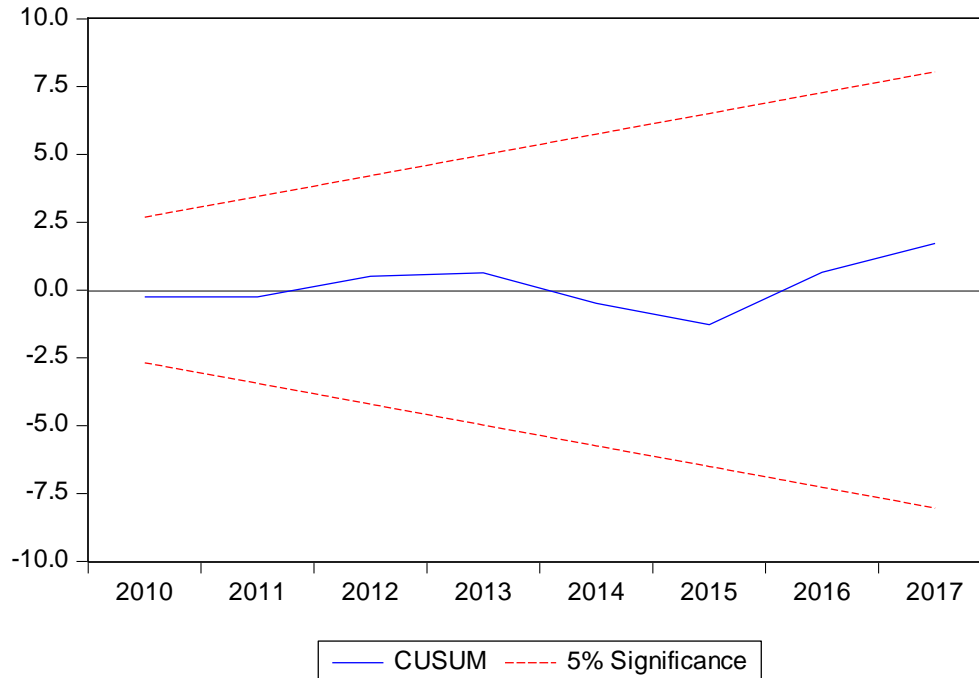
The result of the stability test of the long run relationship between infrastructure and economic growth using the cusum graph shows that the model is stable, because the graph fails within the critical region

Model 2 Results

The second model is an extension of the first model; the only difference is the inclusion of governance indicators (government effectiveness, voice and accountability and corruption control) each of these indicators has a minimum of -2.5 and a maximum of 2.5 values. Higher values of the indicators symbolise good quality governance. The reason for introducing governance is to investigate whether governance has a mediating effect on infrastructure-growth nexus.

Tables: ARDL Bound Test Result for Model Two
Null Hypothesis: No Long-Run relationship exist

Test Statistic	Value	K
F-Statistic		27.05772
Critical value bounds		
Significance	1(0)	1(1)
10%	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99

Source: Author's computation using E view 10. 2018.

From table 5 above it shows F-computed is 27.05772 which is greater than the upper critical bound of 3.99. The result shows that the null hypothesis can be rejected at all critical levels. This result buttressed the existence of a cointegration relationship among the variables.

The next procedure is an estimation of the long run model of determinant of economic growth in Nigeria. The estimated result is presented in table below:

Table 6: Estimated Long Run Coefficient of ARDL (1, 2, 1, 2, 2, 2) Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GEE	0.025305	0.808206	2.669085	0.0390
GHE	0.202892	0.431065	-2.870441	0.0036
GTP	0.040461	0.546223	2.074075	0.0430
VOA	-7.362521	0.178186	-3.624903	0.0019
GOE	-6.541310	50.00635	1.308096	0.2322
COC	-4.792756	25870.18	-2.847407	0.0072
C	-60.90696	42312.87	-1.439443	0.1932

EC = GDP - (0.0253*GEE -0.20289*GHE + 0.0405*GTP - 7.3625213*VOA

    -6.54131042*GOE -4.792756*COC -60.9069646)

       The result of the estimated long run relationship in table 6 above shows that with the incorporate governance indicators (VOA, GOE and COC) into the model government expenditure on education has a positive coefficient and it is significant. But the coefficient is less than that in model one without the governance indicators. This implies bad governance (poor corruption control, poor government effectiveness and weak voice and accountability) mediate on the effect of infrastructure on economic growth.

       Government health expenditure has a positive coefficient (0.20) and it is significant at 5 per cent significance level. But when compare to that of the first model devoid of governance, the coefficient 0.20 < 0.77 is less than that of the first model. The implication is that bad governance impinges negatively on infrastructure-growth nexus.

       Government expenditure on transport also has a positive coefficient (0.04) and it is significance at 5 per cent significance level. This also justifies the negative mediating effect of bad governance on economic growth via its effect on infrastructure.

       Voice and accountability (VOA) and corruption control (COC) have negative coefficients which are significant at 5 per cent level of significance. Government effectiveness has a negative coefficient but not significant. Thus bad governance is a cog in the wheel of economic growth. This result is in tandem with the cog the wheel hypotheses.

The next procedure is the estimation of the short run dynamics which is shown in table 7 below:

Table 7: Result of Short Run ARDL Model 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	0.283816	0.065079	-4.361132	0.0033
D(GEE)	0.241294	0.014093	-17.12114	0.0000

D(GHE)	0.268197	0.016843	15.92292	0.0000
D(GHE(-1))	0.259859	0.015791	-16.45619	0.0000
D(GTP)	0.076255	0.010309	-7.397222	0.0001
D(VOA)	1.292894	0.941808	0.665820	0.5269
D(VOA(-1))	-0.945413	0.005394	-3.962021	0.0054
D(GOE)	-0.321249	0.726509	14.64347	0.0000
D(GOE(-1))	-0.507033	0.418545	6.472278	0.0003
D(COC)	-0.326505	0.732690	4.915820	0.0017
D(COC(-1))	-2.065032	1.082902	-19.06943	0.0000
ECM(-1)*	-0.567084	0.002263	20.80681	0.0000

		Mean dependent var	4314.201
R-squared	0.965122		
Adjusted R-squared	0.911289	S.D. dependent var	3535.896
S.E. of regression	330.0054	Akaike info criterion	14.74013
Sum squared resid	1524650.	Schwarz criterion	15.32079
		Hannan-Quinn criter.	14.90734
Log likelihood	-179.6217		
Durbin-Watson stat	2.190614		

From the result in table 7 above the error correction term (ECM) has the right sign (negative) and its coefficient is -0.57 and it is significant. This shows a moderate speed of adjustment towards long run equilibrium (about 57 per cent disequilibrium is corrected on yearly basis by changes in economic growth). Both the short run and the long-run yielded the same sign for the variables. The slight variation is in government effectiveness and corruption control. Government effectiveness is negative in both the long run and short run but in the long run wasn't significance but it is significant in the short run.

Diagnostic test is conducted to ascertain the robustness of the model specified above and stability test conducted to establish the stability of the long run relationship.

Table 8: Diagnostic Tests Results

Serial Correlation LM Test	F (1, 5)4.477591	0.9856
Hetroskedasticity	F(18,7)0.286863	0.9846
Normality	0.961121	0.612283
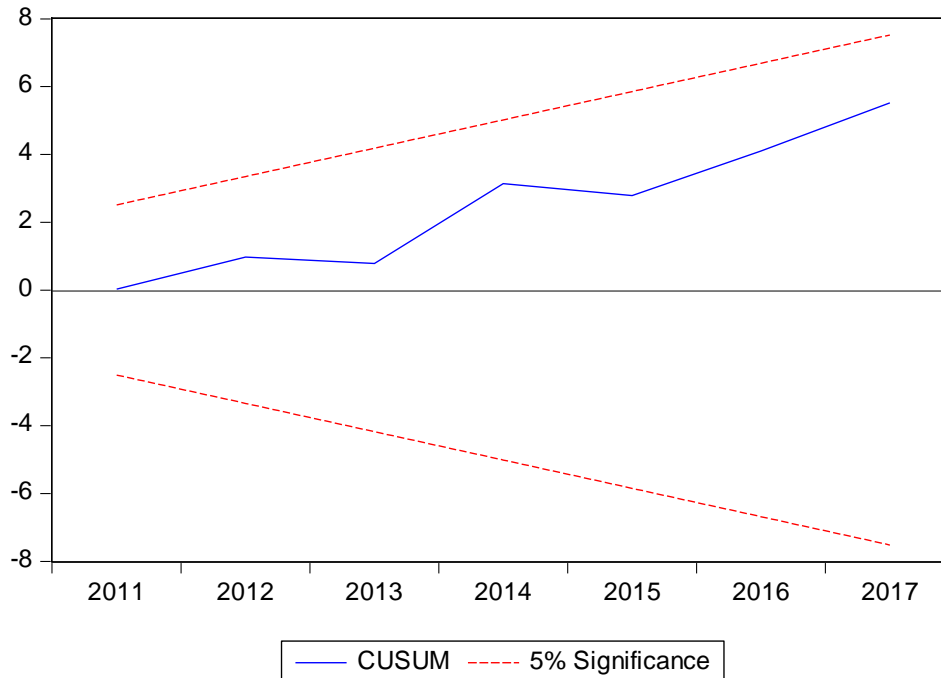
The Diagnostic test results in table 7, shows that the model has the desired econometric properties. There is no serial correlation, no heteroskedasticity (homoscedaticity**)** is established and the variables are normally distributed. The cusum graph falls within the critical bounds establishing that the model is stable.

Conclusion

The paper concludes that infrastructure contributed positively to economic growth in Nigeria but with the incorporation of governance there is a reduction of the effect infrastructure on economic growth. The reduction in the effect may be partly explained by the mediating effect of bad governance on infrastructure.

The paper therefore recommends improvement in the quality of governance in Nigeria so as to strengthen the infrastructure-growth nexus.

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