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Infrastructure Dilemma and Alternative Funding: Evidence from Nigeria

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ABSTRACT

This study examined infrastructure dilemma (ID) and the need for alternative funding in Nigeria. ID was proxied by capital finances to social and community, economic and, administrative capital finances; while domestic debt represents alternative funding. Time series data from the Central Bank of Nigeria statistical bulletin, economic reports of various issues, National Bureau of Statistics and Debt Management Office DMO from 1970 to 2013 were used. Descriptive statistical tools, OLS, Phillip Perron (PP) unit root test, Johansen co integration and the Error Correction model (ECM) were analysed. The result shows that all the explanatory variables were statistically insignificant as indicated by their p= 0.90(Sconfin), 0.82(Ecofin) and 0.19(Admnfin). This result is a proof of infrastructure dilemma in Nigeria and urgently calls for attention. The study recommends a project tied based financing, and the exploration of the potentials of the capital market.
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Keywords: Infrastructure, Domestic Debt.

Aims Research Journal Reference Format:
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INTRODUCTION

Infrastructure consists of two major components - economic infrastructure, consisting of public utilities and public works such as power, water, waste disposal, postal services, telecommunications and transportation. Social infrastructure has healthcare and education (Adekunle 2014; Okunlola, Ajala and Adesanya (2014), Ikpefan 2010, Williams, Okonkwo, and Abolore 2014). However, investment commitments associated with the development of infrastructure are usually huge, often predicated on the dual- gap thesis (Onakoya, Afees, Oseni 2012, Edame and Ejue 2013). Edame and Ejue (2013) describes dual-gap thesis as the framework which shows that the development of a nation is a function of investment and that such investment which requires domestic savings is not sufficient to ensure desired development to take place hence; debt becomes imperative.

Literature confirms positive and significant link existing between infrastructure financing and growth (Patroni 2004; Ikpefan 2010; Williams, Okonkwo and Abolore, 2014; Christense 2004, Asogwa 2005, Adofu and Abula 2010), but a few seem to concentrate on alternative funding option (debt). In the light of this, the study seeks to examine the link between infrastructural financing and domestic debt in Nigeria. Following the introduction is the review of literature; next is methodology; followed by empirical result and analysis and; conclusion with recommendations

2. THEORETICAL UNDERPINNING

Infrastructure financing theories depended on the economic ideology of the budgetary process. Frischmann theory opined that public accessibility to infrastructural development would generate values for any given society and will open access and generate significant positive results for that society (Akinwale 2010, Frischmann 2005 and 2007). Edame and Ejue (2013) also agrees with Frischmann theory and think private infrastructure is unknown as state is primarily responsible for its financing through diverse revenue embedded in the budget.

Conversely, the place of the absoluteness of budget came stale when a shift in thinking suggests debt may be incurred for similar purpose (Onoh, 2007; Uppender, 2008; Akinwale 2007,2008). This form the basis of Keynes arguments and evident in the case of Wagner's theory of public sector and finances where the duo seamlessly moves in same direction (Frischmann 2005, Onoh, 2007, Uppender 2008, Akinwale 2007, 2010).

2.1 Trend Analysis of Nigeria Domestic Debts Profile

Nigeria's total domestic debt has been on the rise since 1970 till date. It maintained an increase figure between 1991 through to 2000 rising between #116,198.70million in 1991 to #898,253.90million in 2000. Rose in 2001 through to 2005 to #1,016,974.00billion and #1,525,906,60billion; #2,275,947.30 in 2006 and #4,127,973.50billion in 2007, decreased in 2008 to #2,320,310.00billion and continued its increase trend in 2009 and 2010 rising twice the amount of 2008 to #4,551,822.39billion 2010 (CBN 2005, Adofu and Abula 2010; Debt Managemet office 2012, Onyeiwu 2012).

Also, a budget of N4.987 trillion was approved for 2013 against #4.75 trillion in 2012. The highlights include a crude oil budget benchmark of $79 (which has continued its downward trend in recent time) up from $72 per barrel, a reduction in the nation's budget deficit to 2.17 percent from 2.85 percent and recurrent expenditure was slashed by over N50 billion to N2.38 trillion, while capital project allocations was increased to N1.62 trillion from N1.34 trillion in 2012, which currently stands at less than 20 percent of 2015 budget; and shows that the deficit percentage contribution of capital funding of major infrastructure remains insignificant (Onakoya, et al 2012 and National Bureau of Statistics). Indeed, the National Integrated Infrastructure Master Plan of the core infrastructure stock of roads, rail, airports, ports, power, water, ICT of the OECD countries average 70 percent of GDP (Okunlola et al 2014, Adekunle 2014). To bridge this lacuna Adekunle (2014), Okunlola et al (2014) affirm that an annual $100 billion dollars (contributing 18 – 20%) is needed in funding. Better still, Williams, et al (2014), Izedonmi and Liaboya, (2012) advised better used of the bond market as alternative source of funding.

3. METHODOLOGY

Most econometrics data are time series. This study is indifferent. Hence, the study deploys the descriptive statistical tool and the ordinary least square regression for its estimation. As a consequence, the P-P test, Johansen co integration test and Error Correction Mechanism (ECM) will be obtained from the model specified. All data sources are secondary. Estimation is with the aid of E-views7 software. Data sets cover a period of forty three years (1970 - 2013), sourced from the CBN, NBS and DMO.

3.1 Model Specification
The model specified is;

$$Y = b_0\ \Omega_i^{b1}\ \Omega_2^{b2}\ \Omega_3^{b3}\ e^{ui} \ldots \quad (1)$$

That is,

$$Ddbt = f(SComfin, Ecofin, Adminfin) \quad (2)$$

Where:
Ddbt = Total Public Debt in Nigeria
SComfin = Social and community infrastructure financing
Econfin = Economic infrastructure financing
Adminfin = Administration infrastructure financing

Further,

$$\ln Y = \alpha + \Omega_1 \ln\partial_1 + \Omega_2 \ln\partial_2 + \Omega_3 \ln\partial_3 + \mu \quad (3)$$

Where:
Ln = natural log (ln to base e)
α = the Y intercept
Ω_1, Ω_2 Ω_3 = the partial regression coefficients
∂_1, ∂_2 ∂_3 = Independent variables
μ = Stochastic term.

Thus equation (3) is written as;

$$\ln PDbt = \alpha + \Omega_1 \ln SComfin + \Omega_2 \ln Econfin + \Omega_3 \ln Adminfin + \mu_i$$

3.2 Estimation Procedure
3.2.1 Phillip Perron Unit Root Test
This involves testing the order of integration of the individual series under consideration based on the non stationarity state of most economics variable, as developed by Phillip and Perron (1988), given as;

$$\Delta Y_T = \alpha_0 + \alpha_1 Y_{T-1} + \varepsilon\Gamma \quad (4)$$

Where
Δ is the first difference operator εT is random error term
Y = the variable
T= linear time trend
α_0= constant.

The unit root test is then carried out under the null hypothesis $\alpha = 0$ against the alternative hypothesis of $\alpha < 0$ and compare with the relevant critical value for the Phillip-Perron Test. If the test statistic is greater (in absolute value) than the critical value at 5% or 1% level of significance, then the null hypothesis of $\alpha = 0$ is rejected and no unit root is present. If the variables are non-stationary at level form and integrated of the same order, this implies evidence of co-integration in the model.

3.2.2 Johansen Co-integration Test

This involves testing for the presence or otherwise of co-integration between series of the same order of integration through forming a co-integration equation and establish the long run equilibrium relationship established. The lack of co integration suggests that such variables have no long run relationship: they wander arbitrary far away from each other.

The co integration is constructed as:

λ_{max} [H_1(r-1) / H_1(r)] = -T log(1- λ) - Eigenvalue (5)
for r = 0; 1; 2...; p – 2, p - 1. The null is that there exists r co-integrating vectors against the alternative of r + 1 vectors..

Given as

$$\lambda max\ [H1\ (r)\ /\ H0] = -T \sum_{i=r+1}^{p} \log(1-\lambda) \qquad (6)$$

Where the null hypothesis is λ_i= 0, so only the first r Eigenvalues are non-zero. It has been found that the trace test is the better test, since it appears to be more robust to skewness and excess kurtosis hence, decision are made based on trace test. (Bo, 2011).

3.3 Error Correction Model - ECM

The ECM shows how y_t responds in the short run (SR) to changes in x_t and to deviations from long run (LR) equilibrium $(y_{t-1} - \theta x_{t-1})$. ECM model thus shows that the increase in y is explained by the increase rate in x and past disequilibrium between these variables. $\theta x_{t-1} = y_{t-1}$ or $\theta x = \bar{y}$, is the LR equilibrium value of y. Thus, if $\alpha < 1$, then y rises when $y_{t-1} < \bar{y}$ and y falls when $y_{t-1} > \bar{y}$. This dynamics makes y to converge towards it LR equilibrium. Also, a $1-\alpha$ = the speed of adjustment to the LR. Meaning the higher is α, the faster is the adjustment to new equilibrium because the faster it takes for the error to disappear. This is specified below

$$\Delta y_t = \alpha_0 + \beta(y_{t-1} - \theta x_{t-1}) + \sum \alpha_{yi} \Delta y_{t-i} + \sum \alpha_{xi} \Delta x_{t-i} + e_t \qquad (7)$$

4.0 EMPIRICAL RESULTS.

Table 4.1: Descriptive Statistics

	DMDBT	SCOMFIN	ECOFIN	ADMNFIN
Skewness	2.364015	1.995488	1.393098	1.845681
Kurtosis	8.367902	5.847830	3.884296	5.244767
Jarque-Bera	91.67715	43.06813	15.30956	33.44170

Source: Authors

Basically, the Skewness is a measure of asymmetry of the distribution of the series around its means. The Kurtosis measures the normality of the series. For a normal distribution, Kurtosis is usually 3. If the Kurtosis is >3, the distribution is peak. If it is < 3 the distribution is flat. All series in our study however demonstrates peak distribution. Further, the Jarque – Bera test statistics which test whether the series is normally distributed and measures the difference of the skewness and Kurtosis of the series is normally distributed.

Table 4.2: PPUnit Root Test Results

Variable	PP Statistics		PP statistics		Order of integration
	Level	Critical values	1st Difference	Critical values	
DMDBT	-4.667399	1% -3.600987 5% -2.935001 10% 2.605836			I(0)
SCOMFIN			-6.954792	1% -3.596616 5% -2.933158 10% -2.604867	I(1)
ECOFIN			-8.226304	1% -3.596616 5% -2.933158 10% -2.604867	I(1)
ADMNFIN			-6.509704	1% -3.596616 5% -2.933158 10% -2.604867	I(1)

Source: Authors' Computation

The table shows that the variables have a unit root against the alternative that it does not. The choice of lag length is based on Akaike and Schwartz-Bayesian information criterion. The decision rule is to reject the null hypothesis if the PP statistics value exceeds the critical value at a chosen level of significance and in absolute terms. The result of the table shows that only the endogenous variable became stationary at I(0) since their PP values are greater than the critical values at 1%, 5% and 10%, which review that the exogenous variables were non- stationary at their level form hence; at first differencing. The null hypothesis of no unit root was rejected for Dmdbt, but accepted for Scomfin, Ecofin and Admnfin We therefore proceed to test for the cointegrating relationship between these variables.

Table 4.3 Co integration

Hypothesis	Trace Stats	Critical value	Max-Eigen Stats	Critical Value
None *	159.1471	63.87610	86.70536	32.11832
At most 1*	72.444171	42.91525	52.44493	25.82321
At most 2	19.99678	25.87211	15.85774	19.38704
At most 3	4.139038	12.51798	4.139038	12.51798

Source: Author's computation
Note: Trace test indicates 2 cointegration eqn(s) at 0.05level
Max-Eigen indicates 2 cointegration eqn(s) at 0.05level
*denotes rejection of the hypothesis at the 0.05level

In the table, both trace and the max indicate a co-integrating vector rejection of the null hypothesis of no long run equilibrium relationship of at most 1; and the null hypothesis was rejected since the prob falls above our critical 0.05 percent value and we evaluates the co integration equation with the error correction model.

Table: 4.4 Error Correction Estimates

Error Correction:	D(DMDBT)	D(SCOMFIN)	D(ECOFIN)	D(ADMNFIN)
CointEq1	0.986868	0.010868	-0.179012	0.058129
	(0.13065)	(0.00412)	(0.03096)	(0.00866)
	[7.55336]	[2.63827]	[-5.78185]	[6.71304]
C	955186.8	10298.10	-171993.4	55237.20
	(123029.)	(3879.01)	(29154.4)	(8153.87)
	[7.76394]	[2.65483]	[-5.89941]	[6.77435]

As evident from the estimation of the VECM from the co integration equation, the speed of adjustment of disequilibrium by changes in amount expended in social and community infrastructure financing is 1%, economic infrastructure financing is 17%; while that of admin infrastructure financing is 5%. In other words, the speed at which it is correcting the disequilibrium is 1 percent, 17 percent and 5 percent respectively annually compared with 98 percent at which funds are sort for this purpose.

Table 4.5: OLS Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSCONFIN	0.054963	0.442349	0.124253	0.9017
LNECOFIN	0.117261	0.519023	0.225927	0.8224
LNADMNFIN	0.601281	0.452121	1.329913	0.1911
C	4.554082	1.018068	4.473259	0.0001

R-squared	0.561277	Mean dependent var	11.25068
Adjusted R-squared	0.528372	S.D. dependent var	2.763658
S.E. of regression	1.897946	Akaike info criterion	4.205930
Sum squared resid	144.0880	Schwarz criterion	4.368129
Log likelihood	-88.53046	Hannan-Quinn criter.	4.266081
F-statistic	17.05788	Durbin-Watson stat	2.399722
Prob(F-statistic)	0.000000		

Source: Author's computation

The result of the table shows that all explanatory variables wandered away from the 0.05 percent significant level criterion. In specific terms, social and community infrastructure financing indicate a *p value* = 0.144, that of economic infrastructure financing indicates a *p value* = 0.679, while administrative infrastructure financing also shows a *p value* = 0.7050. By this result, all the variables are above our preferred 0.05 percent level of significant hence, we do not reject the null hypothesis but accept it. This means that for the period under review, government financing of the key capital infrastructure such as health and education, as component of social and community infrastructure (SCOM) which indicates a probability value of = 0.144 is statistically insignificant. As a result, the decision rule is to accept our null hypothesis if the calculated value is >0.05 (i.e. p = 0.144) otherwise we reject if it is <0.05. Similarly, infrastructure such as power, water, waste management, postal services, telecommunication and transport, as components of economic infrastructure is statistically insignificant as well and indicate a *p value* = 0.679.

Again this falls within the acceptance region of our decision rule hence, we accept the null hypothesis of no significant relationship. Further, that of administration infrastructure shows a p value = 0.705 and this is statistically insignificant because it is also above our 0.05 percent preferred level of significant hence, we equally accept the null. By implication, the infrastructure sorry state in Nigeria is further captured by these results and conforms to similar study of Olaseni and Alade (2012). Consequently, the outcome may not be unconnected with the nation's over 50 years of poor governance, erratic and distorted policies, public sector dominance of production and consumption, as well as abrupt uncontrollable corruption. In all, judging by the value of the coefficient of determination (R^2) which measures the variability of variables response to a 1% increase in value, our R^2 is explained by a relatively low variance of 0.46 (i.e. 46 percent), meaning that for any 1 percent increase in the explained variable the explanatory variables react within 46 percent threshold.

5. CONCLUSION

The study analyse the link between infrastructural financing and domestic debt in Nigeria. In substantiating the claim of huge expenditure so far spent on infrastructure by the government on key capital projects such as examined in the study, the paper traced this claim and examined them therein. The descriptive and multivariate methodology was deployed to ascertain the level of relationship between the explained and the explanatory variables. Our skewness conform to the >1.0 or < - 1.0 rule and show that it is substantial and its distribution is far from being symmentrical. Similarly, the Kurtosis confirms to the order of Prism and Gaussian distribution of 3.0. The unit root test was tested using the Phillip Perron to determine order of stationarity. This was followed by the testing the long run (LR) relationship using the Johansen co integration while the ECM was deployed to check the speed of adjustment of the variables finally; the OLS was tested to determine the nature of relationships between the variables.

5.1. Policy Recommendation

The study brings to bear the urgency in which the country need to have a pragmatic and total policy shift in implementing its infrastructure programme in meeting its vision 202020 target of becoming one of the 20 biggest economy in the world. The study therefore suggests the following recommendation;

1. **A project tied based financing:** Government at all level is advised to tie any capital project with its inflows and as such discourages diversion.
2. Government is encouraged to explore the full potentials of the capital market and public private partnership.
3. A check on utilization of these alternative sources is suggested as reasons for further studies.

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