A G D I Working Paper

WP/20/051

Fiscal Vulnerability and Transport Infrastructure Development in Nigeria[1]

Forthcoming: Iranian Economic Review

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[1] This working paper also appears in the Development Bank of Nigeria Working Paper Series.

Research Department

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January 2020

Abstract

In spite of the massive revenue emanating from oil wealth, the successive government of Nigeria failed to give to its citizenry the dividend of democracy owing in large part to their inability to establish a market clearing situation because of inadequate linkage between the sources and the markets (transport infrastructures). An enquiry into the cause and potential solutions to the problems of transport infrastructure development in Nigeria informed the need to regress indices of fiscal vulnerability on the indicator of transport infrastructure development in Nigeria from 1986 through 2017 using the dynamic ordinary least squares regression technique. Results show that high-levelfiscal vulnerability deters optimal government expenditure on transport infrastructure development in Nigeria. Based on the findings of the study, itis recommended that government should do more to block all leakages of fiscal revenues and subsequently ensure that more allocation is channelled into transporting infrastructure development because of its forward and backward linkages.

Keywords: Fiscal Vulnerability; Transport Infrastructure Development; Nigeria

JEL Classifications: H5, E44, H12, R4

1.0 Introduction

The significance of transport infrastructure development has not been higher than in recent times because of the growing demands and the need for a subsequent supply of goods and services across the world. The road and belt initiative of the Chinese government, which aims to link the significant part of the world by road is an excellent example of the recent effort to increase the transport infrastructure around the world. Infrastructure provision is crucial for developing countries to keep transport costs low and possibly to enhance the attractiveness and competitiveness of their economies (Flyvbjerg, Skamris Holm, & Buhl, 2004). Recent decades have been extremely difficult for governments owing to strict budget constraints imposed by fiscal adjustments and policy rules that have significantly reduced the propensity to invest (Percoco, 2014). However, this long period of low investment in transport infrastructure has generated a situation in which the growth potential of countries has deteriorated, and the size of unmet transport demand increased, with subsequent negative impacts on poverty, income distribution, and economic development in general (Calderon &Servén, 2003; Percoco, 2015).

The influence of transport infrastructure on the economy has been discussed along various dimensions. In the apparent submissions of the classical location theory, the locational density of economic activities is predicated upon the transportation cost. By intuition, region, or geographical space with high transportation cost are most likely to have substantial economic activities compared to the ones with lower transportation cost (Weber, 1928; Moses, 1958; Alonso, 1964). In the overarching ideas of the new economic geography theory, transport cost are central to location of the market in a perfectly competitive market framework and also determine labour mobility across region mobility (Fujita, Krugman &Vanables 1999; Fujitaand&Thisse, 2002). We can then aver that transport infrastructure is essential for growth and development in a macroeconomic model of endogenous factor-induced growth change (Aschauer, 1990). Despite the apparent relevance of transport infrastructure for growth and development, the attendant fiscal capacities to finance growth-inclined transport facilities are mostly unavailable, misinformed and misappropriated in Africa most populous black nation (Nigeria).

Testing the inference of fiscal vulnerability-transport infrastructure development nexus in Nigeria is essential for some reasons. In spite of the overly pronounced importance of transport infrastructure development in contemporary ages, transport demands of road

dwellers in Nigeria have been mostly unmet owing to problems of underfinancing, macroeconomic imbalances arising as a result of fiscal vulnerability or fiscal stress among many other deep-rooted issues (Alves, 2013). Current and projected primary fiscal balances are crucial to assessing the extent to which fiscal policy of the government aligns with the intertemporal budget constraints facing the nation at the varying time for which transport infrastructure investment is significant because of the enormous forward and backward linkages. Apparently, no single country-specific study has explained the development of transport infrastructure from the fiscal vulnerability point of view. This deficiency in the literature of public sector economics in Nigeria has informed the need for this study. In addition to reduced cost of transport, transport infrastructural development guarantees minimal firms cost of production and subsequently improved productive capacity. Standard transport infrastructure that links Nigerian market to the source of goods and services will not only benefits from scale effect but also result in substantially large productive capacity built on the efficiency of operations (Nocke, 2006; Baldwin and Okubo, 2006). The agglomeration effect is other relevance of improved transport infrastructure through its synergetic connections among economic agents (e.g. Eberts & McMillen, 1999).

Aside from the fact that no country-specific study has examined the impediments to the growth of transport infrastructure in general, this study leads the debate on the fiscal imbalances, the level of government macroeconomic dilemma defined in its budget constraints as fiscal vulnerability or stress experienced in meeting in macroeconomic objectives. Previous studies have examined transport infrastructure or its development as a precursor to other macroeconomic objectives (mostly economic growth) neglecting the underlying financial framework that generates such long desired and anticipated growth objective. Ighodaro(2009); Bosede, Abalaba and Afolabi (2013); Apanisile and Akinlo (2013); Amadi, Amadi and Nyenke (2013); Oyesiku, Onakoya and Folawewo (2013) are some of the studies that examined transport infrastructure on economic growth in Nigeria. In other climes, Filani (1993) examined transport infrastructure for rural development. This study takes another dimension from existing literature by looking at the financial framework that aid or abate the growth of transport infrastructure development in Nigeria. It deviates from the conventional estimation of the current or existing level of transport facilities and how they predict variations in other macroeconomic variables. This study instead takes an eclectic approach in the examination of the intertemporal budget constraint facing the

government and how this influences the growth or otherwise of transport infrastructure development in Nigeria.

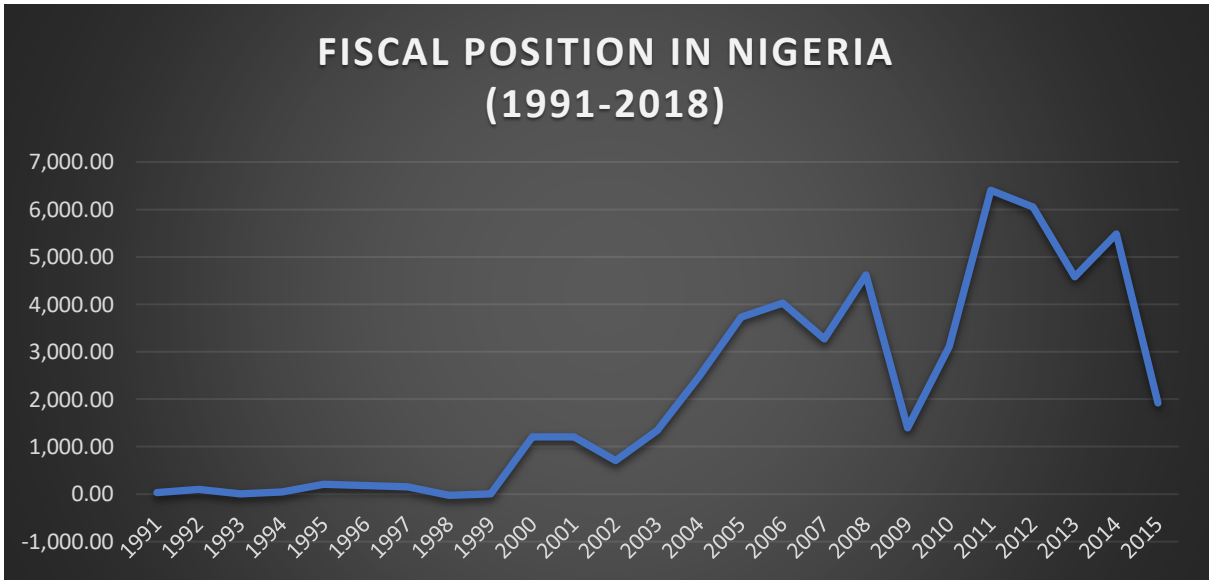
This paper examines the empirical connection and validates the longstanding conjecture that fiscal vulnerability and fiscal stress facing the Nigeria government impede improved transport infrastructure development in the country. There is no gainsaying that a sound financial framework is required to cater for the infrastructural development needs of developing nations. Large and active oil revenues, matured, broad, deep and sophisticated Nigerian capital market are clear examples that the nation has the capacity to finance the viable transport infrastructure that could propel another wave of economic growth due to the forward and backward linkage advantages of the transport infrastructure development. That many years of accrued oil revenue in domestic and external reserves accounts, large capital markets have failed to transform to improved transport infrastructure development remains a mirage. As revenue rises, government fiscal obligations have corresponding grown if not larger causing a priority dilemma in its pursuance of her macroeconomic objectives. This leads to a hypothetical condition about how much fiscal vulnerability or stress facing the government predicts variations in its ability to grow its transport infrastructure. Is government fiscal vulnerability a source or a reflection of ill-growth for transport infrastructure development? How significant are variances in transport infrastructure development as induced by fiscal stress experienced by prevailing governments? How significant are government debt obligations and cost of capital outsourcing, and how do they predict variations in transport infrastructure size? are essential questions for policy and research. This study hopes to advance policymaking on the expected productivity returns to investment in different types of transport infrastructure (rail, roads, air, etc.), industry sectors (manufacturing, services, etc.), and over time (i.e. short-run versus medium and the long-run effects) as induced by the depth of fiscal vulnerability or stress that the government faces. Such detailed information about the productivity of fiscal vulnerability-transport infrastructure development nexus is entirely missing in the literature of public sector and transport economics in Nigeria. Moreover, the wide variation in the existing estimates of the output elasticity of transport infrastructure development as induced by other macroeconomic factors also justifies carrying out a fiscal stress-transport infrastructure development specific empirical analysis. The structure of the paper is as follows. Section 2 presents the literature review; Section 3 provides the methodology; Section 4 presents results and subsequent interpretations and section 5 summarises the main conclusions of the study.

2.0 Literature Review

Stylised Facts: Fiscal Development in Nigeria

There is empirical evidence to support the argument on the existence of several different channels through which fiscal policy promotes growth and development through provisions of basic amenities. The use of fiscal policy as a significant stool for stabilisation is overwhelmly ascertained in countries showing variations in growth parameters. The observable fiscal policy measures determine, to a large extent, the net receipt, fiscal surplus or deficit that is obtainable in a nation. Known for shock-absorbing, the fiscal policy aid government counterbalancing acts in private consumption and investment. They in most cases rely on counter-cyclicality of revenue and expenditure pattern such that expected loss in revenue is met with a rise in tax and other relative balancing tools (Ewetan, 2012). The National Bureau of Statistics, 2012 reported an increase in the size of the public sector, owing mainly to rising oil revenue. Bar the introduction of democracy and the civilian rule, an average of 21% in GDP growth was attributable to oil wealth. The civilian government brought about the most pronounced form of fiscal discipline since the discovery of oil in the 1970s (National Bureau of Statistics Nigeria, 2008). The monetisation of foreign exchange receipts for distribution to various tiers of government and the oil price surge of 2000 through 2004 triggered another wave of increased government expenditure for which transport infrastructure development was insignificant. A wholesome government spending at around 19% of GDP was observed compared to 14% in 1999 (MÜller-Krumholz, 2014). In 2005, debt obligation at 7.5% was surprisingly rising even when oil revenue was rising. It was around 0.3% in 2000. In 2009, extra-budgetary expenditure grew substantially, and deficit to GDP was about 12.72% in 2009 (the highest at the time) (Central Bank of Nigeria, 2010).

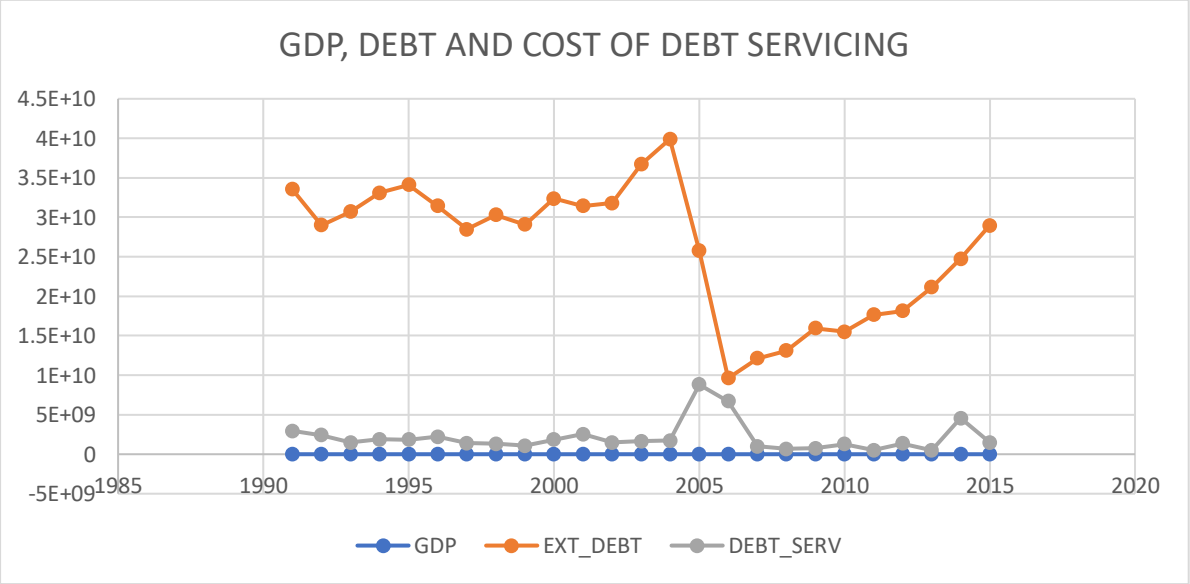
The problems were mounting, and the consequences are large and impending. Fiscal consolidation was widely discussed as the consensus path for transparency and accountability in public sector growth. The fiscal consolidation path was to have a potent capacity for a government-private partnership where government creates an enabling environment, and private sector drive the means of production.



Sources: Author's Computation, 2018

2.2 Nigeria's Debt Profile and Debt/GDP

The public debt-to-GDP ratios play a crucial role in fiscal consolidation and in setting prudential limits on public borrowing. Although, there is empirical evidence of a weak relationship between the debt-to-GDP ratios, there are also, persuasive arguments in the literature that, high debt-to-GDP ratios cause macroeconomic instability, which is not suitable for growth, and hence makes debt unsustainable.



Source: Author, 2019

The Nigeria public debt has been consistently on the increase since the Paris Club exit in 2005, thus making the fiscal policy more vulnerable. Public debt increased significantly as

most of the borrowings deployed to financing recurrent expenditures. The debt to GDP ratio dropped significantly from the early 2000s to 2005; it had however attained a stable trend from 2005 when the country exited from the Paris Club of nations. Since then, the trend remained stable; accompanied by the growth in GDP in recent years.

2.3 Theoretical Review

Fiscal vulnerability depicts a government's exposure to the possibility of not achieving its broad fiscal policy objectives. Its primary concern is with the occurrence of unexpected fiscal policy challenges and the capacity of the government to handle them. When addressing fiscal vulnerabilities, the first risk that comes to mind is "sovereign debt risk" and how much damage it could cause to the economy in the absence of fiscal adjustments. Common fiscal imbalances could lead to high levels of government debt, sovereign debt rollover and ultimately, insolvency. How much fiscally vulnerable a government, should determine its subsequent capacity to develop its transport infrastructure. There is a need to develop indices that can gauge fiscal vulnerabilities in order to be able to absorb unexpected fiscal shocks and their attendant effects on the economy. Two basic concerns that feature prominently in the theoretical literature on fiscal vulnerability are the determination of the thresholds or limits for public debt and the choice of appropriate fiscal variables to estimate rollover risks and fiscal vulnerabilities.

2.3.1 Fiscal Illusion Theory

The theory of fiscal illusion originates from the work of Puviani (1903) and with additional impetus from Buchanan (1960). The 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.

2.3.2 Public Expenditure Theory

The public sector has a role to play in society to ensure the smooth running of economic activities. Also, the goals of government are sometimes numerous and have several stakeholders involved. Therefore, to avoid chaos, efficiency and equity should guide public spending (Ewetan, 2012). (Ewetan, 2012) explain that efficiency concerns the smooth running of public activities. Efficiency has to do with the coordination, collection and monitoring of government revenue and expenditure towards the provision of services to the stakeholders. Equity is about the fair sharing of public gains among stakeholders. The applicable public expenditure theory in this study is based on Wagner's law, known as the law of increasing state spending. Wagner's law was formulated by (Wagner, 1886). The theory states that for any country, public expenditure steadily rises as income growth expands. According to Borcherding, Ferris and Garzoni (2005), Wagner's law stipulates that in the process of economic development, the share of the public sector in GDP has been increasing over time. (Wu, Tang, & Lin, 2010) explain that the law is premised on four principles, as follows: that growth results in increased complexity because there are new and continuing increases in public expenditure; that public expenditure increases result in urbanisation and externalities; that the goods supplied by the public sector should have a considerable income elasticity of demand; and that growth results in an increase in demand with a resultant increase in public expenditure. This study expects that if growth in expenditure matches economic growth, then it should also translate into economic development; however, this has not been the case in reality in developing nations like Nigeria because sometimes there are elements of fiscal illusion in government activities.

2.4 Empirical Review

Globally and subsequently in Nigeria, only a few studies have built upon the budgetary impact of fiscal stress as it explains variations in government capital budgeting for which infrastructure development is about the largest. This empirical blind spot comes as a surprise, especially in the context of Nigeria where fiscal reforms have been welcomed, if not justified, by pointing to its calming effect of government budgetary expenditures particularly the need to augment government expenditure on dilapidated, obsolete and archaic public facilities particularly in the crisis-torn North-Eastern Nigeria. Regarding the overriding influence of

fiscal irregularities and transport development, Akinbami and Fadare (1997)s show that spending-driven fiscal consolidation programs have better conditions to be successful than adjust in fiscal policy options that involve tax increase and investment reduction primarily and as such induces growth of capital expenditure which includes transport infrastructures. Oni and Okanlawon (2006) examined Nigeria's transport infrastructure development as an essential development phase of the development plan of national economic empowerment and development strategy (NEEDS). The author found that transport infrastructure development needs are in practice at complete variance with the development objectives of the NEEDS. Omoke, Diugwu, Nwaogbe, Ibe and Egbe (2015) examined the privatisation implications for the performance of Nigerian seaports and found average, the berth occupancy and turn-around time improved from 51.35% to 72.47% and 8.18 days to 4.83 days respectively

Svensson (2000) provide additional evidence that spending-driven consolidations are shorter than tax-driven consolidations and that the size of the consolidation program does not significantly affect the duration of fiscal consolidations for capital project growth. Blanchard and Perotti (2002) using a mixed structural VAR and event study approach found that positive government spending shocks increase output and private consumption and have a crowding-out effect over private investment, while positive tax shocks hurt output and private spending in the U.S. On the contrary, Afonso and Jalles (2013) show that during consolidations, lower government consumption increases private consumption. This effect is higher for countries with lower debt levels, implying that more successful consolidations might be associated with reduced crowding-out effects. Nevertheless, this debate is far from reaching an agreement, as some recent studies have shown that several countries are now facing uncertainty about the effects of fiscal measures on economic activity.

Other studies focus on the impact of fiscal consolidations on income distribution neglecting the role of fiscal irregularities on transport infrastructure development. Coenen, Straub and Trabandt (2013) argue that depending on the fiscal instrument used, fiscal consolidations may have pronounced distributional effects. Furceri *et al.* (2018) show that fiscal consolidations increase income inequality and lower-wage income shares in the short and medium-term. Agnello and Sousa (2014) also uncovered a significant widening of the income gap during episodes of fiscal consolidation. Moreover, Gupta *et al.* (2005) find that successful fiscal consolidations are associated with higher income inequality; while Afonso and Jalles (2013) show that the stance of the cyclically adjusted primary balance and the duration of the

consolidations can contribute to their success. The timing, size, and composition of the austerity measures are other essential factors that can affect a fiscal consolidation, its likelihood of success and duration (Pal & Wahhaj, 2017; Percoco, 2015; Rommerskirchen, 2015). In terms of timing, gradual consolidations are considered to be more successful than quick adjustments. However, Pal and Wahhaj (2017) show that when public debt is very high, and the economy is not growing, quick measures might be the best option. In the same line, Ewetan (2012) also notice that when a fiscal consolidation lasts for an extended period, it can be affected by fatigue, and the consolidation process might be reversed. Coenen, Straub and Trabandt, (2013) and Agnello and Sousa (2014) emphasised the size of the fiscal consolidations, which can indicate the extent of the governments' commitment to achieving long-term sustainability in public debt. Besides, Gupta *et al.* (2005) notice that massive consolidations need multiple instruments for the consolidation to succeed.

In other climes, Espinet, Schweikert, van den Heever and Chinowsky (2016) examined the reactive responses of road infrastructure as induced by climate changes in Mexico. They found the rising cost of finance and the associative economic consequences to induce high vulnerability status in the North East region of Mexico. In India, Gupta, Bandyopadhyay and Singh (2019) analysed the role of the carbon tax as a pre-requisite in reducing growth trajectory of carbon emission from road passengers in India. Using a simulation approach, they found CO_2 to reduce by large amount compared to projection in the year 2050. In this paper, we take a step forward and analyse how fiscal vulnerability affects government ability to invest in infrastructure investment. We look not only at the first level of the government expenditure functional components but also transport at their sub-components. The exploration of effects in the sub-levels of government expenditures is expected to provide a broader understanding of the impact of vulnerability on transport infrastructure development.

3.0 Methodology

Theoretical Framework and Model

In modelling the role of fiscal vulnerability/fiscal stress in transport infrastructure development in Nigeria, the study shadows the debt equation model as in Chang, Lee and Lee (2009). This equation assumes that the government borrows money (B_t) at time t, to finance their primary deficit. The primary deficit is defined as the difference between primary expenditures, G_t, and government revenues, R_t. public debt from the previous year (B_{t-1}) and interest payment

$(i * B_{t-1})$.

$$B_t = G_t - R_t + B_{t-1} + i * B_{t-1} \quad \textbf{(1)}$$

Where i represents the cost of debt servicing and other variables remains as defined above. Re-arranging equation **(1)**, we have

$$B_t - B_{t-1} = G_t - R_t + i * B_{t-1} \quad \textbf{(2)}$$

Considering the variables as ratios of GDP and using the GDP deflator $P_t$and real *GDP* Y_t, equation (**2**) gives us:

$$\frac{B_t}{P_t Y_t} - \frac{B_{t-1}}{P_{t-1} Y_{t-1}} * \frac{P_{t-1} Y_{t-1}}{P_t Y_t} = \frac{G_t}{Y_t} - \frac{R_t}{Y_t} + i * \frac{B_{t-1}}{P_{t-1} Y_{t-1}} * \frac{P_{t-1} Y_{t-1}}{P_t Y_t} \quad \textbf{(3)}$$

Defining inflation rate as $\pi = \frac{P_t}{P_{t-1}}$and real growth rate as$g_t = \frac{Y_t}{Y_{t-1}}$, we have,

$$b_t - \frac{1}{(1+\pi)(1+g)} b_{t-1} = P_t \frac{1}{(1+\pi)(1+g)} b_{t-1} \quad \textbf{(4)}$$

Where P_t= ratio of primary balance-to-GDP (- surplus; + deficit), at time *t*. Giving the above scenario, the goal of government will be to stabilise the public debt in a period when there is a high level of public indebtedness ratio. This is to make sure that the ratio of public debt-to-GDP remains unchanged, that is ($b_t = b_{t-1}$). We can thus, re-write equation **(4)** as:

$$-P_t - \frac{1}{(1+\pi)(1+g)} b_{t-1} - \frac{(1+\pi)(1+g)-(1)}{(1+\pi)(1+g)} b_{t-1} \quad \textbf{(5)}$$

Where P_t= ratio of primary balance-to-GDP (- surplus; + deficit), at time *t*.

While the preceding argument holds, there are also debates in the literature on the timing of the stabilisation of public debt that will guarantee optimal government budgetary expenditure. On apriori, the fiscal intervention or adjustment should be immediate in order to indicate the existence of a flexible fiscal policy regime. The purpose of the intervention is to generate the necessary primary surplus that would eventually inhibit the growth of the public debt (in our case, foster transport infrastructure development), whenever it increases.

We can thus, rearrange equation (5) to obtain:

$$P_t = \frac{i-1\{(1+\pi)(1+g)-(1)\}}{(1+\pi)(1+g)} b_{t-1} \quad \textbf{(6)}$$

$$P_t^* = \frac{i-1\{(1+\pi)(1+g)-(1)\}}{(1+\pi)(1+g)} b_{t-1} \quad \textbf{(7)}$$

Where equation **(7)** is the required primary balance to stabilise the public debt, $P_t$is a current primary balance, $P_t^*$is the stabilising primary balance or fiscal rule. Thus, $P_t^* > P_t$suggests that fiscal policy is vulnerable, and the converse holds if, $P_t^* < P_t$. It implies that the primary

balance required to stabilise the public debt is unachievable by the fiscal authority. The primary balance is defined as the budget balance net of interest payments on the debt. The government thus has to issue more bonds in order to service its debt obligations. Consequently, a fiscal risk resonating in fiscal solvency may crystallise in the long-run; should the public debt continue to increase, and the government is unable to achieve a primary surplus.

Also $P_t^* - P_t < 0$ implies that fiscal policy is not vulnerable. The government managed to achieve or to exceed the stabilising primary balance. However, since our focus is on fiscal vulnerability and transport infrastructure investment, the model includes indices of fiscal vulnerability and transport infrastructure investment. This study is a prototype of McHugh, Petrova, and Baldacci (2014). The functional relationship is specified thus;

$$TRN_{InfDev} = f(FIS_{VULN}) \quad \textbf{(8)}$$

Where TRN_{InfDev}represents transport infrastructure development and FIS_{VULN}represents indices of fiscal vulnerability/stress. The transport infrastructure development model is expressed as:

$$GOVT_{TRNEXP_t} = A + \sum_{t}^{n=1} \gamma_n \frac{DEBT_t}{GDP_t} + \sum_{t}^{n=1} \pi_n \frac{REVENUE_t}{DRBT\ SERVICE_t} + \sum_{t}^{n=1} \omega_n NET_{GOVEXP_t} + \sum_{t}^{n=1} \theta_n INF_{RATE_t} + \mu_t \quad \textbf{(9)}$$

where γ, π, ω, and θ are the elasticities of debt to GDP ratio, cost of debt servicing, net government expenditures and inflation respectively. A is the efficiency of the transport development model. $GOVT_{TRNEXP_t}$ is government expenditure on transportation as a measure of the output elasticity of transport investment, $\frac{DEBT_t}{GDP_t}$is the ratio of government debt to gross domestic product (GDP), $\frac{REVENUE_t}{DRBT\ SERVICE_t}$ is the ratio of the percentage of government revenue used in servicing debt, $NET_{GOVEXP_t}$is the difference between government revenue and its expenditure (deficit), and INF_{RATE_t} is the prevailing level of inflation affecting government public expenditure; μ_t represents error term; t is the time series characteristics of the data set (1986-2017).Given the purpose of this study which is to examine the effect of fiscal vulnerability on transport infrastructure development, we take the semi-logarithms and time derivatives of equation **(9)** to generate the following dynamic function:

$$lnGOVT_{TRNEXP_t} = A + \sum_{t}^{n=1} \gamma_n \frac{DEBT_t}{GDP_t} + \sum_{t}^{n=1} \pi_n \frac{REVENUE_t}{DRBT\ SERVICE_t} + \sum_{t}^{n=1} \omega_n lnNET_{GOVEXP_t} + \sum_{t}^{n=1} \theta_n INF_{RATE_t} + \mu_t \quad \textbf{(10)}$$

Data

We rely on country-specific indices of fiscal vulnerability measures and transport infrastructure development in Nigeria. Annual time-series data from 1986 through 2017 were gathered on the subject matter. The choice of Nigeria was guided by the desire to explain the inherent fiscal obligation in pursuance of transport infrastructure development in Nigeria. Data availability was also an important consideration when choosing the scope and dimension of the study. Reliable aggregates on fiscal vulnerability leading to transport infrastructure development were not generalisable in the cross-border examination (unbalanced series), so we restricted our domain to the Nigerian context. Transport infrastructure investment was measured with government expenditure on transport as in the work of Akanbi and Schoeman (2011), fiscal vulnerability/stress in Nigeria was disaggregated and measured with debt to GDP ratio as in Checherita-Westphal and Rother (2012); Chen, Yao, Hu and Lin (2017); Edo (2002), revenue to debt service ratio as in Edo, Osadolor and Dading (2020), net government expenditure as in Aschauer (1989). We included the inflation rate as a control variable in our baseline model. Inflation was measured with consumer price index as in Quah and Vahey (1995) from 1986 through 2017. The data are mainly obtained from the CBN statistical bulletin various issues up until 2017 and World Bank Database (World Development Indicator, 2017). We rely on data from the Central Bank of Nigeria (CBN) statistical bulletin of various issues up till 2017. The variables used in this study are described in Table 1.

Table 1: Variable Description

Abbreviation	Variable	Measured As	Source
$GOVT_{TRNEXP_t}$	Transport Infrastructure Development	Government Expenditure on Transportation	Central Bank of Nigeria (CBN)
$\frac{DEBT_t}{GDP_t}$	Debt to GDP Ratio	Debt to GDP Ratio	World Bank Database (WDI)
$\frac{REVENUE_t}{DRBT\ SERVICE_t}$	Cost of Borrowing	Revenue to Debt Service Ratio	World Bank Database (WDI)
NET_{GOVEXP_t}	Net Government Expenditure	Net Government Expenditure	Central Bank of Nigeria (CBN)
INF_{RATE_t}	Inflation	Consumer Price Index	World Bank Database (WDI)

Source: Authors, 2020
*WDI: World Development Indicator; CBN: Central Bank of Nigeria

Empirical Strategy

In accounting for the dynamics of fiscal vulnerability/fiscal stress in transport infrastructure development in Nigeria, the study made use of a 3-prong econometric procedure. First, is the pre-estimation evaluation done with Augmented Dickey-fuller (ADF) unit root tests to ascertain the order of integration of the variables and equally inform the choice of estimation technique to be used. Secondly, the descriptive statistics method to help the show, describe and summarise the data in a meaningful way and also to know if the data are normally distributed through their averages and Jarque-Bera values (Gujarati and Dawn, 2009). Then, the ordinary least squares regression technique. Subsequently, the post-estimation technique was conducted to confirm the robustness and validity of the regression model. The Breusch-Godfrey Serial Correlation to test for the presence of serial correlation, Breusch Pagan Heteroscedasticity to test for heteroskedasticity and Cusum stability test to verify the structural stability of the model.

4.0 Results and Interpretations

Descriptive Statistics

Table 1: Descriptive Statistics of the Data Set

	$GOVT_{TRNEXP_t}$	$\frac{DEBT_t}{GDP_t}$	$\frac{REVENUE_t}{DRBT\ SERVICE_t}$	INF_{RATE_t}
Mean	3.865	4.145	7.092	6.536
Median	4.295	4.998	7.868	5.459
Maximum	8.735	6.643	9.344	8.453
Minimum	2.459	3.565	4.343	2.457
Std. Dev.	2.655	1.575	2.285	2.568
Skewness	0.2991	0.667	0.473	0.737
Kurtosis	1.323	1.646	2.664	2.099
Jarque-Bera	3.457	1.664	2.182	1.268
Probability	0.133	0.071	0.383	0.737

Source: Authors, 2019

Table 1 shows the mean and median of all the observations in the data set lie within the maximum and minimum values indicating the high tendency of the normal distribution. All the variables are positively skewed. The kurtosis statistics show that all the variables were platykurtic, suggesting that their distributions were flat relative to normal. The Jarque-Bera statistics shows that the series is normally distributed since the p-values of all the series are not statistically significant at 5% level. Thus, informing the acceptance of the null hypothesis that says each variable is normally distributed.

Table 2: Correlation Matrix of the Data Set

	$GOVT_{TRNEXP_t}$	$\frac{DEBT_t}{GDP_t}$	$\frac{REVENUE}{DRBT\ SERVI}$	NET_{GOVEXP_t}	INF_{RATE_t}
$GOVT_{TRNEXP_t}$	1				
$\frac{DEBT_t}{GDP_t}$	0.645737	1			
$\frac{REVENUE_t}{DRBT\ SERVICE_t}$	0.234445	0.543322	1		
NET_{GOVEXP_t}	0.713332	0.432888	0.512342	1	
INF_{RATE_t}	0.723792	0.002332	0.017134	0.729483	1

Source: Author, 2019

The study presents the results of the correlation analysis of the set of variables employed in Table 2 above. The Table shows that the correlation coefficients among the variables are below 0.75, indicating that there is no tendency for multicollinearity to occur among the independent variables.

4.2 Time Series Properties of the Variables

The ADF test is used to test for stationarity of the data. The ADF test consists of estimating the following regression equation.

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum_{i=1}^{m} \varphi i \Delta Y_{t-i} + \varepsilon_t \quad \textbf{(11)}$$

Where α represents the drift, t represents deterministic trend and m is an optimal lag length ample enough to ensure that ε_t is a white noise error term.

Table: 3 Unit Root Test: Augmented Dickey-Fuller Test (ADF)

Variables	*Level T-Stat*	*Critical Value @ 5%*	*First Difference T-Stat*	*Critical Value @ 5%*	*Order of Integration*
$GOVT_{TRNEXP_t}$	-1.673739	-3.464662	-5.898565	-4.519382	I(0)
$(\frac{DEBT_t}{GDP_t})$	-1.629614	-5.637379	-4.592401	-3.879542	I(0)
$(\frac{REVENUE_t}{DRBT\ SERVICE_t})$	-3.88934	-2.963972	-7.220743	-2.777895	I(0)
NET_{GOVEXP_t}	-4.237807	-2.785662	-5.784555	-1.945778	I(0)
INF_{RATE_t}	-1.636387	-2.673737	-7.655221	-4.555627	I(0)

Source: Author, 2019

The study used Augmented Dickey-Fuller to ascertain the order of integration of the variables. It is observed that the variables are stationary at levels I(0) at 5% significance level. We proceed to estimate the Ordinary Least Square Regression Model. The primary form of the dynamic OLS model is given as:

$$\Delta lnGOVT_{TRNEXP_t} = \beta_0 + \sum_{s=0}^{n_i} \beta_1 \Delta \frac{DEBT_{t-s}}{GDP_{t-s}} + \sum_{s=0}^{n_i} \beta_2 \Delta \frac{REVENUE_{t-s}}{DRBT\ SERVICE_{t-s}} + \sum_{s=0}^{n_i} \beta_3 \Delta lnNET_{GOVEXP_{t-s}} + \sum_{s=0}^{n_i} \beta_4 \Delta INF_{RATE_{t-s}} + \varepsilon_t \quad \textbf{(12)}$$

Where Δ is the first difference operator, $n_i = (\mathrm{i} = 1,2,3,4)$, while other variables remain as defined earlier.

OLS Regression Result

Table 4: Dynamic OLS Regression Result

Dependent Variable: $\Delta lnGOVT_{TRNEXP_t}$				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-4.960661	15.168813	-0.327030	0.0532
$\Delta \frac{DEBT_t}{GDP_t}$	-2.729548	1.493621	-1.827470	0.0432**
$\Delta \frac{REVENUE_t}{DEBT\ SERVICE_t}$	-0.703785	1.689088	-0.416667	0.0419**
$\Delta lnNET_{GOVEXP_t}$	0.260615	0.777440	0.335222	0.0073*
INF_{RATE_t}	0.040481	0.171039	0.236679	0.0297**

Note: *(**) (***) implies 1% (5%) (10%) significance level

Source: Author, 2019

The estimated result presented in Table above explained the dynamic relationship between fiscal vulnerability and transport infrastructure development in Nigeria. The result revealed that the coefficient of debt to GDP ratio and revenue to debt ratio is negative and statistically significant at 5% level of significance. This implies that a percentage increase in debt to GDP ratio and revenue to debt ratio led to approximately 2.73 and 0.70 percentage decreases in transport infrastructure development respectively. This economic implication is that as the share of the national productivity in servicing debt increases, finances require to procure transport infrastructure investment will equally reduce showing an inverse relationship that confirms the vulnerability of government fiscal programmes. The ratio of revenue to debt shows an inverse relationship implying that revenue emanating from deficit financing does not translate to improved and better investment in transport infrastructure which could be as a result of a higher cost of debt servicing associated with the revenue accrued.

The coefficients of net government expenditure and inflation tendencies are positive and statistically significant at 1% and 5% respectively. This implies that a percentage increase in net government expenditure and inflation rate led to 0.007 and 0.03 percenatge increase in transport infrastructure in Nigeria. The economic intuition is that net government expenditure surplus (fiscal surplus) induces investment in the capital project (transport infrastructure) because of the increased revenue as against sub-optimal expenditure. Increase inflationary tendency connotes more money in circulation, which in turns means more investment opportunities in the transport sub-sectors in Nigeria.

Table 5: Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.846	Prob. F(3,25)	0.4433
Obs*R-squared	2.237	Prob. Chi-Square(3)	0.3268

Source: Author, 2019

Given the probability value of 32.68 per cent, we fail to reject the null hypothesis and conclude that our short-run model is free from serial correlation.

Table 6: Heteroscedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	3.0298	Prob. F(6,27)	0.0214
Obs*R-squared	13.681	Prob. Chi-Square(6)	0.3334

Source: Author, 2019

The p-value (0.3334) of Obs* R-squared showed that we could not reject the null hypothesis. This implies that residuals have a constant variance which is desirable. That is, residuals are homoskedastic.

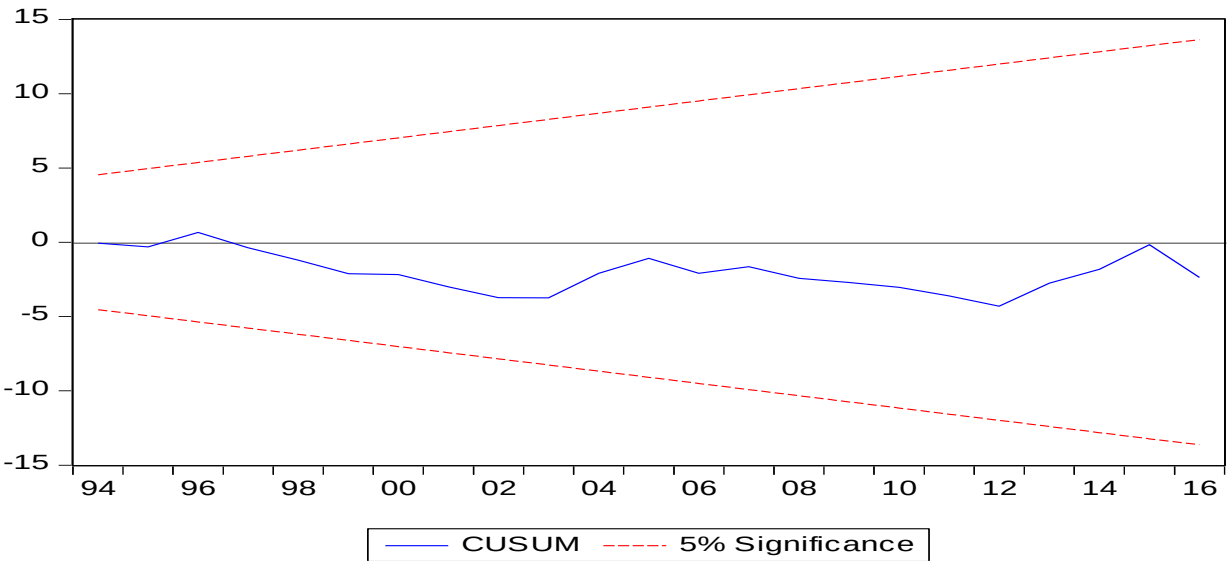


Fig. 1: CUSUM Stability Test

Source: Author, 2019

The above figure shows that the CUSUM line is within the critical bounds of 5 per cent level of significance, which indicates that the model has structural stability.

5.0 Conclusions

Despite the apparent relevance of transport infrastructure for growth and development, the attendant fiscal capacities to finance growth-inclined transport facilities are mostly unavailable, misinformed and misappropriated in Africa most populous black nation (Nigeria). Current and projected primary fiscal balances are crucial to assessing the extent to which fiscal policy of the government aligns with the intertemporal budget constraints facing the nation at the varying time for which transport infrastructure investment is significant

because of the enormous forward and backward linkages. This study investigates the effects of fiscal vulnerability on transport infrastructure investment in Nigeria from 1986 to 2017 (32 years). In evaluating its objectives, the paper adopts the Dynamic Ordinary Least Square (DOLS) regression technique to account for the dynamics of the model. The empirical result indicates that the debt to GDP ratio and revenue to debt ratio exhibit an inverse relationship with transport infrastructure development in Nigeria. However, net government spending (fiscal surplus) and inflationary tendencies show a positive and significant relationship with transport infrastructure development in Nigeria. The findings of the study agree with the results of Pal and Wahhaj (2017); Percoco (2014); Rommerskirchen (2015) who found a linear relationship between fiscal vulnerability and transport infrastructure investment in Nigeria. It is therefore recommended that the government should do more to ensure fiscal consolidation that will guarantee more significant investment in transport infrastructure because it impacts all another aspect of life significantly. Mainly, more investment to be geared towards sensitising the public about transparency and accountability of governance and ensure expertise are favoured for public office such that the right personnel to develop the right policy mix for fiscal consolidation emerges.

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