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How Does Economic Growth Respond to Public Infrastructure Expenditure Shocks? Evidence from SVAR in Nigeria

Abdullahi Badiru[1], Abdulsalam S. Ademola[1], Hussaini Dambo[2]

Affiliations

1 Department of Economics and Development Studies, Federal University Dutsin-Ma, Katsina – State, Nigeria

2 Department of Economics and Development Studies, Federal University Gusau, Zamfara – State, Nigeria

Corresponding Author Email: abadiru@fudutsinma.edu.ng

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Abstract

This paper investigates the economic growth response to public infrastructure expenditure shocks in Nigeria. Quarterly time-series data spanning 1981:Q1 to 2019:Q4, sourced from the Central Bank of Nigeria Statistical Bulletin are used in the study. The structural vector auto-regressive method following Blanchard and Perrotti's (2002) with Augmented Dickey-Fuller, Phillips and Perron, and Kwiatkowski-Phillips-Schmidt-Shin stationarity tests are employed in the paper. The results of the stationarity tests showed that all the model's variables namely; real gross domestic product, public infrastructure expenditure, and government revenue became stationary after their first difference. However, the study extracted and classified the variance decomposition and impulse response functions into three regimes namely; short, medium, and long-term respectively. The findings reveal that in the short term, 10.5% variations in economic growth were associated with public infrastructure expenditure shocks while in the medium term, 29.7% variations in economic growth were associated with public infrastructure expenditure shocks, and in the long term, 42.6% variations in economic growth were associated with public infrastructure expenditure shocks in Nigeria. Economic growth responses to public infrastructure expenditure shocks were positive and statistically significant in the three regimes of short, medium, and long-term respectively. The study recommends that the federal government should concentrate more on reforms and spending policies that will result in the best possible policy and ultimately high and sustainable growth in Nigeria.

Keywords: Economic Growth, Public Infrastructure, Expenditure Shocks, SVAR

JEL Classification: E62, H54

1. Introduction

Generally, two principles seem to emanate from economic literature about public infrastructure expenditure and economic growth. The foremost is whether investing in public infrastructure is a helpful instrument of Keynesian economics, particularly when the economy is in a recession, or a slowdown state as experienced in the year 2016 in Nigeria, with a high unemployment rate (NBS, 2017). According to Keynesian economists, an increase in government expenditure, particularly during downturns and recessions, causes a multiplier impact on aggregate demand that raises employment, income, savings, investment, and profits. Thus, in other words, public infrastructure expenditure can help alleviate not only high unemployment, and poverty menaces associated with the business cycle as well as have multiplier effects on the economy toward recovery and growth trajectory path. The second principle is that by enhancing the supply side of an economy, public infrastructure spending can increase its production capacity. It states that increasing public infrastructure spending can increase the economic output of other capital used in the production process of an economy and by extension its growth. In addition to monetary and fiscal policy shocks, technological shocks also have an impact on economic growth (Ramey, 2016). The study focuses on economic growth response to fiscal policy shocks precisely public infrastructure expenditure shocks in Nigeria.

Perotti (2005) has identified and classified four different methods used in the literature to determine the consequences of fiscal policies i.e. public infrastructure expenditure or tax shocks on macroeconomic variables as follows; (i) the identification of fiscal shocks that capture episodes using dummy variables (Burnside, Eichenbaum, & Fisher, 2000), (ii) Identification through the imposed sign rules on the impulse response function (Uhlig, 2005), (iii) Cholesky ordering for the recognition of fiscal policy shocks (Bernanke and Blinder, 1992), (iv) incorporation of decision delays between the formulation of policy and economic activity as well the elasticity of fiscal parameters (Perotti, 2005).

This paper contributes to the existing literature by measuring public infrastructure in monetary terms using the flow of public infrastructure expenditure to explain how economic growth responds to public infrastructure expenditure shocks in Nigeria. The paper is also unique in its classification of variance decomposition into three regimes of short, medium, and long-term respectively. Finally, the paper applied structural vector auto-regressive methodology following Blanchard and Perotti's (2002) model in a quarterly time series context spanning from 1981:Q1 to 2019:Q4 and the relevance of endogenous growth theory proposed by Barro (1990) which is of the view that public infrastructure expenditure played a vital and significant role in the growth of a nation and by extension the sources of growth are found within an economy. The study is divided into five sections, nevertheless. After the introduction, the review of literature is in section two, the methodology is in section three, section four consists of results and discussions, and section five concludes the paper.

2. Literature Review

The analysis of economic growth responses to public infrastructure expenditure or fiscal shock has a long history but this study provides a brief review of the subject matter. For example, Alami, Idrissi, Bousselhami, Raouf and Boujettou (2021) employed quarterly time-series data and structural auto-regressive estimation techniques to investigate the macroeconomic of budgetary shocks' effect on Morocco's economy. The findings indicate that while structurally beneficial shocks to public spending have an adverse effect on economic growth, negative economic growth ultimately has a long-term effect on average price levels and interest rates. Fatih (2021) used annual time series data and structural auto-regressive techniques to investigate the effect of shocks in government expenditure on Algeria's macroeconomic variables. The results show that exports and imports both respond positively to shocks of public expenditure, while export responses are moderate, whereas inflation responds negatively to expenditure shocks. The study proposes Algeria diversifies its economy and increase its tax revenue.

Rahaman and Leon-Gonzalez (2020) utilized a Bayesian structural vector auto-regressive method to determine the effects of public expenditure shocks in Bangladesh. The findings reveal that the expansion of public expenditure shock results are a massive improvement in private investment and consumption, and the decrease in output owing to the tax increase shock is highly robust. However, investment does not fall due to tax increases but private consumption decreases. The result suggests that in Bangladesh, stabilizing output through fiscal policy is preferable to doing so through monetary policy. As a result, the fiscal authority might raise spending without affecting Bangladesh's private investment. Munir and Riaz (2020) examined the macroeconomic consequences of exogenous public expenditure shocks in Pakistan using quarterly time-series data and a structural vector auto-regressive technique. The findings reveal that whereas current expenditure raises general prices, developmental expenditure lowers general prices, resulting in a real increase in the gross domestic product above current expenditure. Although both non-tax and tax revenue correlated with general prices and inversely correlated with interest rates, tax revenue raises the real gross domestic product more than non-tax revenue. The findings imply that the government should direct its spending toward useful projects and adopt a stringent responsibility policy for the creation and collection of the tax to set Pakistan's economy step toward development.

Hussain and Liu (2018) assessed the macroeconomic impact of shocks on public expenditure in Canada using annual time-series data and a structural vector auto-regressive. The result shows that the multiplier for Canadian government spending ranges from 0.92 to 1.52, as shown by government spending shocks. Parraga-Rodriguez (2016) used quarterly time series data spanning from 1969:1 to 2007:4 and a structural vector auto-regressive method to analyze the effects of government expenditure shocks in America. The findings reveal that whereas a rise in government expenditure has a multiplier impact between zero and one, increases in transfers have a multiplier impact over one. Ioana (2015) employed a structural vector auto-regressive technique to investigate the impact of Romania's public expenditure shocks. The findings reveal that fiscal shocks have a smaller impact on macroeconomic variables, and fiscal multipliers are comparatively small.

Cebi and Culha (2013) used quarterly time-series data from 2002:1 to 2012:4 and a structural vector auto-regressive technique to assess the effect of shocks to government spending on Turkey's real exchange and trade balance. The results reveal how a rise in government spending shocks caused the trade balance to worsen and the exchange rate to rise. Contrary to the increase in the exchange rate and widening of the trade imbalance produced by shocks to government non-wage spending, shocks to government investment have relatively little impact. The analysis concludes that government spending matters and that shocks to government expenditure are linked to tax increases. To evaluate the efficiency of public expenditure output in Romania, Leonte and Stoica (2012) used a structural vector auto-regressive technique with quarterly time series data spanning from 1999:1 to 2010:3. The findings reveal that Romania's gross domestic product responded positively but modestly to increase in public spending. According to the study's conclusions, a fiscal expansion in the Romanian economy would have a multiplier impact on the Keynesian variety.

Natasa, Andreja, and Ales (2011) examined how the macroeconomic dynamics of the Slovenian economy are impacted by fiscal shocks using quarterly time-series data from 1995Q1 to 2010Q4. The findings indicate that shocks in government expenditure have a beneficial immediate impact on Slovenia's GDP, investment, and private consumption. In the time after the shock, the effect is negligible. Furthermore, the findings reveal that during the shock phase, positive tax shocks hinder the economy's growth, private spending, and investment. After that, the effect again loses statistical significance. The analysis concludes that temporary changes in Slovenian government spending and taxation cannot be utilized to stimulate the economy. Cloyne (2011) used quarterly time series data from 1955:1 to 2007:4 and a structural vector auto-regressive method to investigate shocks to government expenditure, wealth impacts, and taxation with distortions for the United States. The findings show a favorable empirical response to growth, consumption, and real wage, among other important variables. Furthermore, the findings also reveal that the wealth impact is minimal; capital usage, investment adjustment costs, sticky prices, and habit all played significant roles; yet, the systemic distortions are significantly reduced by the hike in tax rates, despite their relatively small scale. De Castro and De Cos (2006) examined the impact of exogenous spending shocks in Spain using the structural vector auto-regressive method. The results show that raising government expenditure results in increased growth in the short-term, but at the expense of increased inflation, greater public deficits, and lower growth over the long term. The results also show that tax increases temporarily boost the public budget balance while hindering economic growth over the medium term. The study concludes that fiscal policy has grown more counter-cyclical during the study period and that the consolidation processes do not appear to have had any negative effects on output growth.

In summary, the vast literature reviewed on the topic was on advanced economies with little or no attention paid to economic growth responses to public infrastructure expenditure shocks in Nigeria. There is no research work on the issue of economic growth response to public infrastructure expenditure shocks, particularly from the Nigeria point of view. To the best of our knowledge, this area of the study appeared untouched and therefore needs attention. This paper filled this gap by adopting Blanchard and Perrotti's (2002) model using structural vector auto-regressive methodology and the classification of the variance decomposition into three regimes namely, the short, medium, and long term respectively.

3. Methodology

The paper investigates economic growth response to public infrastructure expenditure shocks in Nigeria utilizing quarterly time-series data. The Central Bank of Nigeria (CBN) Statistics Bulletin, 2020 served as the data's primary source and it spans from 1981:1 to 2019:4. Government revenue was proxy as (GR_t), public infrastructure expenditure as (PIE_t), and the real gross domestic product as a measure of growth (GDP_t). In the spirit of Blanchard and Perotti (2002), in equation (1), the fundamental VAR model is defined as follows;

$$Y_t = \Gamma_1 Y_{t-1} + ...\Gamma_p Y_{t-p} + u_t \tag{1}$$

Where $Y_t \equiv (GR_t, PIE_t, GDP_t)'$ is an endogenous three-dimensional vector of quarterly government revenue, public infrastructure expenditure, and the real gross domestic product. Thereafter, in the estimation of equation (1), the reduced-form residuals $u_t \equiv (u_{gr,t}, u_{pie,t}, u_{gdp,t})^1$ structural shocks can be derived and expressed as linear combinations $e_t \equiv (e_t^{gr}, e_t^{pie}, e_t^{gdp})^1$ in the form $Au_t = Be_t$. Transforming the form and writing it in matrix form gives equation (2) as follows;

$$\begin{bmatrix} 1 & 0 & -a_{13} \\ 0 & 1 & -a_{23} \\ -a_{31} & -a_{32} & 1 \end{bmatrix} \begin{bmatrix} u_{gr,t} \\ u_{gie,t} \\ u_{rgdp,t} \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & 0 \\ b_{21} & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix} \begin{bmatrix} e_t^{gr} \\ e_t^{gie} \\ e_t^{gdp} \end{bmatrix} \qquad (2)$$

Equation (2), $\sum u = A^{-1}BI \; B^1 A^{-1^1}$, $\sum u$ contains $\frac{n(n+1)}{2} = \frac{12}{2} = 6$ free components. There should be certain limitations placed on A and B. Apply the equation, $2n^2 - \frac{n(n+1)}{2} = \frac{n(3n-1)}{2} = \frac{24}{2} = 12$ for the system to be recognized, restrictions need to be put in place. Where our n denotes the number of system variables and is equal to 3. From equation (2), A and B have three constraints out of the nine restrictions that result in having three 1's and six 0's a_{13} and a_{23} are the government's tax revenues' elasticity to GDP as well as the elasticity of public infrastructure expenditure to GDP. The final constraint forms two model requirements. (equation 2); the first specification sets, $b_{21} = 0$ and $b_{12} \neq 0$, where the second specification set $b_{21} = 0$ and $b_{12} \neq 0$ as earlier mentioned, the first specification was that decisions about government revenue come to precede those regarding spending on public infrastructure; according to the second criterion, decisions about revenue come before those about spending on public infrastructure. We do a Granger Causality test between revenue and public infrastructure spending as a diagnostic test. The structural shocks' standard deviations are represented by the B matrix's diagonal elements because we assumed that these shocks are standardized at 1.

4. Results and Discussions

4.1 *Econometric analysis*

Stationarity tests for data involve testing for stochastic characteristics of the study's series. However, three stationarity tests were employed to support robustness and result comparison. The outcome of the stationarity test revealed that government revenue (GR), public infrastructure expenditure (PIE), and real gross domestic product (GDP) have a unit root. Table 1 shows the outcome. The results as shown in Table 1, reveal the stationarity. The results indicate that every variable used in the study namely; economic growth (GDP), public infrastructure expenditure (PIE), and government revenue (GR) were not stationary in using the ADF, PP, and KPSS. The time series variables only became stationary after rendering the first difference, that is, order one I (1) at a 5% significance level.

Lag Length Test for the SVAR Model

Lag selection is critical in the analysis. An adequate number of auto-regressive lags are added to the SVAR model to prevent misleading results. A crucial step in establishing a stable SVAR model is determining what number of lag values should be a component of the model. On the other hand, improper lag length specification in an SVAR model might cause unstable impulse reactions and variance decompositions (Braun and Mittink, 1993). Moreover, while under-fitting can prevent some system dynamics from materializing, inefficiency might result from the model being over-fitted. Table 2 shows the result.

Table 1: Stationarity Test Result

Variables	ADF–STATISTICS		PP- STATISTICS		KPPS-STATISTICS		REMARKS	
	Level	1st Diff.	Level	1st Diff.	Level	1st Diff.	Order of Integration	
GR_t	0.5252	5.9293	0.5252	5.9293	3.3562	0.0909	I(1)	Stationary
PIE_t	2.8344	3.1017	2.8344	3.1017	3.1432	0.0831	I(1)	Stationary
GDP_t	1.5849	5.6628	1.5899	5.6628	1.4960	0.2046	I(1)	Stationary

Critical Values for ADF and PP are: 1% = 3.62; 5% = 2.94; 10% = 2.61
Critical Values for KPSS are: 1% = 0.74; 5% = 0.46; 10% = 0.34
Source: Extract from the ADF, PP, and KPPS test results estimated using E-views version 10

Table 2: Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3898.957	NA	1.59e+19	52.72915	52.78990	52.75383
1	-3171.899	1414.816	9.74e+14	43.02566	43.26867	43.12439
2	-3166.979	9.373992	1.03e+15	43.08079	43.50608	43.25359
3	-3158.618	15.59102	1.04e+15	43.08944	43.69698	43.33628
4	-3140.591	32.88737	9.20e+14	42.96745	43.75726	43.28835
5	-3045.552	169.5288*	2.88e+14*	41.80476*	42.77683*	42.19971*
6	-3044.189	2.377265	3.20e+14	41.90796	43.06229	42.37696
7	-3042.481	2.907017	3.54e+14	42.00651	43.34310	42.54956
8	-3040.270	3.676198	3.89e+14	42.09824	43.61710	42.71535

* indicates lag order selected by the criterion
Source: Authors' Estimation using Eviews Output Version 10

From Table 2, all five criteria namely; sequential modified, Schwarz criteria, Hannan-Quinn information criteria, Akaike information criteria, and the Final predict error all favor 5-lag length at a 5% significant level. Thus, the lag length criteria result presented in Table 2 revealed 5 - lag length as the optimal at a 5% level of significance. An exclusion of five lags was considered to be the minimum number necessary for the model to establish the validity of the outcome using the Wald test. Table 3 shows the outcome.

Table 3: VAR Lag Exclusion Wald Tests

	GR	PIE	GDP	Joint
Lag 1	166.7868 [0.0000]	133.4706 [0.0000]	303.5936 [0.0000]	597.3604 [0.0000]
Lag 2	7.96E-29 [1.0000]	3.51E-29 [1.0000]	2.97E-28 [1.0000]	5.43E-28 [1.0000]
Lag 3	1.44E-28 [1.0000]	8.23E-30 [1.0000]	6.97E-28 [1.0000]	1.03E-27 [1.0000]
Lag 4	26.91510 [0.0000]	24.95205 [0.0000]	238.5572 [0.0000]	279.0171 [0.0000]
Lag 5	42.17780 [0.0000]	24.02108 [0.0000]	226.6291 [0.0000]	281.4360 [0.0000]

Note: Numbers in [ ] are p-values. * indicates statistically significant at 5% level
Source: Authors' Computation using E-views Output Version 10

The result presented in Table 3 shows that χ^2 statistics for the overall endogenous variables' significance in VAR namely; the real gross domestic product (GDP), public infrastructure expenditure (PIE), and government revenue (GR) at 5 lag lengths were jointly significant at 1% level, indicating that the 5-lag length is optimal. Therefore, this paper used a 5-lag length in the analysis. The structural vector auto-regression estimate is next and Table 4 shows the outcomes.

Table 4: Structural VAR Result

Model: Ae = Bu where E[uu']=I				
A =				
1	0	0		
C(1)	1	0		
C(2)	C(3)	1		
B =				
C(4)	0	0		
0	C(5)	0		
0	0	C(6)		
	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.393962	0.107577	-3.662127	0.0003
C(2)	-0.015978	0.008487	-1.882593	0.0598
C(3)	-0.017197	0.006153	-2.794905	0.0052
C(4)	0.170285	0.009799	17.37814	0.0000
C(5)	0.225105	0.012953	17.37815	0.0000
C(6)	0.017020	0.000979	17.37815	0.0000
Log-likelihood	464.7847			
Estimated A matrix:				
1.000000	0.000000	0.000000		
-0.393962	1.000000	0.000000		
-0.015978	-0.017197	1.000000		
Estimated B matrix:				
0.170285	0.000000	0.000000		
0.000000	0.225105	0.000000		
0.000000	0.000000	0.017020		

Source: Authors' Calculation utilizing E-views 10

Table 4 displays the result of structural vector auto-regression estimates. The result reveals that the estimated government revenue coefficient proxy as tax to economic growth was statistically significant and positively signed. It suggests that a 1% increase in government tax would increase economic growth by 0.17%. The findings conform to the endogenous theory which agrees that the effect of taxation on growth is positive. The coefficient of public infrastructure expenditure to economic growth was also statistically significant and positively signed. It suggests that a 1% rise in public infrastructure expenditure would increase economic growth by 0.22%. The findings also supported the endogenous growth theory proposed by Barro (1990) which holds the view that public infrastructure expenditure had a significant impact on the economic growth of a nation and by extension, the sources of growth are found within an economy. This result supports the views of Munir and Riaz (2020) and Rahaman and Leon-Gonzalez (2020).

The VAR Model's Stability

Because the modulus of all the roots is smaller than one and the reduced-form VAR model lies inside the unit circle, it appeared stable as in Appendix I. We first discovered the residuals in reduced form, followed by structural shocks and impulse response, and variance decomposition. However, determine the following:

$$\begin{bmatrix} 1 & 0 & -a_{13} \\ 0 & 1 & -a_{23} \\ -a_{31} & -a_{32} & 1 \end{bmatrix} \begin{bmatrix} u_{gr,t} \\ u_{pie,t} \\ u_{gdp,t} \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & 0 \\ b_{21} & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix} \begin{bmatrix} e_t^{\,gr} \\ e_t^{\,pie} \\ e_t^{\,gdp} \end{bmatrix} \qquad (2)$$

The model needs to be restricted in three ways to be found. We obtained a_{13} Using log (GR) regression on c and log (GDP), $a_{13} = 3.9$. We set $a_{23} = 0$ and $b_{21} = 0$. It follows from this that public infrastructure expenditure decision-making precedes government revenue.

Impulse Response Function

The function of the impulse response (IRF), which maintains the original units of the data and offers an estimate of uncertainty, looks at how one variable reacts to random shocks in another variable. Using a structural decomposition of the computed SVAR's residual covariance matrix, the result described in the paper was reached. Furthermore, IRF is helpful because it offers a more statistically sound way to gauge how one variable responds to changes in another. In this paper, the IRF helped in the determination of the response of economic growth (GDP) to public infrastructure expenditure shocks (PIE) and government revenue (GR). The study focuses specifically on the economic growth response to public infrastructure expenditure shocks within the study period in Nigeria. The result is presented in Figure 1.

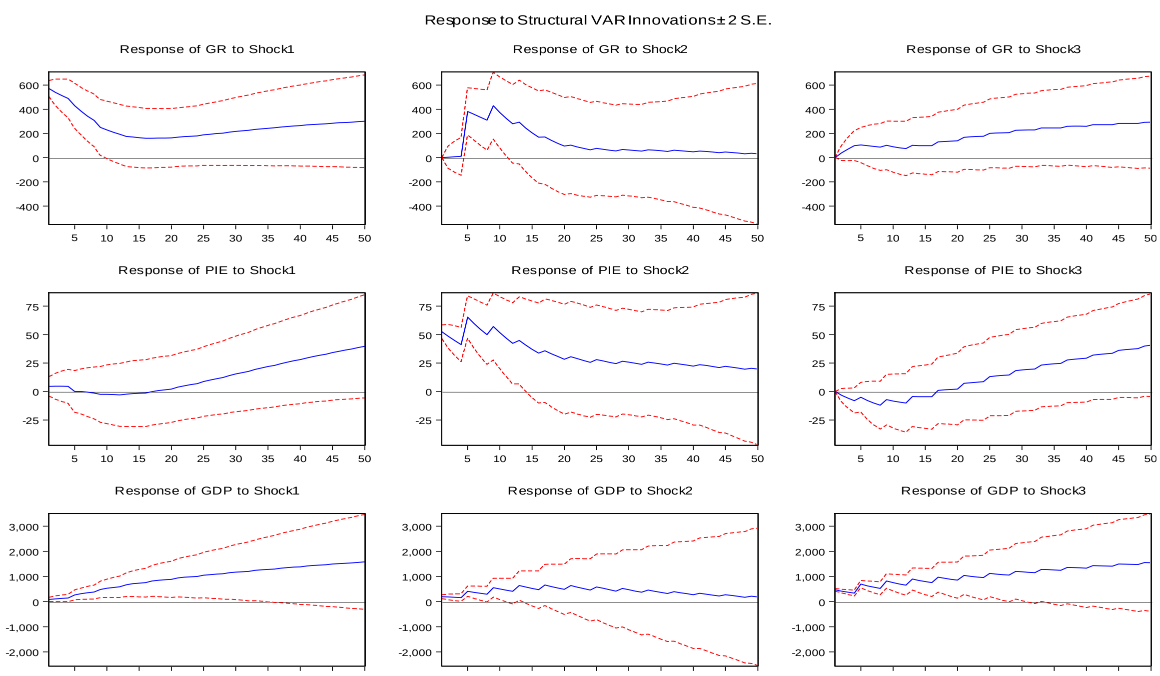

Figure 1: Impulse Response of Structural VAR Result

Figure 1 depicts the responses to shocks among the macroeconomic variables within three regimes namely; short, medium, and long- term respectively. It depicts that, the reaction of growth (GDP) to public infrastructure expenditure shock effect is positive and statistically significant for the three regimes of short-term, medium-term, and long-term respectively. An increase in public infrastructure expenditure shock by 1%, as in Figure 1, rises economic growth (GDP) by 10.5% and it is positive and statistically significant. The economic growth response to tax shock (GR) was statistically significant and positive for the three regimes namely short, medium, and long – term respectively. This outcome is in line with the view of Ioana (2015). The variance decomposition is next and Table 5 shows the result.

Table 5: Variance Decomposition of Economic Growth (GDP)

Period		S.E.	Shock1	Shock2	Shock3
ST	8	0.054690	7.557558	10.57409	81.86835
MT	24	0.115914	16.88322	29.73076	53.38602
LT	48	0.169447	28.59881	42.69875	28.70245

Note: ST = Short - Term, MT = Medium Term, LT = Long - Term
Source: Extract from E-views Output version 10

Variance decomposition (VD) is used to examine the fitted SVAR that deviates from the actual values of the vector of endogenous variables. The variation in macroeconomic variables and the underlying structural shocks are also related using VD. In SVAR, to understand how the model's variables vary, the variance decomposition is examined. Table 5 illustrates the economic growth movement as well as its relationship to shocks. The VD was extracted and classified into three regimes namely short, medium, and long-term respectively. The result reveals that for the short–term, 10.5% of economic growth's fluctuations are associated with public infrastructure expenditure shocks (PIE). While in the medium term, 29.7% of the variation in economic growth is related to public infrastructure expenditure shocks. In the long–term, 42.6% of economic growth's fluctuations are associated with public infrastructure expenditure shocks. This implies that the government of Nigeria has to put more emphasis on public infrastructure expenditure policies and reforms to achieve ultimately, the best course of action and sustainable growth, especially as Nigeria's economy depends heavily on crude oil and agriculture for its growth.

5. Conclusions and Policy Implications

This paper examined the response of economic growth to public infrastructure expenditure shocks in Nigeria. The structural vector auto-regressive technique was employed in the study. The impulse response function and variance decomposition were used to analyze the responses of economic growth to public infrastructure expenditure shocks. From the discoveries of the paper, we can conclude that economic growth response to the impact of public infrastructure expenditure shocks was positive and statistically significant for the three regimes namely; short, medium, and long-term respectively. Therefore, these recommendations are provided based on the paper's findings. Given that the Nigerian economy is recognized to be a crude oil-based and agricultural economy, the federal government should concentrate on government spending policies and reforms that would result in optimal policy and eventually inclusive and sustainable growth. For the economy to be on the path of not only inclusive growth but also prosperity in Nigeria, the federal, state, and local governments should direct all of their spending toward productive projects and adopt a strong responsibility for the generation and collection policy of income via tax.

The scope of the paper covers from quarter one of 1981 to quarter four of 2019. As such, it is limited to only the time frame stated. Structural restrictions resolve the non-uniqueness problem of the innovations, structural vector auto-regression modeling has its limitation even if the restrictions imposed are firmly based on some economic theories, they may not truly reflect what goes on in the actual underlying system or Nigerian economy.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Disclosure statement

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References

Alami, Y, El Idrissi, I, Bousselhami, A, Raouf, R and Boujettou, H. (2021). Macroeconomic impacts of fiscal shocks on the Moroccan economy: A disaggregated SVAR analysis. *Journal of Business and Socio-Economic Development*, Emerald Publishing Limited.

Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98, 103-125.

Bernanke, B.S. and Blinder, A.S. (1992). The federal funds rate and the channels of monetary transmission. *American Economic Review,* 82, 901- 921.

Blanchard, O. and Perotti R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output, *Quarterly Journal of Economics,* 107, 1329-1368.

Braun, P. A. and Mittnik, S. (1993). Misspecifications in vector auto-regression and their effects on impulse responses and variance decompositions. *Journal of Econometrics,* 3, 319-341.

Burnside, C., Eichenbaum, M. and Fisher, J. D. (2000). Assessing the effects of fiscal shocks, *NBER Working Paper, No* 7459, National Bureau of Economic Research.

Cebi, C. and Culha, A. A. (2013). The effects of government spending shocks on the real exchange rate and trade balance in Turkey. *Working paper series no. 13/37.*

Central Bank of Nigeria (2020), *Statistic Bulletin,* Abuja

Cloyne, J. (2011). Government spending shocks, wealth effects and distortionary taxes. *Munich Personal Repec Archive.* Retrieved from: http://mpra.ub.uni-muenchen.de/41689/ (Accessed 23 June, 2022)

De Castro, F. and De Cos, H. (2006). The economic effects of exogenous fiscal shocks in Spain, an SVAR approach, *European Central Bank Working Paper,* No.647.

Dickey, D. A. and Fuller, W. A. (1979). Distribution of the estimators for auto-regressive time series with a unit root. *Journal of American Statistical Association,* 74, 427 - 431.

Fatih, C. (2021). What can SVAR models tell us about the impact of public expenditure shocks on macroeconomic variables in Algeria? A slight hint to the COVID-19 pandemic. *Folia Oeconomica Stetinensia, 21* (2), 21-37. doi: 10.2478/foli-2021-0014.

Hussain, S. M. and Liu, L. (2018). Macroeconomic effects of government spending shocks: new narrative evidence from Canada. *Rochester Stockman Conference.*

Ioana, B. (2015). The effects of fiscal policy shocks in Romania. An SVAR approach. *Procedia Economics and Finance*, 32, 1131-1139.

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics,* 54, 159 - 178.

Leonte, A. and Stoica, T. (2012). Assessing the effect of public spending on output in Romania using a vector auto-regressive framework. *African Journal of Business Management,* 6, 6318-6323. doi: 10.5897/AJBM11.985.

Munir, K. and Riaz, N. (2020). Macroeconomic effects of exogenous fiscal policy shocks in Pakistan: A disaggregated SVAR analysis. *Review of Public Economics*, 233(2), 141-165.

Natasa, J., Andreja, S. K. and Ales, D. (2011). How do fiscal shocks affect the macroeconomic dynamics in the Slovenian economy? *Banka Slovenije Evrosistem*,

National Bureau of Statistics (2017), Retrieved from:
https:// nigerianstat.gov.ng/elibrary?queries[search]=GDP%201981-2017

Parraga-Rodrıguez, S. (2016). The dynamic effect of public expenditure shocks in the United States. *Documentos de Trabajo.* No.1628. Banco De Espana, Madrid.

Perotti, R. (2005). Estimating the effects of fiscal policy in OECD countries, *CEPR Discussion Paper* 4842, Centre for Economic Policy Research.

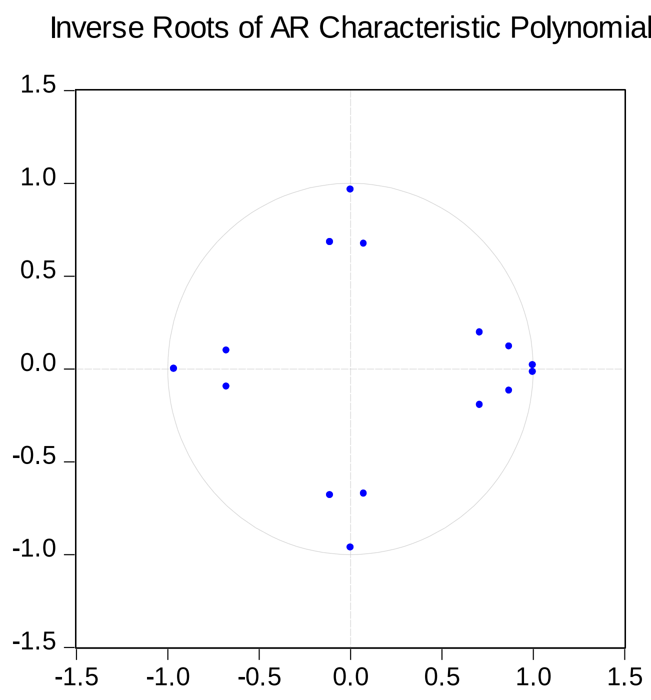
Phillips, P. and Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75, 335 - 346.

Rahaman, A. and Leon-Gonzalez, R. (2020). The effects of fiscal policy shocks in Bangladesh: An agnostic identification procedure, *National Graduate Institute for Policy Studies, Tokyo - Japan Discussion Paper*, No. 20-08

Ramey, V. A. (2016). Macroeconomic shocks and their propagation, *NBER Working Paper No. 21978.* dio:http://www.nber.org/papers/w21978

Uhlig, H. (2005). What are the effects of monetary policy on output? Results from an agnostic identification procedure, *Journal of Monetary Economics*, 52, 381-419.

APPENDIX I: STABILITY RESULT OF THE MODEL



Source: Extract from E-views Output version 10

APPENDIX II: OLS RESULT OF THE MODEL

Dependent Variable: LOG(GR)

Sample: 1981Q1 2019Q4

Included observations: 156

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-34.50479	1.401919	-24.61255	0.0000
LOG(GDP)	3.988438	0.136007	29.32523	0.0000

R-squared	0.848122	Mean dependent var	6.544961
Adjusted R-squared	0.847135	S.D. dependent var	2.455226
S.E. of regression	0.959942	Akaike info criterion	2.768850
Sum squared resid	141.9092	Schwarz criterion	2.807950
Log-likelihood	-213.9703	Hannan-Quinn criterion	2.784731
F-statistic	859.9689	Durbin-Watson stat	0.032041
Prob(F-statistic)	0.000000		

Source: Extract from E-views Output version 10

APPENDIX III: SVAR RESULT OF THE MODEL

Structural VAR Estimates

Included observations: 151 after adjustments
Estimation method: Maximum likelihood via Newton-Raphson (analytic derivatives)

Convergence achieved after 35 iterations

Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I

A =

1	0	0
C(1)	1	0
C(2)	C(3)	1

B =

C(4)	0	0
0	C(5)	0
0	0	C(6)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.007802	0.007475	-1.043729	0.2966
C(2)	-0.130380	0.066972	-1.946771	0.0516

C(3)	-3.788669	0.726461	-5.215243	0.0000
C(4)	571.7893	32.90278	17.37814	0.0000
C(5)	52.52398	3.022416	17.37814	0.0000
C(6)	468.8761	26.98079	17.37814	0.0000
Log-likelihood	-3128.296			

Estimated A matrix:

1.000000	0.000000	0.000000
-0.007802	1.000000	0.000000
-0.130380	-3.788669	1.000000

Estimated B matrix:

571.7893	0.000000	0.000000
0.000000	52.52398	0.000000
0.000000	0.000000	468.8761

Estimated S matrix:

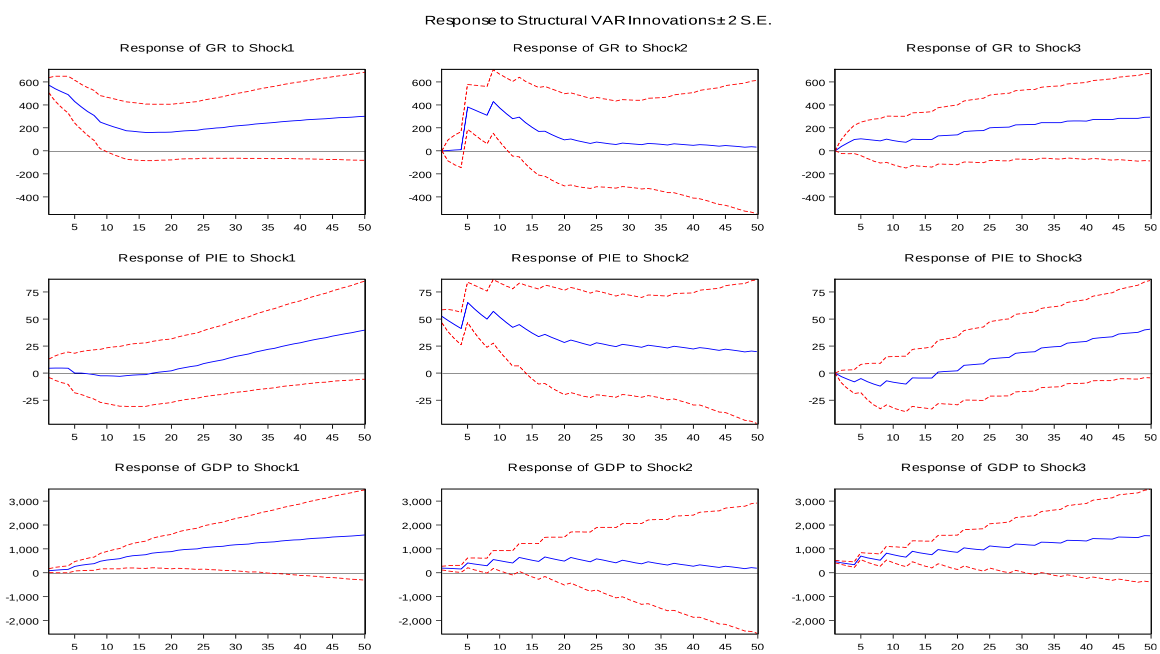
571.7893	0.000000	0.000000
4.461253	52.52398	0.000000
91.45186	198.9960	468.8761

Estimated F matrix:

22352.60	-1743.776	17187.60
4014.462	365.0783	3697.898
101174.4	-21108.61	97556.23

Source: Extract from E-views Output version 10

APPENDIX IV: IMPULSE RESPONSE FUNCTION RESULT OF THE MODEL



Source: Extract from E-views Output version 10

APPENDIX V: VARIANCE DECOMPOSITION RESULT OF MODEL

Variance Decomposition of GR

Period	S.E.	Shock1	Shock2	Shock3
1	571.7893	100.0000	0.000000	0.000000
2	787.7632	99.75725	0.002733	0.240019
3	942.7706	99.25058	0.008781	0.740642
4	1066.536	98.53977	0.017759	1.442475
5	1215.721	88.27646	9.870358	1.853187
6	1327.502	82.36375	15.52179	2.114460
7	1414.166	78.47375	19.22945	2.296798
8	1482.739	75.71729	21.85321	2.429504
9	1566.889	70.34549	27.06063	2.593886
10	1629.317	67.03023	30.26474	2.705029
11	1676.298	64.89441	32.31303	2.792563
12	1712.027	63.48524	33.64432	2.870438
13	1748.898	61.84848	35.06164	3.089877
14	1777.123	60.82150	35.87117	3.307329
15	1799.243	60.17945	36.29077	3.529781
16	1817.031	59.78385	36.45512	3.761029
17	1836.676	59.27739	36.53785	4.184764
18	1854.061	58.93341	36.44058	4.626015
19	1869.881	58.69658	36.22092	5.082500
20	1884.624	58.52992	35.91871	5.551373
21	1902.484	58.22786	35.54284	6.229307
22	1920.175	57.97585	35.10599	6.918167
23	1937.747	57.76396	34.62708	7.608954
24	1955.227	57.58469	34.12093	8.294374
25	1976.041	57.28499	33.55546	9.159548
26	1997.180	57.01966	32.96908	10.01126
27	2018.505	56.78886	32.37116	10.83998
28	2039.900	56.59121	31.76955	11.63924
29	2064.365	56.30118	31.12900	12.56982
30	2089.163	56.04762	30.48687	13.46551
31	2114.107	55.83116	29.84883	14.32001
32	2139.046	55.65039	29.21960	15.13001
33	2166.616	55.40158	28.56989	16.02853
34	2194.402	55.18859	27.92859	16.88282
35	2222.217	55.01107	27.29917	17.68976
36	2249.913	54.86695	26.68447	18.44858
37	2279.776	54.67215	26.06161	19.26624
38	2309.736	54.50841	25.45157	20.04002
39	2339.627	54.37483	24.85654	20.76864
40	2369.314	54.26927	24.27830	21.45242
41	2400.751	54.12495	23.69890	22.17615
42	2432.202	54.00529	23.13386	22.86084
43	2463.523	53.90945	22.58468	23.50586
44	2494.597	53.83562	22.05263	24.11175
45	2527.072	53.73145	21.52318	24.74537
46	2559.511	53.64593	21.00840	25.34567
47	2591.789	53.57846	20.50940	25.91214
48	2623.804	53.52771	20.02716	26.44513

49	2656.932	53.45299	19.54954	26.99747
50	2689.990	53.39205	19.08637	27.52158

Variance Decomposition of PIE

Period	S.E.	Shock1	Shock2	Shock3
1	52.71310	0.716270	99.28373	0.000000
2	71.83240	0.804644	98.99737	0.197986
3	84.94365	0.872262	98.51580	0.611937
4	94.87365	0.918322	97.88487	1.196806
5	115.3102	0.621784	98.38474	0.993477
6	130.0660	0.488706	98.37092	1.140376
7	141.4041	0.414755	98.10774	1.477505
8	150.4466	0.373674	97.68301	1.943314
9	161.0663	0.350747	97.75882	1.890437
10	169.3670	0.337722	97.70746	1.954815
11	175.9675	0.334674	97.57194	2.093389
12	181.2838	0.342117	97.37660	2.281279
13	186.8145	0.338323	97.45683	2.204848
14	191.2890	0.332523	97.50822	2.159253
15	194.9197	0.326908	97.53878	2.134314
16	197.8725	0.322265	97.55435	2.123387
17	201.0912	0.312041	97.62953	2.058434
18	203.8162	0.305295	97.68593	2.008778
19	206.1238	0.304082	97.72407	1.971850
20	208.0804	0.309323	97.74514	1.945537
21	210.4780	0.335684	97.64675	2.017569
22	212.6578	0.384215	97.50582	2.109963
23	214.6411	0.456354	97.32491	2.218735
24	216.4489	0.552168	97.10742	2.340415
25	218.8168	0.700182	96.65373	2.646091
26	221.1133	0.892937	96.13348	2.973581
27	223.3325	1.128929	95.55528	3.315787
28	225.4719	1.405202	94.92778	3.667018
29	228.2222	1.752191	94.01920	4.228612
30	230.9795	2.157102	93.03853	4.804369
31	233.7229	2.614353	92.00028	5.385369
32	236.4367	3.117399	90.91768	5.964917
33	239.7577	3.688811	89.57088	6.740305
34	243.1249	4.316392	88.16701	7.516601
35	246.5101	4.991707	86.72338	8.284915
36	249.8910	5.706095	85.25496	9.038945
37	253.8406	6.469984	83.57616	9.953858
38	257.8546	7.277150	81.86683	10.85602
39	261.9024	8.118526	80.14374	11.73774
40	265.9593	8.985331	78.42080	12.59387
41	270.5293	9.876360	76.55272	13.57092
42	275.1716	10.79361	74.68208	14.52431
43	279.8560	11.72908	72.82298	15.44794
44	284.5572	12.67524	70.98682	16.33794
45	289.7107	13.62224	69.06528	17.31248
46	294.9388	14.57950	67.16438	18.25612
47	300.2127	15.54086	65.29482	19.16432

48	305.5079	16.50057	63.46504	20.03439
49	311.1949	17.44369	61.59671	20.95960
50	316.9548	18.38468	59.76511	21.85021

Variance Decomposition of GDP

Period	S.E.	Shock1	Shock2	Shock3
1	517.5014	3.122929	14.78650	82.09057
2	701.0054	4.272099	15.07584	80.65206
3	825.3016	5.545534	15.29273	79.16173
4	919.0402	6.908490	15.44330	77.64821
5	1254.427	8.336122	19.17281	72.49107
6	1486.018	10.46970	19.88577	69.64453
7	1665.689	12.80947	19.81542	67.37511
8	1813.827	15.19487	19.42841	65.37672
9	2123.141	16.33468	21.05210	62.61322
10	2369.521	18.16242	21.42885	60.40873
11	2575.808	20.19919	21.27593	58.52487
12	2754.000	22.25566	20.86357	56.88076
13	3043.122	23.12924	21.50190	55.36885
14	3289.360	24.47323	21.53287	53.99390
15	3504.270	25.99342	21.24031	52.76627
16	3695.091	27.54944	20.76759	51.68297
17	3964.431	28.24145	20.83843	50.92012
18	4203.285	29.24498	20.59034	50.16468
19	4417.997	30.38721	20.15251	49.46027
20	4613.071	31.57284	19.60328	48.82388
21	4865.828	32.15217	19.34698	48.50085
22	5096.841	32.93803	18.92307	48.13890
23	5309.681	33.82665	18.39594	47.77741
24	5507.123	34.75440	17.80953	47.43608
25	5748.488	35.25116	17.39245	47.35640
26	5974.402	35.88555	16.89223	47.22221
27	6186.796	36.59353	16.34252	47.06394
28	6387.293	37.33266	15.76809	46.89925
29	6622.100	37.75947	15.29913	46.94141
30	6845.858	38.27898	14.79392	46.92711
31	7059.494	38.85074	14.27030	46.87897
32	7263.854	39.44633	13.74211	46.81156
33	7495.381	39.81227	13.28362	46.90411
34	7718.843	40.24151	12.81383	46.94466
35	7934.550	40.70805	12.34218	46.94977
36	8142.846	41.19268	11.87635	46.93098
37	8372.740	41.50669	11.45821	47.03510
38	8596.554	41.86444	11.04126	47.09429
39	8814.228	42.24896	10.63048	47.12056
40	9025.793	42.64714	10.23009	47.12277
41	9254.496	42.91752	9.862815	47.21966
42	9478.428	43.21829	9.502474	47.27923
43	9697.322	43.53824	9.151681	47.31007
44	9911.022	43.86838	8.812785	47.31883
45	10138.24	44.10208	8.496901	47.40102

46	10361.55	44.35684	8.190218	47.45294
47	10580.59	44.62523	7.894123	47.48065
48	10795.08	44.90103	7.609946	47.48902
49	11020.15	45.10355	7.341659	47.55480
50	11241.87	45.32052	7.083124	47.59635

Source: Extract from E-views Output version 10