

Modelling the Response of Fiscal Policy to External Shocks: The Case of Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author BOM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author UCCN managed the literature of the study. Both authors read and approved the final manuscript.

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ABSTRACT

The study assesses the response of Nigerian fiscal policy to a number of external shocks, namely; oil price, foreign aid and exchange rate shocks using Vector Autoregressive (VAR) estimation approach. The results show that fiscal policy in Nigeria is responsive to external shocks mainly oil price shocks, while shocks due to government revenue are also shown as significant for explaining economic activities measured by GDP in Nigeria.

Keywords: Fiscal policy; external shock; autoregressive distribution analysis.

1. INTRODUCTION

The increasing integration and globalization of the world particularly in recent time has continued to provide a platform for interaction of macroeconomic fundamental

among the countries of the world. However, in additional to the generality of such cross-country integration of macroeconomic fundamentals, there exist a number of key global variable, namely; oil prices, exchange rates and foreign all of which has the to influence

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economic policies for which fiscal policy is its essential arm.

The anxiety experienced by economic policymakers around the world is often attributed to the uncertainty that characterizes these key global variables. Thus, the effectiveness or otherwise of fiscal policy of a nation as tool for macroeconomic stability cannot be in isolation of the extent to which economic activities in the nation is vulnerable to shocks due to these global variables.

The aforementioned among others might explain while most developing economies, particularly those from Africa that are highly dependent on volatile prices of primary commodities as well as aid flow had witnessed a number of challenges in the pursuance of effective economic policy such as sound fiscal policy. Nigeria as one of the developing countries has witnessed so many shocks and disturbances both externally and internally over the decades due to some identified external factors and internal factors. To mention just but, a few, the external factors are technology transfer and changes, migration, trade openness, insurgency, wars, population growth and so forth while the internal factors responsible for those shocks are improper implementation of government policies, consumption patterns, unstable investment, changes in future expectation and so forth.

“Tanzi [1] mentioned that the factors associated with external or exogenous shocks are changes in export earnings. A number of developing economies Nigeria inclusive relies heavily on the export of commodities namely, oil, coffee, and cocoa, among others for their foreign exchange earnings. Thus, while the shocks in this light are likely to emanate from say unpredicted variations in the prices associated with changes in the supply of these commodities relative demands, changes in foreign credit also constitute another source of external shocks. This type of shock is not the same as the previous one. Around 1982, the world witnessed a dramatic reduction in the willingness of commercial banks to lend to developing countries. Mexico for example, saw its foreign borrowing fall from \$18 billion in 1981 to \$5 billion in 1983. The debt crisis made new loans unavailable to many countries, thus reducing their ability to continue financing through this source their current expenditure levels. Another factor is changes in the level of foreign grants; that is, in many countries, and especially in the smaller one, an important

external shock may come in the form of sudden changes in the availability of foreign grants of concessionary loans to countries that have relied on the source for their domestic expenditure will be forced to reduce their spending when those grants are no longer available. Example of these shocks abounds, especially in Africa (Nigeria inclusive). We also have factors such as changes in foreign shocks remittance, changes in the cost of foreign borrowing thus; in this case, a change in interest rate in the capital markets can be an important external shock.

Over the years, macroeconomic dynamics in Nigeria has been characterized by fiscal instability attributable the volatility of the government revenue leading to strong deficit and debts biasness. Even the efforts to neutralize the biasness via monetary policy intervention have rather induces the instability of the macroeconomic fundamentals the more.

In the case of high debt profile, the emerging as well the developed economies are often differs in term of their policy responses. In the case of the emerging economies for example, Brazil and Turkey favoured the fixed primary surplus rule, which require fixing the ratio of primary budget to GDP. In a similar development, Argentina and Peru also favoured this approach by applying limits to their overall balance and primary expenditure, while the New Zealand on the other hand favours both the rules for operating balance and debts limits [2,3].

Although, issues and developments as regards stability and growth pact in the European union has been relatively flexible from the perspective of the constraints associated with the practical application, yet Nigeria as a developing country has been falling back on fiscal policy to augment her expenditures in effort to ensure stability of her macroeconomic dynamics.

Over the years, macroeconomic trends in Nigeria suggest that there have been increase in the government deficit mainly due to the risen expenditure profile of the government. However, in addition to the issue of poor quality of public expenditure, the inability and lack of political wills on the part of government to create sovereign wealth fund account to for the excess proceeds from the sale of crude oil has also been a major short fall in efforts to ensure that government expenditure is maintained at a sustainable level and consistent with the absorptive capacity of the economy. Since the adoption of Structural

Adjustment Programme (SAP) emphasis has been on deregulation of the economy with the ultimate aim of reducing government expenditure but it appears that all the austerity measures brought in by SAP only had a very short run effect. This is because since the past two decades there has been an upward trend in government expenditures spending and deficit, particularly between 1996 and 2005 [4].

For example, aftermath of excess proceeds from the sale of crude oil between 1990 and 1992, come a substantial growth in the level of government as high as 21 percent of GDP. However, as the oil market weakened in the subsequent years, the oil receipts become inadequate to meet the increasing levels of demands and expenditures, thus the government then resorts borrowing, but mainly from the Central Bank to bridge resulting deficits [5]. All these have been the major characteristics of fiscal policy administration in Nigeria.

The implication is that fiscal policy management is likely to be highly prone to a lot of irregularities occasioned by some shocks which might be internal or external [6]. However, the fiscal variables, which include government revenue and expenditure, are also highly susceptible to some external shocks which can also have implications on their behaviours and by extension have serious implications on economic growth as well.

The external shocks might be country specific since institutional and structural frameworks of countries differ from one country to the other. For an oil-rich economy such as Nigeria, the fiscal revenues often depend largely on proceeds from the sale of crude oil. Pointing out the extent to which the Nigerian economy is oil dependent is the fact that earning from the sales of oil make up for as high as 80 per cent of the country's total government revenues. This by implications suggests that the economy is potentially vulnerable to fluctuation in the international crude oil prices. Essentially, revenues from oil are highly volatile and that may not be unconnected to the fluctuation feature of global oil prices as well as uncertainty in the manner in oil quota are assigned to OPEC member countries Nigeria inclusive [5]. However, apart from oil related variables, some other factors which might vary from country to country have been identified by quite a number of researchers as external factors that might likely cause perturbation of fiscal policy variables [7,8]. Consequently, identification

of these shocks to fiscal policy and the assessment of the degree of response or behaviour of fiscal policy to these external shocks might go a long way to unravel the reasons for the dwindling Official Development Assistance (ODA) in the recent years. This will also contribute to Literatures on fiscal policy responses to external shocks and the implication on the growth of Nigerian economy. In this study, oil price shocks, foreign aid shocks and exchange rate shocks is considered as external shocks affecting the fiscal policy, while fiscal policy consists of two major fiscal variables such as government revenue and expenditure.

2. LITERATURE REVIEW

The term "shocks" is used to describe a disturbance to the economy that was unanticipated. A shock can also be conceptualized as an event which impacts unexpectedly on a country's economy, and which is exogenous or beyond the control of the country's government to prevent making it discernable from 'non-shocks' such as predictable and/or recurrent trends and policy-induced (that is endogenous) events [9]. Economic literature has identified quite a number of macroeconomic variables that constitute external disturbance to fiscal policy framework. The transmission mechanism of fiscal policy has been identified as been prone to some external influences that perturb the whole fiscal policy administration [5]. Ref. [10] examine the source of economic fluctuation in Pakistan. They use a structural vector auto regression model to show that external shock are the most important source of economic fluctuation in Pakistan. Balassa [11] researched on the policy responses of developing countries to external shocks in two periods; 1973 to 1978 and 1978 to 1983. He also classified developing countries into two; that is, countries that provide more support to import substitution classified as inward countries while countries that provide incentives to exports and imports are classified as outward countries. Balassa [11] eventually found out that outward – oriented countries suffered greater terms of trade losses than inward – oriented countries during both periods of external shocks.

In their examination of the effects of oil price shocks using the case of Philippine economy, [12] finds that oil price shock has the potential to prolong a reduction in the real GDP of the Philippines economy. On the other hand however, their finding based on asymmetric VAR

model, suggests that fall in oil price plays a significant for explaining the level of fluctuations in the variables of interest as against the positive oil price shocks. In a related study, [13] assessed the effects of oil price shocks on Venezuela's economic performance over a longer period (1950 to 2001). The study adopted a general to specific modeling VAR and VECM technique to investigate the relationship between oil prices, governmental revenues, government consumption spending, GDP and investment. The results found two long-run relationships consistent with economic growth and fiscal balance. Furthermore, they found that this relationship is important not only for the long-run performance but also for short-term fluctuations.

Using the case of Nigeria economy, [14] examine the effects changes in oil prices on selected macroeconomic fundamentals namely, output; inflation; exchange rate and money supply. Contrary to the findings of a number of the previous studies indicate evidence of significant impact of oil price shocks on the Nigeria output and inflation. However, oil price shocks were found to significantly influence the real exchange rate. The author argues that oil price shocks may give rise to wealth effect that appreciates the real exchange rate and may squeeze the tradable sector, giving rise to the "Dutch-Disease". The present study differs from [14] by introducing variable in the VAR model such as government expenditure. This is considering the fact that about oil proceeds account for about 90 percent of the total government revenue in Nigeria. In addition, Nigeria is an import dependent country implying that oil price shocks do have implications for imports and government expenditure in Nigeria. It also uses industrial output as a measure of output as against GDP.

Exploring a cointegrating VAR model, [15] use the case of Nigeria to explain the impacts of the macroeconomic policy of capital inflows and exchange rate volatilities. Finding from the study seem to have illuminates the dynamic functions of the levels of capital inflows such as the reaction times with which capital flows begin to react to a shock in exchange volatility and macroeconomics stability. More so, the study argue to have proffer better policies that will cushion the effects of such shocks on key macroeconomic variable in the Nigeria economy. More so, indication from the empirical finding of the study suggests that in the long-run the impact of fiscal policy on output is negligible and not appreciably different from zero. More

sophisticated VAR models may be justified [16].

3. METHODOLOGY AND DATA SOURCE

Econometrics literature has identified VAR as a veritable means of studying the effect of shocks on economic variable in both short and medium terms [17]. Formulation of VAR model is strongly dependent on shocks identification in the VAR model and this often depends on the objectives of the researcher as well as literatures. In this study we are interested in studying shocks effects on fiscal policy and the resultant implication on the output of Nigeria. In other words, we are looking at how fiscal policy shocks are acting as the transmission mechanism of the external shocks affecting it to the output growth of Nigeria. A flow chart for the economy is shown as follows:

From literature, oil price and exchange rate have been identified by [18-20]; among others as external factors that can influence fiscal policy in Nigeria which is an oil-rich country. Fiscal variables to be used as transmission mechanism are government revenue, government expenditure and the output variable is the GDP. VAR models are seen as an independent large scale macro econometric model that do not rely on unrealistic assumptions [17]. The foremost theoretical framework of VAR analysis as proposed by Sims [21] used Choleski decomposition to get impulse responses.

The construction of our VAR model follows the conventional method where the initial model is specified thus:

$$y_t = A_1y_{t-1} + A_2y_{t-2} + \dots + A_p y_{t-p} + \mu_t \quad (1)$$

Where y_t represents an (nx1) vector containing n endogenous variables, $A_i (i=1, 2, \dots, p)$ are (n x n) matrices coefficients, and μ_t is an (n x 1) vector containing error terms. Though the error is $\mu_t \sim iid N(0, \Omega)$ but errors do possess tendency of correlating contemporaneously in all the equations. There exist pn^2 Parameters in the A matrices. The Equation can be written in other form with the usage of the lag operator L which is selected through $L^k x_t = x_{t-k}$. the equation becomes:

$$A(L)y_t = \mu_t \quad (2)$$

Where $A(L) = A_0L^0 - A_1L^1 - A_2L^2 - \dots - A_pL^p$. $A_0 = I$ (identity matrix) it is required that

$A(L)$ lies outside the unit circle for stationarity to be ensured.

The VAR model to be estimated for the purpose of this study is stated as follows;

$$GDP_t = [Oilpr_t, fa_t, exr_t, govrev_t, govexp_t] \quad (3)$$

From the model, the shocks or the exogenous variables are;

$oilpr_t$,.....oil price at period t

fa_t ,.....foreign aid at period t

exr_t ,.....Exchange rate at period t

The fiscal policy variables act as transmission mechanism and at the same time shocks to the system. The variables are;

$govrev_t$,.....Government revenue at period t

$govexp_t$,.....Government expenditure at period t

The output variable is GDP_t .

The GDP gross domestic product of Nigeria at period t

Both the impulse response function and the variance decomposition analysis were used to thoroughly examine the response of the fiscal variables to the identified shocks and also to assess the resultant effect on output growth of Nigeria.

Data on the fiscal variables and the output variable were sourced from the Central Bank statistical bulletin [22]. Data on foreign aid is sourced from World Bank [23] while data on the variables relating to Oil price were sourced from the OPEC database.

4. EMPIRICAL RESULTS DISCUSSION

This study follows the work of [16,24-27], among others, where levels VAR are used. The studies have argued that this approach will prevent loss of vital information about the data sets which might occur in the course of differencing. It has also been argued that the inclusion of lagged lengths of the variables in the VAR will enable the residual to be stationary even with a non-stationary series that is $I(1)$ [28]. Many studies in recent times have also followed the same procedure [17,29-31].

4.1 Impulse Response Function Results

Fig. 1 shows response to one standard deviation rise in oil price. Oil price has been identified as one of the important external shock that can influence the behaviour of fiscal policy and that can also have implication on economy growth in Nigeria. The result shows that government revenue responds positively to shock from oil price. The response was significant for the larger period of the response. There is an indication that the revenue of the government of Nigeria is highly responsive to oil price shock. Almost the same effect is replicated on government expenditure. The oil price also causes government expenditure to rise but not significantly. The implication is that the significant impact of oil price shock on government revenue is not translated to significant government expenditure. The response of foreign aids to oil price shock is not significant and it does not show any conspicuous pattern of movement. This is an indication that oil price shock may not affect foreign aid in Nigeria.

The response of all the variables to one standard deviation in the exchange rate is shown in figure 2. All the variables do not respond significantly to exchange rate shock. Only the GDP respond positively and significantly to the exchange rate shock. This is an indication that overvaluation of currency might not improve growth of Nigeria. In other words, it contributes to the existing literature that discourages currency appreciation if growth is to be achieved. [14] concluded that currency appreciation has the tendency of squeezing out the tradable sector of the economy. This will definitely have adverse effect on the GDP.

Government revenue shock affects both GDP and government expenditure significantly. The shock does not have significant impact on exchange rate and foreign aids. It is however noted that the shock fails to lead to significant increase in government expenditure and the GDP. Both appear to fall in Fig. 3. Again this is corroborating our earlier conclusion that a sudden upsurge in government revenue might not translate to improved growth.

The impulse response of variables to one standard deviation in government expenditure is shown in Fig. 4. The result indicates that government expenditure shock does not have significant impact on both the exchange rate and foreign aids. However, the shock has significant

impact on both the GDP and government revenue. Both the GDP and government revenue react negatively and significantly to shock from government expenditure. This is in line with our

conclusion from the previous figures that both government revenue and expenditure shocks might not influence the growth of Nigeria positively. The implication is that the expenditure

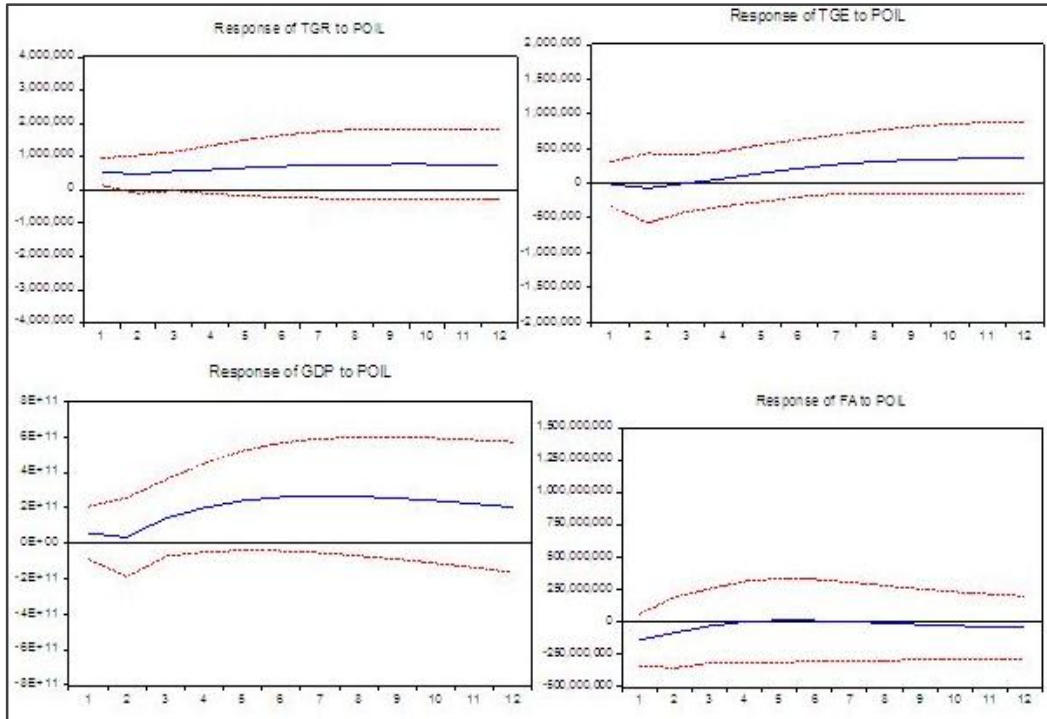


Fig. 1. Impulse response to oil price shock

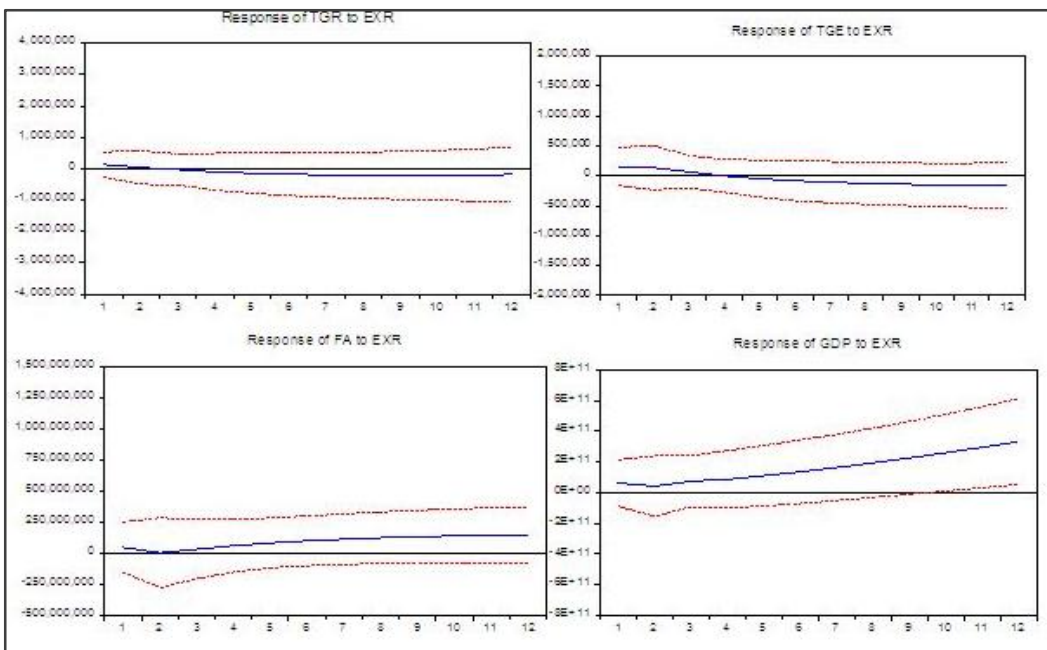


Fig. 2. Impulse response to exchange rate shock

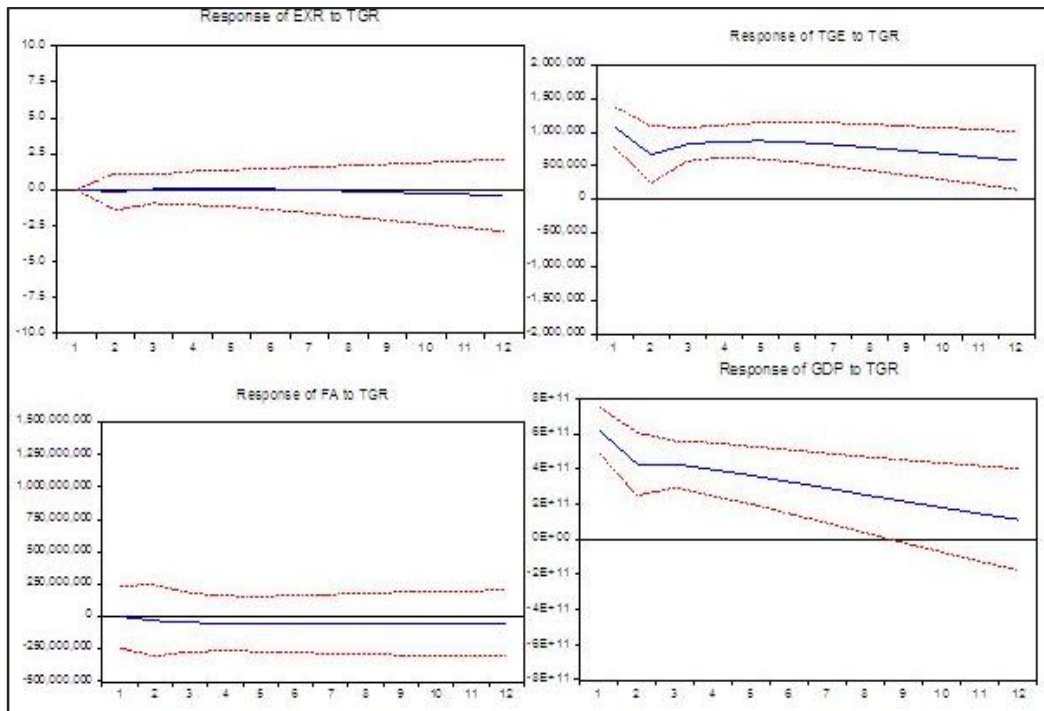


Fig. 3. Impulse response to government revenue shock

of government might not be on the productive activities that can promote growth. This follows the findings of CBN 2010 that the bulk of government expenditure in Nigeria goes to overheads and general administration which might not have any impact on the real sector of the economy.

Fig. 5 shows the response of both the fiscal variables and the GDP to one standard deviation in foreign aid. The results show that none of the variable demonstrates any significant response to the shock. This implies that foreign aid might not have any significant impact on growth in Nigeria.

4.2 Variance Decomposition Results

Variance decomposition analysis explains the contribution of each shock to the behaviour of each variable in the VAR system. This analysis will enable us measure the magnitude of contributions of each identified shock in the VAR system to the behaviour of each variable. The results on table 1 indicates that apart from own shock and government expenditure which are direct fiscal variables, oil price shock contribute the highest shock to the behaviour of government revenue in Nigeria. The trend shows

that oil price shock affects government revenue very well. In other words, it dictates the pace of government revenue in Nigeria. In the same vein the own shock and government revenue shock contribute the highest shock to the behaviour of government expenditure. Oil price shock appears not to have much effect like it does on government revenue. Table 3 shows that apart from the own shock oil price and exchange rate affects foreign aid behaviour in Nigeria. However, the own shock has a pronounced effect on the behaviour of foreign aids in Nigeria. The implication here is that external factors (oil price and exchange rate) outside fiscal policy shocks appears to have much more effects on the behaviour of foreign aids than government revenue and government expenditure shocks which are direct fiscal policy variables. The results on table 4 show that government revenue shock contributes the highest shock to the behaviour of the GDP apart from own shock. The implication here is that government revenue is an important factor that determines the behaviour of the GDP. This is followed by Government expenditure shock. It should be noted that the finding is in line with what we obtained previously. Foreign aid appears to contribute the lowest shock to the GDP.

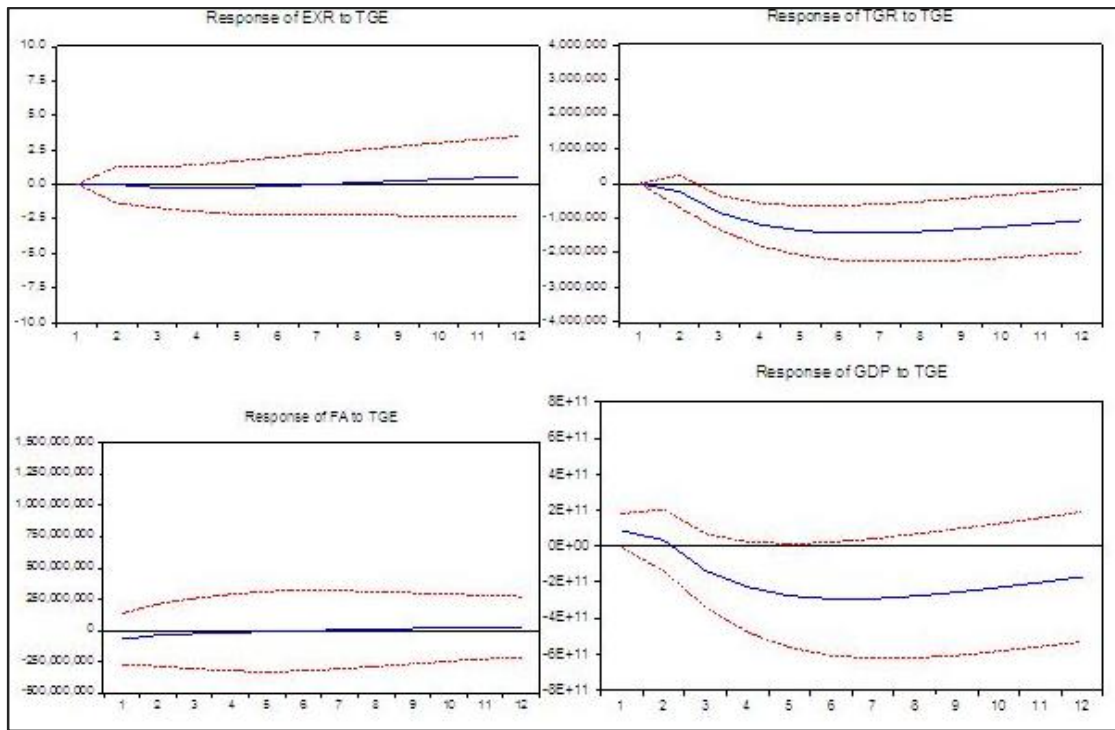


Fig. 4. Impulse response to government expenditure shock

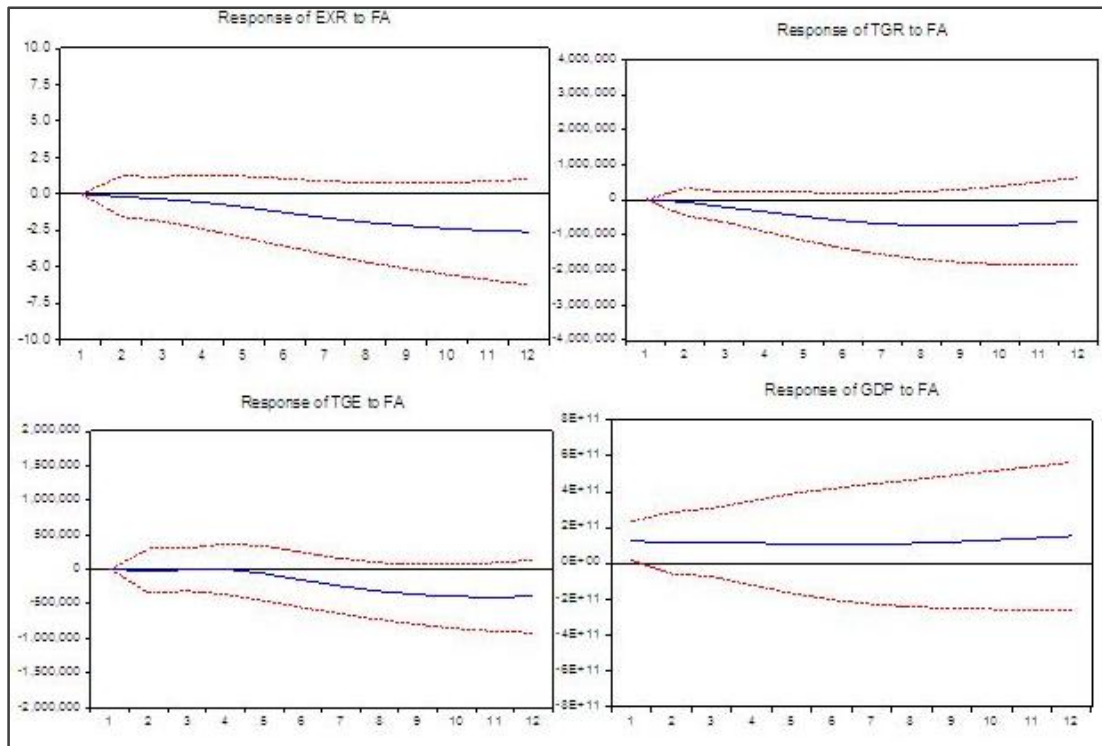


Fig. 5. Impulse response to foreign aids shock

Table 1. Variance decomposition of Government revenue

Period	Standard error	Oil price shock	Exchange rate shock	Government revenue shock	Government expenditure shock	Foreign aid shock	GDP shock
3	3646660.	6.292858	0.149896	87.33373	5.773356	0.366127	0.084035
6	5407917.	7.386767	0.271359	68.99280	20.69345	2.533444	0.122185
9	6672688.	8.772767	0.457285	58.53913	26.40574	5.182552	0.642527
12	7488380.	10.06362	0.569624	52.86988	28.14250	6.555207	1.799158

Table 2. Variance decomposition of government expenditure

Period	Standard error	Oil price shock	Exchange rate shock	Government revenue shock	Government expenditure shock	Foreign aid shock	GDP shock
3	2394320.	0.096407	0.826787	39.90874	59.15367	0.011039	0.003360
6	2930626.	0.881324	0.657215	52.79082	45.24066	0.330601	0.099382
9	3515215.	2.873310	0.837554	51.24746	42.33157	2.624892	0.085215
12	3966176.	4.666672	1.134779	47.89958	40.93341	5.070769	0.294799

Table 3. Variance decomposition of foreign aids

Period	Standard error	Oil price shock	Exchange rate shock	Government revenue shock	Government expenditure shock	Foreign aid shock	GDP shock
3	1.80E+09	0.799546	0.099561	0.091273	0.204863	98.75492	0.049836
6	2.06E+09	0.618581	0.552752	0.282894	0.164542	98.34144	0.039789
9	2.14E+09	0.581279	1.505066	0.462684	0.162262	97.25179	0.036919
12	2.18E+09	0.647746	2.778183	0.615161	0.202149	95.72097	0.035796

Table 4. Variance decomposition of GDP

Period	Standard error	Oil price shock	Exchange rate shock	Government revenue shock	Government expenditure shock	Foreign aid shock	GDP shock
3	1.25E+12	1.563304	0.721701	47.79413	1.727755	2.714113	45.47900
6	1.72E+12	6.433307	1.676227	38.67396	8.177279	2.672617	42.36661
9	2.08E+12	9.116192	3.816657	30.78952	10.85011	2.702061	42.72546
12	2.38E+12	9.549028	7.575174	24.63101	10.43562	3.115365	44.69380

4.3 Conclusions and Recommendations

From the findings in this study, it can be concluded that oil price shock is a significant factor affecting government revenue in Nigeria. The shock also affects the GDP using government revenue as a transmission mechanism. This is an indication that fiscal policy in Nigeria appears to be highly susceptible to oil price shock. Again, considering the fiscal policy shocks, the GDP does not respond significantly and positively to both government revenue and expenditure shocks. The implication of this is that government revenue might not have been utilized for productive activities that can promote the growth of the GDP. This is contributing to the findings of CBN, 2010 that government revenue has been grossly inadequate to fund the real sector of the economy due to the high cost of

administration and other overheads. It has been found that external shocks (Oil price shock and Exchange rate shocks) affects the fiscal policy shocks and foreign aid shock does not have much effect on the GDP. Finally, findings from the study also support the literature in favour of the moderate exchange rate as an impetus to achieving economic growth. Overvaluation of currency has been shown to be a disincentive to achieving accelerated economic growth. Thus, we recommend based on the conclusion drawn from the finding of the study that, fiscal policy in Nigeria should be appraised based on exchange rate and oil price shocks and not foreign aid shocks. These have been shown to contribute high shock to the behaviour of fiscal policy shocks in Nigeria. Effort should be made by policymakers to ensure that oil revenue translates to economic growth. This can be done

by improving on the funding of the real sector of the economy. Aggressive investment promotion strategy should be embarked upon so as to promote the growth of the country. The monetary authorities should also guide against overvaluation of naira. This has been shown to have adverse effect on the growth of the economy.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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