Original Article

The Impact Of Government Revenue Shocks On Macroeconomic Variables In Nigeria: 1981-2020

Musa Dauda[1*], Philip O. Alege [2], Olabanji O. Ewetan[3]

[1, 2, 3] Department of Economics and Development Studies, Covenant University, Ota, Ogun State, Nigeria.
Email: [1] musadaudapgs@stu.cu.edu.ng

*Corresponding Author: Musa Dauda
Department of Economics and Development Studies, Covenant University, Ota, Ogun State, Nigeria.
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Abstract

Governments all around the world, but notably those in emerging nations, work to attain full employment, stable prices, and equilibrium in the balance of payments. This is to guarantee that such nations will always be relevant and influential in world economic affairs. This has led governments to consistently use certain macroeconomic policies in recent years, specifically fiscal and monetary policies, with the express purpose of assuring quick, sustained economic growth. One such tool used to achieve the macroeconomic goal is fiscal policy using government revenue. This study examined the impact of government revenue shocks on the macroeconomic variables in Nigeria. Specifically, investigated the impact of government oil and non-oil revenue shocks on economic growth in Nigeria. The study employed the Dynamic Stochastic General Equilibrium model with the features that are evident in Nigeria such as the households, firms, monetary authority, fiscal authority, and the rest of the world. The study discovered that government oil revenue has a positive relationship with output and interest rate, while positive government non-oil revenue reacted negatively to output and interest rate in Nigeria. Since taxation is one of a country's funding sources, it remains insufficient and has counter consequences, the study suggests that the government should look for other sources of revenue because increasing tax rates logically results in higher tax burdens for individuals and businesses. As a result, purchase power parity will reduce, there will be a decline in production, and as a result, government revenue will decrease. Instead of a tax cap, it is preferable to promote domestic industries to broaden the tax base and help the country become self-sufficient and independent. To boost non-oil sectors like tourism, agriculture, FDI, and entrepreneurship and promote economic diversification, the nation must also increase its efforts in these areas.

Keywords: Government Oil Revenue, Government Non-oil Revenue Macroeconomic Variables, DSGE.

INTRODUCTION

Governments all around the world, especially those in developing nations, work to attain full employment, stability in prices, and equilibrium in the balance of payments. This is to guarantee that suchnations will always be relevant and influential in world economic affairs. This has led governments to consistently use certain macroeconomic policies in recent years, specifically fiscal and monetary policies, with the express purpose of assuring quick, sustained economic growth. One such tool used to achieve themacroeconomic goal is fiscal policy using government revenue. It is therefore imperative to critically understand from a scholarly perspective what government revenue and government revenue shocks are all about. The amount of money a government gets in taxes and other levies determines its capacity to support its expenditures. Government expenditure and revenue are essential elements of the overall budget for the country and serve as tools for fiscal policy, (Adegboye, Uwuigbe, Ojeka, Dahunsi, & Adegboye, 2022). Government revenue shocks can be described as expected or unexpected changes that have an impact on government revenue, whether it comes from oil or not. Depending on the scenario, the government revenue shocks could be either positive (a rise) or negative (a fall) in revenue. The first scenario is the size of the income rise, which may be measured in absolute terms or percentage changes, and the second is the timing of the shocks, that is, the speed and persistence of the shift. The GDP growth rate, government revenue, inflation, unemployment, and the balance of payments are just a few of the economic development indicators that have recently taken a downturn. With all these signs, Nigeria's economic growth may prove to be a difficult undertaking (Berembo & Igonikon, 2020).

According to Azubike (2009) and Berembo and Igonikon (2020), for government to meet up with the increasing needs of society in developing countries, huge funds should be at its disposal which neither a person nor a community can provide alone. Especially when the economy is faced with revenue shocks. Hence, finding more sustainable economic growth for the economy needs to be sourced from the mobilization of public resources and one medium through which such funds could be derived is through taxation and revenue among others. For the government to generate taxation for sustainable development, the government must ensure an enabling environment for businesses to strive through macroeconomic indicators. The oil revenue according to literature such as Ordu and Anaele (2015) is most affected when there are fiscal policy shocks. In Nigeria, the greatest amount of revenue comes from oil revenue. This is so because Nigeria has a significant amount of oil resources, including natural gas, and crude oil is one of its main sources of exports. What happens to government oil revenue in the event of oil shocks? This will have an impact on oil revenue, which will probably have a negative major impact on the macroeconomic environment. In addition, Nigeria is endowed with more natural resources that can be discovered and whose owners are subject to taxation, including tin, iron ore, coal, limestone, lead, zinc, and arable land (Berembo and Igonikon, 2020).

As such revenue emanating from these areas via taxation is critical to the sustainable growth and development of the nation. Even though Nigeria can generate enough revenue through the available resources, what happens to such revenue when the economy is faced with events that orchestrated the fiscal policy shocks such as the great depression of the 1930s, the global financial crisis of 2007 to 2009, the COVID-19 pandemic of 2020 or the Russian/ Ukraine war of 2022 all these are the event that has affectedfiscal policy in the time past which also resulted to negative effect government revenue. This will therefore be very difficult for the government to generate enough revenue to run the economy when there is a negative shock on the revenue. Despite being referred to as the giant of Africa, Nigeria continues to experience severe underdevelopment and slow economic progress. Low per capita income, a weak health and education system, a short life expectancy, a low human development rating (index), high unemployment and inflation, bad infrastructure, and a low standard of living are all signs of low levels of development (Berembo and Igonikon, 2020). Studies like those by Joseph and Omodero (2020) and Kim, Wang, Park, and Petalcorin (2021) examined the connection between tax and non-tax revenue and economic growth, (Asongu, Adegboye, & Nnanna, 2021).

The study also recognized forecasts as a lack in the literature. However, this study fills a gap by examining oil and non-oil revenue separately and employing a model that can explain the impact of shocks more effectively than any other model. The study also ascertained the distortion induced by revenue shocks on the macroeconomic environment by looking into the long-term effects of revenue shocks. The full effect of government revenue on macroeconomic variables in Nigeria will be hidden ifthe oil and non-oil revenue sources are not examined. All of this is taking place amid revenue shocks that affect both oil and non-oil sources of income, such as the value-added tax and other levies. Considering this, it has become essential for this study to look at how government revenue shocks affect Nigeria's macroeconomic environment. Study Aim and Objective: The primary goal of this study is to examine how changes in government revenue affect macroeconomic indicators in Nigeria between the second quarter of 1981 and the first quarter of 2021. Specifically: to

- investigate the impact of government oil and non-oil revenue shocks on economic growth in Nigeria,

The research question that guided this study to ascertain the problem under investigation:

- What is the impact of government oil and non-oil revenue shocks on economic growth in Nigeria?

RELATED LITERATURE REVIEW

Scholars have offered a variety of viewpoints on the idea of government revenue. Some of these perspectives are Azubike (2009), defined government revenue as money generated from different sources such as oil and non-oil revenue to meet the government's increasing needs of the society to ensure the sustainable economic growth of its society. Onuchukwu, Kalagbor and Nzor (2012), described government revenue as money that plays a vital role in establishing how these funds would be sourcedand how they will as well be expended to actualize economic objectives for development. To Proshare (2016), government revenue is the income generated from various resources that government utilizes for the execution of its obligations. Government revenue comprises many sources. They include revenue from oil and oil-related sources; non-oil sources (including taxation, federation account, and levies); independent revenue; and other sources. According to Kristiana, Pramono, Nathalia and Goelton (2020) government revenue is gotten from taxes, levies, wealth management results, and other valid sources of revenue that are used to run the economy. This study, therefore, defined government revenue as the total amount of money generated from both oil and non-oil revenue such as crude oil, levies, taxes, and other sources of revenue by the government to execute government expenditure.

The theory of John Maynard Keynes, whose classical theory was developed in 1933 at the core of the great depression that hit the western world economies, is one of the theories used in the theoretical literature to explain the notion and impact of government revenue as well as expenditure on the economy.This theory has continued to spark debates among academics and economists. According to the Keynesian theory, the government can affect macroeconomic productivity levels through its fiscal policy by raising or lowering tax rates (Berembo and Igonikon, 2020). It went on to claim that this influence came about because of the factors being changed in a way that lowers inflation, boosts employment, and preserves good value for money. In other words, Keynes thought that if fiscal policy is intervened in, it will result in a countercyclical measure and that when market forces are left to work their course, the economy will stabilize at an equilibrium level of underemployment (Tyagi, 2013).

The central belief here is that public finance and expenditure when adequately combined can help the government achieve the macroeconomic objectives that put it on the path of growth and development. It further suggests that the governments can either increase revenue and expenditure to achieve theireconomic objectives (Onuchukwu, Kalagbor and Nzor, 2012). In other words, if the expenditure is increased, for instance, production and investment activities could be stirred up in the economy thereby making the productive sector active which can be seen in terms of job creation opportunities and income flow. In addition, production will trigger exports and thus increase exports and reduce imports. Similarly, when revenue is increased expenditure should also increase at the same time otherwise a deficit situation could occur and thus putting the actualization of macroeconomic objectives in jeopardy.

In further defense of their position on this matter, Abu and Abdullahi (2010) contend that the Keynesian model predicts that when government spending rises, economic growth also rises and vice versa. To preserve an equilibrium between the effective supply and demand for goods and services, the government must control revenue and spending. The spending that is required to support this degree of economic stability is, however, spending aimed at expanding the productive sector of the economy. Another expenditure that is not focused on achieving these will not have the expected impact on the macroeconomic goals. Having highlighted this theory as it relates to government revenue and economic development, this research however anchors on Keynesian theory as it concurs with the theory of public finance. The underlying principle as it pertains to public expenditure and revenue as this theory posits isto put policies that will enable the government to generate the needed revenue for the nation and then channel these to the economy in such a way that economic growth and development can be attained. This theory is therefore used as an underlying theory to study the impact of government revenue shocks on the macroeconomic variables in Nigeria.

Scholars have shown a significant level of interest in attempting to unravel empirically the impact of government revenue shocks on the macroeconomic environment in Nigeria in recent times. The empirical literature indicates a different trend of findings using different methods. Studies such as Joseph and Omodero (2020) used the Ordinary Least Square (OLS) method, Kim, Wang, Park and Petalcorin (2021) used Structural Vector Autoregression (SVAR), and Etsemitan (2021) used the Johansen Cointegration test and Error Correction Model (ECM) all found a positive relationship between government revenue and macroeconomic variables. While studies such as Adeusi, Uniamikogbo, Erah and Aggreh (2020) used Ordinary Least Square (OLS), and Alami, El-Idrissi, Bousselhami, Raouf and Boujettou (2021) used Structural Vector Autoregression (SVAR) discovered a negative relationship between government revenue and macroeconomic variables. The general observation is that the results have been mixed which might be due to the country investigated (developed or developing country), methodology used, the scopeof the study, and variables used as a proxied. The study uses the Dynamic Stochastic General Equilibriummodel like previous scholars such as (Alege, 2012, Alege, Oye, & Adu, 2019; Oye, 2019).

RESEARCH METHOD

This study looked at how changes in government revenue affected macroeconomic indicators in Nigeria. The study measured this impact using revenue from both oil and non-oil revenues. Five agents make up the study: households, firms, monetary and fiscal authorities, and the rest of the world.

The Households

Bhattarai and Trzeciakiewicz (2017) served as the inspiration for this investigation. A household with an unlimited lifespan, k ∊ [0, 1], makes decisions about how many units of goods to buy and how much labour to put into production to maximize its lifetime utility while staying within its intertemporal budget constraints. It consists of two different types of households, with Ricardian households **∂** making up one of the groups.

Ricardian Household

This set of consumers derive satisfaction at time t from consuming a composite good, C_t relative to habit formation, pulic good G_t and leisure $1 - L_t$. There is neither saving and investment.

$$E_t \sum_{0=t}^{\infty} \beta^t \mathcal{U}\left((C_{R,t} - hC_{R,t-1}), G_t, L_t\right) \quad (3.1)$$

This can be expressed from functional form in expression (3.1) to explicit form as written in expression (3.2). Using the coefficient of relative risk aversion (CRRA):

$$E_t \sum_{t-0}^{\infty} \beta^t \left[\left(\frac{(C_{R,t} - hC_{R,t-1})^{1-\sigma}}{1-\sigma} + \mathrm{m}\frac{G_t^{1-\rho}}{1-\rho} - \frac{L_t^{1-\varphi}}{1+\varphi}\right)\right] \quad (3.2)$$

Where:

E_t: Rational expectation operator

β^t: Intertemporal discount factor

$C_{R,t}$: Composite goods for private consumption

G_t: Public goods consumption

L_t: Number of labour supplied.

h: Coefficient of habit formation

m: Public goods consumption weight

σ: Inverse of elasticity of substitution

φ: Inverse on Frisch elasticity of labour supply

h, σ, m, φ >0;

0<β^t<1

$C_{R,t}$ is a composite good for private consumption that consists of domestic goods C_d and foreign goods C_f implying that the household divides its resources between locally produced and imported items. The Dixit and Stiglitz, (1977) Constant Elasticity of Substitution in equation (3.3) is used to define the Composite goods for private consumption $C_{R,t}$:

$$C_{R,t} \equiv \left[(1-\alpha)^{\frac{1}{\eta}} C_{D,t}^{\frac{\eta-1}{\eta}} + (\alpha)^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}} \tag{3.3}$$

Where:

$C_{R,t}$: Composite good for private consumption which consist of domestic and foreign goods

$C_{D,t}$: Domestic goods consumption index

$C_{F,t}$: Foreign goods consumption index

1-α: Degree of openness

α: Home bias parameter

η: Elasticity of substitution between the domestic and foreign goods

Where C_D, and C_F, are assumed to be (Dixit & Stiglitz, 1977) aggregators of individual consumption goods. They comprise of a continuum of both domestic and foreign goods as written below:

$$C_{D,t} = \left[\int C_{D,t}^{\overset{\varepsilon-1}{(i)}}\, di\right]^{\frac{\varepsilon-1}{\varepsilon}} \tag{3.4}$$

$$C_{F,t} = \left[\int C_{F,t}^{\overset{t-1}{(i)}}\, di\right]^{\frac{\varepsilon-1}{\varepsilon}} \tag{3.5}$$

Equations (3.4) and (3.5), imply that parameter $\varepsilon>1$ is the degree to which different items produced in the domestic economy can be substituted for one another. The household decides how much money to spend on both domestic and foreign goods. To reduce their total spending on both domestic and foreign items, solve equation (3.6):

$$\text{Min } P_t C_{R,t} = P_{D,t} C_{D,t} + P_{F,t} C_{F,t} \quad (3.6)$$

The demand function of both local and foreign goods is subject to equation (3.3):

$$C_{D,t} = (1-\alpha)\left(\frac{P_{D,t}}{P_t}\right)^{-\eta} C_{R,t} \quad (3.7)$$

$$C_{F,t} = (\alpha)\left(\frac{P_{F,t}}{P_t}\right)^{-\eta} C_{R,t} \quad (3.8)$$

Where:

$C_{D,t}$: Consumption of domestic goods index

$C_{F,t}$: Consumption of foreign goods index

$C_{R,t}$: Index of total consumption

$P_{D,t}$: Domestic price index

$P_{F,t}$: Foreign price index

P_t: Index of all consumer prices

The price indices $P_{D,t}$ and $P_{F,t}$ which is the lowest price at which the household can purchase one unit of $C_{D,t}$ and $C_{F,t}$ are written as:

$$C_{D,t} = \left[\int P_{D,t}^{(i)\,\varepsilon-1} di\right]^{\frac{1}{\varepsilon-1}} \quad (3.9)$$

and

$$C_{F,t} = \left[\int P_{F,t}^{(i)\,t-1} di\right]^{\frac{1}{\varepsilon-1}} \quad (3.10)$$

We can get the consumer price index, which measures the overall price level by summing up equations 3.9 and 3.10 respectively as written below:

$$P_t = [(1-\alpha)(P_{D,t})^{1-\eta} + (\alpha)(P_{D,t})^{1-\eta}]^{\frac{1}{1-\eta}} \quad (3.11)$$

The household maximizes utility function in equation (3.2) while being nominally constrained by its budget. The budgetary restriction assumes that the household receives compensation for its supply of labour, $W_t N_t$. They are the business's proprietors, and they get dividends in the form of FV_t. They also receive a lump sum transfer payment from the government TP_t and possess equity in the risk-free financial instrument F_t. The household uses its resources to pay for a portfolio of financial assets F_{t+1} as well as for consumption items $P_t C_{R,t}$. This connection can be expressed as:

$$P_t C_{R,t} + E_t(Q_{t,t+1} D_{t+1}) \leq W_t N_t + D_t + TP_t + FV_t \quad (3.12)$$

Where:

$E_t(Q_{t,t+1} \equiv (\frac{1}{1+i_t})$: stochastic discount factor at a period at a period ahead

i_t: Nominal interest rate

D_{t+1}: Payment at period t+1 for portfolio held at the end of period t

The Lagrangian function, is obtained by combining equation (3.2) and the constraint equation (3.12) to get:

$$\mathcal{L} = \sum_{t-0}^{\infty} \beta^t \left[\left(\frac{(C_{R,t}-hC_{R,t-1})^{1-\sigma}}{1-\sigma} + \text{m}\, \frac{G_t^{1-\rho}}{1-\rho} - \frac{N_t^{1+\varphi}}{1+\varphi}\right)\right] + \lambda_t \beta^t [W_t N_t + D_t + TP_t + FV_t - P_t C_{R,t} - E_t(Q_{t,t+1} D_{t+1})] \quad (3.13)$$

The first-order conditions (FOCs) for consumption, labour supply, and financial instrument are deduced from equation (3.13) above. Taken as the partial derivative of $C_{R,t}$ in equation (3.13), the FOC with respect to consumption is obtained as follows:

$$\frac{\partial \mathcal{L}}{\partial C_{R,t}}: (C_{R,t} - hC_{R,t-1})^{-\sigma} - \lambda_t P_t = 0 \quad (3.14)$$

$$\lambda_t = \frac{(C_{R,t}-hC_{R,t-1})^{-\sigma}}{P_t}$$

At period t+1, we have:

$$\lambda_{t+1} = \frac{(C_{R,t}-hC_{R,t-1})^{-\sigma}}{P_{t+1}}$$

When we split the FOC on consumption at period t+1 by period t, we get the following results:

$$\frac{\lambda_{t+1}}{\lambda_t} = \left(\frac{C_{R,t+1}-hC_{R,t}}{C_{R,t}-hC_{R,t-1}}\right)^{-\sigma} \frac{P_t}{P_{t+1}} \quad (3.15)$$

We use the partial derivative of N_t to calculate the FOC with regard to the financial asset

$$\frac{\partial \mathcal{L}}{\partial N_t}: N_t^{\varphi} + \lambda_t W_t = 0 \quad (3.16)$$

$$\lambda_t = \frac{N_t^{\varphi}}{W_t}$$

As is common, the FOC for a financial asset is determined by taking the partial derivative of D_t. This leads to

$$Q_{t,t+1} = \beta \frac{\lambda_{t+1}}{\lambda_t} \quad (3.17)$$

Substituting equation (3.15) into (3.17) we have:

$$Q_{t,t+1} = \beta \left(\frac{C_{R,t+1}-hC_{R,t}}{C_{R,t}-hC_{R,t-1}}\right)^{-\sigma} \frac{P_t}{P_{t+1}} \quad (3.18)$$

Taking the expectations of equation (3.19) on both sides, we have:

$$E_t Q_{t,t+1} = \beta E_t \left[\left(\frac{C_{R,t+1}-hC_{R,t}}{C_{R,t}-hC_{R,t-1}}\right)^{-\sigma} \frac{P_t}{P_{t+1}}\right] \quad (3.19)$$

Where$E_t Q_{t,t+1} \equiv Q_t = \frac{1}{(R_t)}$ is substituted into equation (3.19) we have:

$$1=\beta R_t E_t \left(\frac{C_{R,t+1}-hC_{R,t}}{C_{R,t}-hC_{R,t-1}}\right)^{-\sigma} \frac{P_t}{P_{t+1}} \quad (3.20)$$

Equation (3.20) represents the consumption over time. One of the two primary optimality criteria for the household sector is represented by this equation, which is the Euler equation. It describes the household's ideal consumption between the present and the future. Equation (3.20) is log-linearized to produce:

$$C_{R,t} - hc_{R,t-1} = (C_{R,t+1} - hC_{R,t}) - \frac{1-h}{\sigma}(r_t - E_t\Pi_{t+1}) \quad (3.21)$$

Where:

$$\Pi_{t+1} = P_{t+1} - P_t$$

By taking the partial derivative of L_t it is possible to establish the First Order Condition (FOC) regarding the labour supply.

$$\lambda_t = \frac{L_t^{\varphi}}{W_t}$$

and

$$\lambda_t = \frac{(C_{R,t}-hC_{R,t-1})^{-\sigma}}{P_t}$$

The marginal rate of substitution between the labour supply and consumption can be obtained by taking the second optimality condition. This will be

$$\frac{L_t^{\varphi}}{W_t} = \frac{(C_{R,t}-hC_{R,t-1})^{-\sigma}}{(1+t)P_t} \quad (3.22)$$

When equation (3.30) is re-arranged, we have:

$$\frac{w_t}{p_t} = (C_{R,t} - hC_{R,t-1})^{\sigma} L_t^{\varphi}(1+\mathrm{r}) \quad (3.23)$$

Equation (3.23) is log-linearized to give the Ricardian home labour supply to the firms as:

$$w_t - p_t = \frac{\sigma}{1-h}(c_{R,t} - hc_{R,t+1}) + \varphi n_t \quad (3.24)$$

Non-Ricardian Household

Under the conditions of the budget constraint expressed in equation (3.25) and specified in equation (3.2), this type of household maximizes the utility function:

$$P_t C_{VR,t} \leq W_t N_{VR,t} + TP_t \quad (3.25)$$

Budget restrictions mean that households only receive wage bills $W_t N_t$ and government transfers TP_t, and they must utilize all of their other incomes to purchase consumables. Due to the non-Ricardian household's lack of ownership of businesses, inability to generate profits, and inability to amass financial assets such bonds from financial institutions, the household's budget is constrained. Equation (3.26) representing the lagrangian function is produced by combining equations (3.2) and (3.25):

$$\mathcal{L} = E_t \sum_{t-0}^{\infty} \beta^t \left[\left(\frac{(C_{R,t}-hC_{R,t-1})^{1-\sigma}}{1-\sigma} + \mathrm{m}\frac{G_t^{1-\rho}}{1-\rho} - \frac{L_t^{1-\varphi}}{1+\varphi}\right)\right] + \lambda_t\beta^t[W_t L_t + TP_t - (1+r)P_t C_t \quad (3.26)$$

In (3.27) to (3.29), the labour supply and λ_t are used to obtain the first order condition (FOC) with respect to consumption, respectively:

$$\frac{\partial \mathcal{L}}{\partial c_t}: \lambda_t = \frac{(C_{VR,t} - hC_{VR,t-1})^{-\sigma}}{(1+t)P_t} \qquad (3.27)$$

$$\frac{\partial \mathcal{L}}{\partial N_t}: \lambda_t = \frac{L_{VR,t}^{\varphi}}{W_t} \qquad (3.28)$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_t}: W_t L_{VR,t} + TP_t - P_t C_{VR,t} = 0 \qquad (3.29)$$

The combination of equation (3.27) and (3.28) which is the first order condition (FOC) of labour supply and consumption will be:

$$\frac{W_t}{P_t} = (C_{VR,t} - hC_{VR,t-1})^{\sigma} L_{VR,t}^{\varphi} \qquad (3.30)$$

When we take log transformation of the budget constraint in equation (3.25) will be given as consumption equation of the non-Ricardian household as:

$$c_{VR,t} = \frac{WL}{PC}(w_t - p_t + l_{VR,t}) + \frac{TP}{PC}(tp_t) \qquad (3.31)$$

The transfer payment from the government to Non-Ricardian Household law of motion is expressed as:

$$TP_t = \rho_{TP} TP_{t-1} + \varepsilon_t^{TP} \qquad (3.32)$$

The above equation (3.31) indicates that the non-Ricardian households are not optimizers, but they equate their consumption spending with their wage income and government transfer payment. The labour schedule for the non-Ricardian households can be obtained by Log-linearinzing equation (3.30) as:

$$w_t - p_t = \frac{\sigma}{1-h}(C_{VR,t} - hC_{VR,t}) + \varphi l_{VR,t} \qquad (3.33)$$

The Firms (The Production Sector)

Several identical monopolistic competitive companies j ϵ [0, 1], that create differentiated commodities using a linear production technology with labour as the only input are said to exist in the home economy, according to Gal & Monacelli (2005):

$$Y(j)_t = A_t N_{t(j)} \qquad (3.34)$$

Where:

A_t: factor productivity overall

N_t: The enterprises' input of labour

Log $A_t \equiv \alpha_t$ is assumed to grow follow AR (1) process such that:

$$\alpha_t = \rho_\alpha \alpha_t + \varepsilon_t^{\alpha}$$

ε_t^{α} represents the economic production technology shock. With a mean of zero and a standard deviation of one, it has a normal distribution is $\sigma_{\varepsilon^\alpha}$ meaning that ε_t^{α} ~N (0, $\sigma^2 \varepsilon^{\alpha}$) the total output produced across all firms is specified below:

$$Y_t = \left[\int_0^1 Y_{t(j)}\, 1 - \frac{1}{\varepsilon}_{dj}\right]^{\frac{\varepsilon}{\varepsilon-1}} \qquad (3.35)$$

Y_t is the total domestic output index, which matches equation's consumption (3.3). In intermediate enterprises, there are two stages to the optimizations. Businesses initially assume that wages paid for labour are granted. They calculate the amount of labour needed to keep costs down. Second, businesses reduce their overall costs while using the linear manufacturing technique as indicated by equation (3.34). The following is stated:

$$\text{Min } C= \frac{w_t}{p_t} N_t + Q\gamma \tag{3.36}$$

Where:

$\frac{W_t}{p_t}$: Real wages that is wages adjusted for inflation.

L_t: Labour input

γ: Fixed cost and Q are the constant where Q = 0

The Lagrangian function is written as:

$$\mathcal{L} = W_t L_t + \lambda_t [Y_{j,t} - A_t L_{j,t}] \tag{3.37}$$

By taking first order condition (FOC) of equation (3.37) with respect to $Y_{j,t}$ *and* L_t we have:

$$\frac{\partial \mathcal{L}}{\partial L_{j,t}}: W_t - \lambda_t [A_t] = 0 \tag{3.38}$$

$$\lambda_t = \frac{W_t}{A_t}$$

$$\frac{\partial \mathcal{L}}{\partial Y_{j,t}}: \lambda_t \tag{3.39}$$

λ_t is the Lagrangian multiplier, that is, it represents the firm's nominal marginal cost of production. This means that:

$$MC_t = \frac{w_t}{\alpha_t} \tag{3.40}$$

Defining the real marginal cost (mc_t) as:

$$MC_t = \frac{W_t}{A_t P_t} \tag{3.41}$$

When we log-linearized equation (3.41) we have:

$$mc_t = w_t - p_t - a_t \tag{3.42}$$

Using the equation's linear production function (3.34), we obtained the amount of labour demanded by each firm as:

$$L_{j.t} = \frac{Y_{j,t}}{A_t} \tag{3.43}$$

The following are the total labour demands made by all enterprises:

$$L_{j,t} = \frac{Y_{j,t}}{A_t} \rightarrow L_t \equiv \int_0^1 L_{j,t} dj = \frac{\int Y_{j,t}}{A_t} dj$$

This means:

$$\mathrm{L_t} = \frac{\mathrm{Y_t}}{\mathrm{A_t}} \tag{3.44}$$

The production relation in equation (3.45) can be obtained by log-linearizing equation (3.44), a non-linear equation, to provide the following values:

$$\mathrm{l_t} = \mathrm{y_t} - \mathrm{a_t} \tag{3.45}$$

Price Setting

Price setting is one of the major concerns of the intermediate enterprises; the enterprises are concerned with setting the optimum price for their goods and consider the fact that price frequently determines profit in the future and to ascertain the best price for their commodities. In this case, the firms use the (Calvo, 1983) price-setting mechanism that is at each period $1 - \theta$ fraction of randomly selected domestic firms' sets their prices optimally at each period, while the other θ fraction keeps their prices unchanged. Let $P_t^*(j)$be the price that firm j picked when resetting its price in period t. $p_{t(j)}^*$ is considered to be the same for all firms because they will choose the same price in every given period, resulting in $p_{t(j)}^* = p_t^*$. Firms set prices, p_t^* by optimizing their nominal discounted profits while keeping demand limitations, so that:

$$\text{Max } E_t \sum_{k=0}^{\infty} (\beta\theta)^k E_{t,t+k} Y_{t+k|t} \left[P_t^* - mc_{t+k|t}\right] \tag{3.46}$$

$$\text{Subject to } Y_{t+k|t} = \left[\frac{P_t^*}{P_{t+k}}\right]^{-\varepsilon} Y_{t+k} \tag{3.47}$$

We have the optimal price equation of the resetting firm for the optimization issue derived from equations (3.46) and (3.47) as follows:

$$P_t^* - P_{t-1} = 1 - \beta\theta \sum_{k=0}^{\infty} (\beta\theta)^k E_t\left[\widehat{mc_{t+k|t}} + P_{t+k} - P_{t+1}\right] \tag{3.48}$$

Where $\left[\widehat{mc_{t+k|t}} = mc_{t+k|t} - mc\right.$

When equation (3.48) is re-arranged to have equation (3.49), it can be written as:

$$P_t^* = \mu + (1 - \beta\theta) \sum_{k=0}^{\infty} (\beta\theta)^k E_t[mc_{t+k|t} + P_{t+k}] \tag{3.49}$$

Where: $\mu = -mc \equiv \log \frac{\varepsilon}{\varepsilon - 1}$

Equation (3.49), according to Galí and Monacelli (2005), suggests that enterprises set their prices based on the anticipated markup over the weighted average of expected marginal cost.

Monetary Authority (Central Bank)

The monetary authority should be your third agent as a point of concentration. It is assumed that the Central Bank adheres to a straightforward Taylor's rule, using interest rates to influence monetary policy. In accordance with this rule, the CBN calculates the interest rate by taking historical interest rate values, inflation, output, and exchange rate variation into account.

$$\frac{R_{t-1}}{R} = \left[\frac{R_{t-1}}{R}\right]^{\rho R} \left[\left(\frac{\pi_t}{\pi}\right)^{\upsilon\pi} \left(\frac{Y_t}{Y}\right)^{\upsilon Y} \left(\frac{Ex_t}{Ex}\right)^{\upsilon Ex}\right]^{1-\rho R} s_{r,t} \tag{3.50}$$

Where:

R_t: Interest rate the Nominal.

R_{t-1}: Interest rate lagged.

π_t: Inflation rate

Y_t: Output

Ex_t: Exchange rate

$s_{r,t}$: Transforming monetary policy.

ρR: Degree of interest rate easing

$\upsilon_\pi, \upsilon_Y, \upsilon_{Ex}$: parameters that gauge how the central bank reacts to changes in output, inflation, and the exchange rate. The target numbers for interest rate, inflation rate, output, and exchange rate are also R, π, Y and Ex. The log-linearisation of equation (3.50) gives:

$$r_t = \rho R r_{t-1} + (1 - \rho R)[\upsilon_\pi \hat{\pi}_t + \upsilon_y \hat{y}_t + \upsilon_{Ex} \Delta Ex_t] + s_{r,t} \quad (3.51)$$

The Fiscal Authority

Fiscal rules, according to the IMF (2021), provide a long-term restriction on fiscal policy by imposing numerical limits on budgetary aggregates. The discretionary policymaker's optimization problem is as follows:

Max $U_t(G_t, RT_t)$

This is dependent on government spending restrictions. To maximize its utility function, the policy problem is to select G_t (government revenue) and RT_t (rent) from one period to the next. As a result, the fiscal policymaker's utility function is defined as follows:

$$\text{Maximise} \sum_{t=0}^{\infty} \frac{G_t^{1-\zeta}}{1-\zeta} + \ln RT_t \quad (3.52)$$

Subject to the nominal budgetary restraint

$$P_t G_t + m\tau_t P_t = \tau_t P_t \quad (3.53)$$

Where:

G_t: Government revenue

RT_t: Rent received.

The amount of rent paid is defined as being based on the likelihood that officials will ask for rent as well as the overall amount of money the government brings in. This is how it is explained:

$$RT_t = m\tau_t \quad (3.54)$$

Where m is the degree of rent seeking, $m < 0 \leq 1$, the degree of rent seeking increases as $m \longrightarrow 0$. τ t is the total government revenue ζ: Institutional Parameter, where $\zeta \rightarrow 1$, the political institution is strong and when $\zeta \rightarrow 0$, there is a weak political institution. Our equation (3.52) is subject to the nominal government budget constraint equation (3.53). (3.53). The restriction shows that both total government revenue from taxes and total government revenue from rentals accrued to the government.

$$P_t G_t + m\tau_t P_t = \tau_t P_t$$

Where:

G_t: Total Government oil revenue

$m\tau_t$: Rent raise.

τ_t: Total government non-oil revenue

P_t: Nominal price

The lagrangian function for the maximization problem from equations (3.52) and (3.53) is such that:

$$\mathcal{L} = \sum_{t=0}^{\infty} \frac{G_t^{1-\zeta}}{1-\zeta} + \ln RT_t + \lambda_t[\tau_t P_t - P_t G_t - m\tau_t p_t] \quad (3.55)$$

In the same way, first order condition (F.O.C.) of equation (3.55) is given as below:

Total Government expenditure: $\frac{\partial \mathcal{L}}{\partial G_t} = 0$: $G_t^{1-\zeta} = -\lambda_t P_t$ (3.56)

Rent: $\frac{\partial \mathcal{L}}{\partial RT_t} = 0$: $\frac{1}{RT_t} = -\lambda_t P_t$ (3.57)

λ_t: $\frac{\partial \mathcal{L}}{\partial \lambda_t} = 0$: $\tau_t P_t = P_t G_t + m\tau_t P_t$ (3.58)

Equations (3.56) and (3.57) are combined to give equation (3.59):

$$G_t^{\zeta} = \frac{1}{RT_t} \quad (3.59)$$

When equation (3.59) is re-arranged it give:

$$G_t^{\zeta} = RT_t \quad (3.60)$$

Equation (3.61) gives:

$$G_t = (m\tau_t)^{\frac{1}{\zeta}} \quad (3.61)$$

As stated in equation (3.61), the level of rent seeking (m), the effectiveness of political institutions (ζ), and the government's revenue (τ_t) all affect the government expenditure policy G_t at a given period t.

When equation (3.61) is log-linearised, it gives:

$$g_t = \frac{1}{\zeta} m\tau_t + s_g \quad (3.62)$$

Rest of the World (ROW)

Several countries make up the world economy. Each economy is supposed to be tiny and open, with little or no effect on the rest of the world.

General Equilibrium

Aggregate Demand: Goods Market Equilibrium and the IS-Curve In order for the domestic economy to meet the requirement of the goods market clearing condition, total output must equal total domestic and international requests (exportations) of locally produced goods. This means that:

$$Y_{t(j)} C_{D,t(j)} + \int_0^1 C_{D,t(j)}^i \, \mathrm{di} + G_t \quad (3.63)$$

$C_{D,t(j)}$: Goods j provided in the domestic economy are in demand domestically.

$C_{D,t(j)}^i$: Demand from foreign country i for goods k made domestically in the economy.

According to Gali (2008) $C_{D,t(j)}$ and $C_{D,t(j)}^{i}$ is defined as:

$$C_{d,t(j)} = \left(\frac{P_{D,t(j)}}{P_{D,t}}\right)^{-\varepsilon} C_{D,t} \text{ where } C_{D,t} = (1-\alpha)\left(\frac{P_{D,t}}{P_t}\right)^{-\eta} C_t \text{ and}$$

$$\int_0^1 C_{D,t}^{i} = \left(\frac{P_{D,t(j)}}{P_{D,t}}\right)^{-\varepsilon} C_{D,t}^{i} \text{ where } C_{D,t}^{i} = (\alpha)\left(\frac{P_{D,t}}{\varepsilon_{i,t}P_{F,t}}\right)^{-\gamma} \left(\frac{P_F^{i}}{P_t^{i}}\right)^{-\eta} C_t^{i}$$

Equation (3.63) is substituted for total domestic output in equation (3.64) to obtain the sum of exports of items made globally and domestically combined.

$$Y_t = \left[\int_0^1 Y_{t(j)} \frac{\varepsilon-1}{\varepsilon} dj\right]^{\frac{\varepsilon}{\varepsilon-1}} = C_{D,t} + \int_0^1 C_{D,t(j)}^{i} di + G_t \quad (3.64)$$

it becomes: $Y_t = (1-\alpha)\left(\frac{P_{D,t}}{P_t}\right)^{-\eta} C_t + \alpha \int_0^1 \left(\frac{P_{D,t}}{\varepsilon_{i,t}P_{F,t}}\right)^{-\gamma} \left(\frac{P_{F,t}^{i}}{P_t^{i}}\right)^{-\eta} C_t^{i} di + G_t$

$$= \left(\frac{P_{D,t}}{P_t}\right)^{-\eta} \left[(1-\alpha)C_t + \alpha \int_0^1 \left(\frac{\varepsilon_{i,t}P_{F,t}}{P_{D,t}}\right)^{\gamma-\eta} Q_{i,t}^{\eta} C_t^{i} di\right] + G_t \quad (3.65)$$

$$Y_t = \left(\frac{P_{D,t}}{P_t}\right)^{-\eta} \left[(1-\alpha)C_t + \alpha \int_0^1 (Z_t^{i} Z_{i,t})^{\gamma-\eta} Q_{i,t}^{\eta\frac{1}{\sigma}}\right] + G_t \quad (3.66)$$

Log-linearising equation (3.66) we have:

$$y_t = c_t + \alpha\gamma z_t + \alpha\left(\eta - \frac{1}{\sigma}\right) q_t \quad (3.67)$$

Equation (3.67) can be written as:

$$y_t = c_t + \frac{a\omega}{\sigma} z_t + g_t \quad (3.68)$$

Where ω is defined as: $\omega = \sigma\gamma + (1-\alpha)(\sigma\eta - 1)$

The following is the state of the rest of the world's goods markets clearing:

$$y^{*} = c^{*} \quad (3.69)$$

$y^{*} = c^{*}$ are indices for world output (production) and consumption

Where:

$$y_t^{*} = \int y_t^{i} \, di$$

$$c_t^{*} = \int c_t^{i} \, \text{di}$$

Gal, (2002) asserts that the equation (3.68) of the goods market clearing condition combined with the consumption Euler equation yields the Open Economy IS Curve (3.21).

$$y_t - \frac{a\omega}{\sigma} z_t = E_t\left(y_{t+1} - \frac{a\omega}{\sigma} z_{t+1}\right) - \frac{1-h}{\sigma}(\text{i}-E_t\Pi_{t+1} - \rho)$$

$$y_t = E_t y_{t+1} - \frac{1-h}{\sigma}(\text{i}-E_t\Pi_{t+1} - \rho) - \frac{a\omega}{\sigma} E_t \Delta z_{t+1}$$

$$= E_t y_{t+1} - \frac{1-h}{\sigma}(\text{i} - E_t(\Pi_{D,t+1} + \alpha\Delta Z_{t+1}) - \rho) - \frac{\alpha\omega}{\sigma} E_t \Delta Z_{t+1}$$

$$= E_t y_{t+1} - \frac{1-h}{\sigma}(\text{i} - E_t \Pi_{D,t+1} - \rho) - \frac{\alpha(\omega-1)}{\sigma} E_t \Delta Z_{t+1} \quad (3.70)$$

Where $\Theta = (\omega - 1)$

When we insert $y_t = y_t^* + \frac{1}{\sigma\alpha} Z_t$ into equation (3.70) to get open economy IS curve

$$y_t = E_t y_{t+1} - \frac{1-h}{\sigma\alpha}(\text{i} - E_t \Pi_{D\ t+1} - \rho) - \alpha\Theta E_t(\Delta y_{t+1}^*) \quad (3.71)$$

The assumption of flexible prices is considered in equation (3.71) as:

$$y_t^l = E_t y_{t+1}^l - \frac{1-h}{\sigma\alpha}(r_t^l - \rho) - \alpha\Theta E_t(\Delta y_{t+1}^*) \quad (3.72)$$

Subtract equation (3.72) from (3.71) to obtain the dynamic IS curve:

$$\tilde{y}_t = E_t \tilde{y}_{t+1} + \frac{1-h}{\sigma\alpha}(\text{i} - E_t \Pi_{D,t+1} - r_t^l)$$

Exogenous Shock Processes

This study considers six exogenous shock sources, including output, interest rates, rent seeking, government non-oil revenue, government oil revenue, and technology. The exogenous shocks processes' equations can be written as:

Technology: $\alpha_t = \rho_\alpha \alpha_t + \varepsilon_t^\alpha$ (3.73)

Government Oil Revenue: $r_t^{or} = \rho_{or} ror_{t-1} + \varepsilon_t^{or}$ (3.74)

Government Non-oil Revenue: $z_t^{nor} = \rho_{nor} znor_{t-1} + \varepsilon_t^{nor}$ (3.75)

Interest rate: $s_t^r = \rho_r sr_{t-1} + \varepsilon_t^r$ (3.76)

Output: $z_t^y = \rho_y zy_{t-1} + \varepsilon_t^y$ (3.77)

Rent Seeking: $rt_t = \rho_{rt} rt_t + \varepsilon_t^{rt}$ (3.78)

Where: $\varepsilon_t^j \sim$ iiL $(0, \sigma_I^2)$

j $= \alpha$, or, nor, r, y, rt, y,

Estimation Technique

The New Keynesian school developed the macroeconomic modeling now known as the Dynamic Stochastic General Equilibrium model. The underlying assumptions of the DSGE are the microeconomic foundation, imperfect competition, price rigidity, non-neutrality of money and issue of uncertainties. The study works under the assumption of a Small Open Economy. That is involving in international trade, but the economy is small enough that it cannot influence world price, interest rate and income.

The study consists of five optimizing economic agents such as households, firms, monetary authority, fiscal authority, and the rest of the world. The system of equations that was estimated were derived from: The result of decentralized optimization of each of the agents in the economy, the market clearing condition and the shock processes. After obtaining them, this constitutes a system of equations that was estimated. It is anticipated that this set of equations will only have one solution. This requires that the number of equations and the number of endogenous variables must be the same. The Blanchard-Khan condition is the name given to this situation. This study satisfies this, too. Three steps are involved in the Small Open Economy NK Model's solution: log-linearizing the model, resolving the system of linear difference equations that results from the model, and finally using the Bayesian simulation method. The DSGE model was simulated using Dynare 4.6.4 in a Matlab R2021a environment to provide the desired results. This study used quarterly data spanning the years 1981Q2 through 2020Q1. The data was obtained from the Central Bank of Nigeria Statistical Bulletin (2020) and World Development Indicators (2020).

RESULTS AND DISCUSSION

The results of this study were achieved using Dynare 4.6.4 in a Matlab R2021a environment. The study investigated the impact of government oil and non-oil revenue shocks on economic growth in Nigeria.

Impulse Response Analysis

The Impulse Response Functions gauges how endogenous variables respond to standard deviation-sized shocks. In this study, the effects of fiscal policy (government oil revenue and government non-oil revenue), monetary policy, and output were examined.

Shocks

The impulse Response function shows that a positive government oil revenue shock reacted positively on output and interest rate from quarter1 which later converge around a state steady in 20. This means that government oil revenue has a positive relationship with output and interest rate. The findings are like that of Joseph and Omodero (2020), Kim, Wang, Park and Petalcorin (2021) and Etsemitan (2021) who found a positive relationship between government revenue and macroeconomic variables. These findings suggest that rising government oil revenues will have a favorable effect on macroeconomic indicators like the gross domestic product and interest rates. Although good, Nigeria's government's non-oil earnings had a detrimental impact on both output and interest rates. Similar results have been found by Adeusi, Uniamikogbo, Erah, and Aggreh (2020) and Alami, El-Idrissi, Bousselhami, Raouf, and Boujettou (2021). This indicates that when the government raises non-oil revenue, such taxes, it will negatively affect macroeconomic factors in Nigeria.

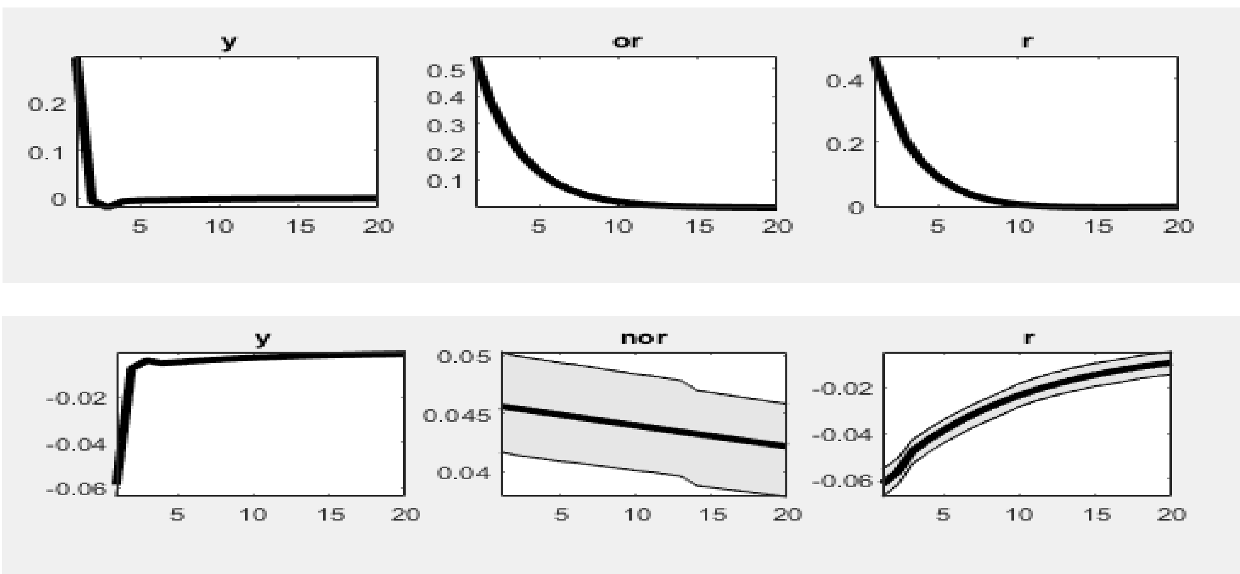

Figure 1: Impulse Response Function

One Step Ahead Forecast

The purpose of this forecast is to predict what will happen after shocks by taking into consideration events in the past and present events. From figure 2, it can be deduced from the observed variables in the model that on the long run, output, oil revenue and non-oil revenue are expected to increase, while interest rate is expected to have a cyclical trend (increase and decrease) all from quarter 1 to 50, 100 and 150 as shown in figure 2:

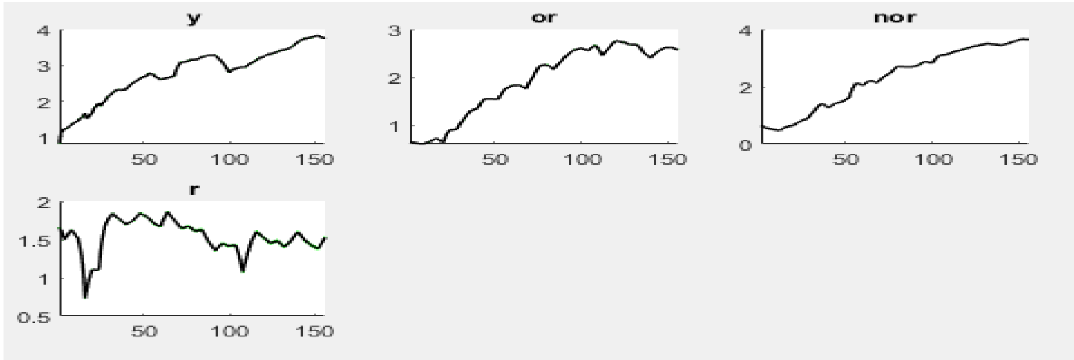

Figure 2: One step ahead forecast

Smoothed Shocks

The smoothed estimated shocks plot is predicted to be centered at zero. Some of the smoothed shock processes are centered around zero, as shown in Figure 3. Thus, this suggests that the statistics in the estimated model are reliable.

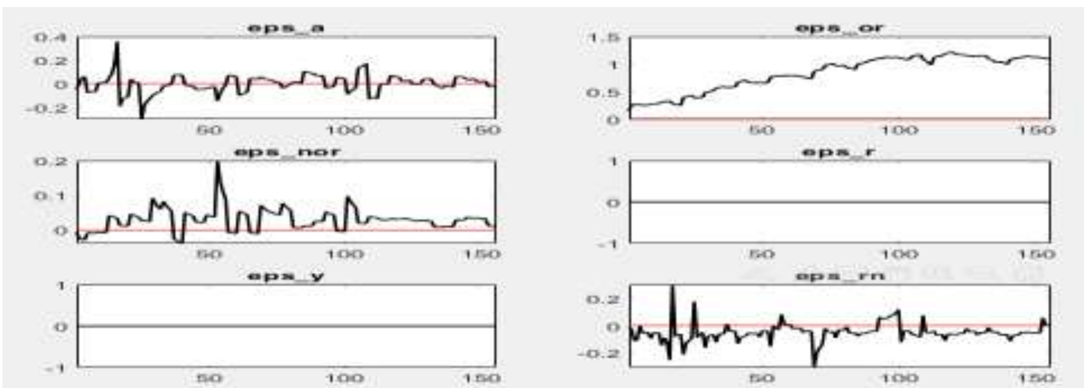

Figure 3: Smoothed Shocks

Fiscal Policy and Macroeconomic Variables in Nigeria

To do this, numerical simulations are run on the equation system using the first-order Taylor's approximation method. The numerical simulations are performed using the Dynare software in a Matlab environment. A matrix of exogenous shock covariance, theoretical moments result, and variance decomposition result are some of the outputs from Dynare software in a Matlab environment.

Table 1 demonstrates the covariance matrix of exogenous shocks. This demonstrates that there are no serial relationships between the shocks.

Table 1: Matrix of Covariance of Exogenous Shocks

Variables	Eps_a	Eps_or	Eps_nor	Eps_r	Eps_y
Eps_a	0.010000				
Eps_or	0.000000	0.010000			
Eps_nor	0.000000	0.000000	0.010000		
Eps_r	0.000000	0.000000	0.000000	0.010000	
Eps_y	0.000000	0.000000	0.000000	0.000000	0.010000

Source: Researcher's Computation using Dynare 4.6.4 and MATLAB

Tables 2 explain the theoretical moments and the autocorrelation factor. To examine the outcomes of the numerical simulations, certain statistics are required.

Table 2: Theoretical Moments (HP filter, lambda = 1600)

Variables	Mean	Standard Deviation	Variance
Output (y)	0.0000	0.1111	0.0123
Government Oil Revenue	0.0000	0.1136	0.0129
Government Non-oil Revenue	0.0000	0.1136	0.0129
Interest Rate	0.0000	0.1919	0.0368

Source: Researcher's Computation using Dynare 4.6.4 and MATLAB

The variance decomposition result presented in table 3 shows the e proportional impact of each shock on changes in an endogenous variable It helps determine how significant a shock is as a cause of volatility for a macroeconomic variable.

Table 3: Variance Decomposition (in percent) (HP filter, lambda = 1600)

Variables	Output (y)	Government Oil Revenue (or)	Government Non-oil Revenue (nor)	Interest Rate (r)
Output Shocks	100.00	0.00	0.00	0.00
Government Oil Revenue Shocks	0.00	100.00	0.00	0.00
Government Non-oil Revenue Shocks	0.00	0.00	100.00	0.00
Interest Rate Shocks	0.00	0.00	0.00	100.00

Source: Researcher's Computation using Dynare 4.6.4 and MATLAB

CONCLUSIONS AND RECOMMENDATIONS

Governments all around the world, particularly those in developing nations, work to attain full employment, stable prices, and equilibrium in the balance of payments. This is to guarantee that certain nations will always be significant and influential in world economic affairs. This has led governments to routinely use certain macroeconomic policies in recent years, specifically fiscal and monetary policies, with the express purpose of assuring quick, sustained economic growth. Fiscal policy employing money from the government is one such weapon used to accomplish the macroeconomic goal. The study focused on the impact of government oil and non-oil revenue shocks on economic growth in Nigeria and examined the effects of government revenue shocks on the macroeconomic environment in Nigeria. The DSGE model was employed in the study. This model contains five optimal agents: households, producers, the Central Bank, the government, and the rest of the world. This model includes characteristics that are relevant to the Nigerian economy, including Ricardian and Non-Ricardian households, price rigidity, uncertainty, high-interest interest rates, increases in government spending and public debt, decreases in government revenue, and unstable balance of payment.

The study used quarterly data from the Central Bank of Nigeria Statistical Bulletin (2020) and World Development Indicators, which covered the period from 1981's second quarter to 2020's first quarter (2020). 156 observations altogether in the model. The GDP growth rate (output), government oil revenue, government non-oil revenue, and interest rate were the variables used in this study. The study found out that the impulse response function result indicates a positive government oil revenue relationship with output and interest rate from quarter 1 to quarter 20. While government non-oil revenue reacted negatively to output and interest rate in Nigeria. This means that increase in taxation to generate more revenue have a negative transmission effect on macroeconomic variables in Nigeria. The study therefore suggested that the government increase the level of economic diversification of the nation, delink government revenues from oil and gas revenues, and focus more on non-oil revenue by investing in infrastructure that is essential to the development of the private sector, establishing rules and regulations that will promote a strong and vibrant private sector, and supervising the conversion of oil wealth into financial investments whose monetary value will increase over time.

The study further revealed that because taxes are one of a nation's primary sources of revenue, they frequently fall short and have unfavourable effects. Increasing tax rates logically results in higher tax burdens for individuals and businesses. As a result, the purchase power parity will shrink, inflation will rise, production will fall, and government revenue will subsequently reduce. Instead of setting a tax ceiling, it would be better to promote domestic industry to broaden the tax base and help the country become self-sufficient and independent. For stronger economic growth, the nation must also make greater efforts to implement its economic diversification strategy and support various industries other than the oil industry, including tourism, agriculture, FDI, and entrepreneurship.

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Conflict of Interest

The authors state no conflict of interest exists.

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