Estimation of Fiscal Multipliers and Its Macroeconomic Impact: The Case of Nigeria

*Penzin, D. J. and Adamgbe, E. T.**

Abstract

Fiscal multipliers are important tools for macroeconomic projections and policy design. However, very little is known about the size in developing countries, given the complexity of their estimation. The unavailability of reliable high frequency data and structural characteristics of these countries also make the estimation of fiscal multipliers difficult, in such countries. This paper estimated fiscal multipliers associated with government spending and tax-related revenue for Nigeria using quarterly data, spanning 1985: Q1 to 2015Q4. The structural vector autoregression (SVAR) methodology suggested by Blanchard and Perotti (2002) was utilised in the model. The SVAR framework applied followed the approach by Favero and Giavazzi (2007) to augment for a feedback mechanism, arising from the level of debt, especially given Nigeria's rising debt level. The results showed that government spending multiplier for Nigeria was high, at 0.47 on impact and at 0.35 within a quarter. Similarly, the tax revenue multiplier was equally high at 0.67 on impact and 0.33 within a quarter. This result suggested that reform programmes, aimed at rejuvenating the economy should consider the impact of these multipliers in assessing expenditure requirements and tax plans that would achieve government objectives over the programme period.

Keywords: Fiscal Multipliers, Government Spending, Tax, Structural Vector Autoregression
JEL Classification: E24, E32, E62, H20, H50, H68

I. Introduction

Recent literature have shown rapid interest in the estimation of fiscal multipliers in the post-global financial crisis (Spilimbergo, et al., 2009; Batini, et al., 2014). These arose because of the absence of robust monetary and fiscal policies to deal with economic fluctuations during the crisis. Against this backdrop, accurate estimation of fiscal multipliers can provide useful insight on the setting of achievable fiscal targets that are consistent with an effective monetary policy regime.

Notwithstanding the country-wide empirical literature on fiscal multipliers, the debate still lingers on their sizes and macroeconomic effects in a resource-rich small open economy. Some studies acknowledged that the size of fiscal multipliers tended to be larger in relatively closed economies and those

* *The authors are staff of the Research Department, Central Bank of Nigeria. The usual disclaimer applies.*

operating fixed exchange rate regimes. Batini, et al. (2014) and Spilimbergo, et al., (2009) associated the size of multipliers to structural characteristics, such as: labour market rigidities which magnify the response of output to demand shocks; economies with a lower propensity to consume, which tend to have higher fiscal multipliers as the 'leakage' is less conspicuous. Other country-specific factors, such as leakages, monetary policy response to fiscal shocks and sustainable fiscal condition post-stimulus actions, have also been responsible for why fiscal multipliers differ in size (Spilimbergo et al., 2009). However, as in Barrell, et al., (2012), multipliers are shown to be usually smaller in relatively more open economies, because the fiscal shocks will spillover to other countries via imports.

It is established in the literature that fiscal multipliers differ across countries, due largely to the dissimilarities in the structure of economies and intra-country conditions, due to fiscal policy orientation, agents' expectation, sequencing and timing (Barrel et al., 2012; Whalen and Reichling, 2015). The size of the multipliers can also be influenced by slack in the economy, the sophistication of the financial system, and the conduct of monetary policy (Chinn, 2013). Also, the impact on output can be lowered by large automatic stabilisers (such as transfers, taxes, and other fiscal stimulus). Ilzetzki, et al. (2013) also observe that economies operating fixed exchange rate regimes have long-run multipliers larger than one, while those with flexible exchange rate regimes have negative multipliers both on impact and the long-run. Another structural problem, as Karagyozova-Markova, et al. (2013) opined, is that excessively high or rapidly-increasing government debt levels, which could negatively impact on the efficacy of fiscal policy in increasing output. Spilimbergo, et al. (2009) further opined that negative fiscal multipliers could be observed, when fiscal expansions were contractionary[1].

The size of fiscal multipliers is also shown to have strong correlation with the business cycles (Baum et al., 2012; Auerbach and Gorodnichenko, 2010; Delong and Summers, 2012; Batini et al., 2014). During expansions when the economy is operating at full employment, the effect of a fiscal stimulus is less pronounced (implying lower fiscal multipliers). On the contrary, during recessions, when the economy is operating below full employment, multipliers are higher. At such periods, an expansionary fiscal policy would have a greater impact, as increases in demand will be met by increases in supply of goods, and also increases in employment of labour to produce those goods.

[1] If they decrease consumers' and investors' confidence, especially if the fiscal expansion raises, or reinforces concerns for fiscal sustainability.

Despite the plethora of studies on fiscal multipliers in advanced economies, they appear seemingly unpopular in developing countries, given the complexity of their estimation. Separating the direct effect of fiscal measures on output, because of the bi-causality between the two variables, remains a fundamental challenge (Batini, et. al., 2014). The structural characteristic of economies, which is difficult to capture, also comes into play. It is also not very clear whether the expenditure patterns in those economies influenced largely the multiplier sizes. Again, the unavailability of reliable high frequency data, which has been widely accepted as a requirement for structural model estimation, apparently constrains the identification scheme.

Taking into consideration the peculiarities of the Nigerian economy, such as oil-dependency and the weak nature of tax related revenue, this study, therefore, would determine the size of the fiscal shock multipliers and assess their impact on some macroeconomic indicators. This is against the backdrop that despite the weakened fiscal space, anecdotal evidence portrays fiscal surprises in Nigeria as limiting the effectiveness of monetary policy.

This paper seeks to advance our knowledge on fiscal multipliers in frontier economies, by examining the case for Nigeria. The investigation asks two questions: What is the size of the fiscal multiplier associated with government spending and tax-related revenue shocks? What could be the impact on output, inflation and interest rates? The case for Nigeria is important in several ways: fiscal policy remains a major tool for macroeconomic management, given strong structural rigidities; the fiscal dominance, associated with the relatively large central government may constrain the effectiveness of monetary policy; and the post-global financial crisis reliance on fiscal policy buttresses the need for a better understanding of the impact of the fiscal multipliers on the economy. Consequently, the objective of this paper is to determine the size of the fiscal shock multipliers and assess the impact on output, interest rates and inflation.

The paper was structured into five Sections, following this introduction in Section 1; Section 2 reviewed the theoretical and empirical literature on fiscal multipliers. In Section 3, the methodology, including the model specifications and the estimation techniques were provided. The analysis of empirical results was presented in Section 4. Section 5 contained the policy recommendations and concluding remarks.

II. Literature Review

II.1 Theoretical Issues

The Keynesian theory echoes the argument that government spending would, most likely, have greater expansionary impact in periods of recession than expansion. Thus, they advocate government deficit spending, especially during periods of recession, anchoring their arguments on the fact that during such periods, the beneficial multiplier effects of increased spending far outweigh the fears of crowding out. On the contrary, during periods of expansions, deficit spending would not be required, since the economy would experience a partial crowding out, if there were slack in the economy, with practically no crowding out in periods of recession. This is because savings and investment decisions do not depend only on the rate of interest, but largely on expectations of future profit. The expectations of future profit are usually calculated by businesses on the basis of a number of factors, including the state of mind or emotional psychology of investors. Also, when there is slack in the economy and government spending has positive multiplier effects, the total impact of spending could outweigh losses in investment arising from higher rates of interest. This implies a "crowd in" of the deficit spending could result in increase in output with positive effects on investment, due to profit expectations.

In addition, increasing the budget deficit by a certain amount is expected to cause output to increase by the inverse of the marginal propensity to save. With the spending multiplier increasing output, the effective money supply would also increase because businesses would borrow. When both money supply and income increase, the effects of crowding out would be eliminated because the banking system has created a new supply of money to fund the increased demand for borrowing (Perry, 2014).

II.2 Empirical Literature

Several studies have been conducted on fiscal multipliers, particularly in developed economies. Blanchard and Perotti (2002) studied the effects of shocks in government spending and taxes on economic activity during the post-war period in the United States. Employing a mixed event study/Structural VAR (SVAR) approach, the results consistently showed that positive government expenditure shocks had a positive effect on output, while positive tax shocks had negative effects. While investigating the effects of taxes and spending on the components of GDP, it was observed that both increase in government spending and taxes had significant negative effect on investment spending.

Perotti (2005) used a VAR approach for the OECD countries and observed the following: the effects of fiscal policy on output appear small; there was no indication that tax cuts were more effective than increases in spending; the impact of tax cuts and government spending shocks on output became significantly weaker, over time.

Borg (2014) employed an SVAR approach similar to Blanchard and Perotti (2002) for Malta. Using quarterly data over the period 1995 to 2012, the findings revealed that positive shocks to government expenditure had an expansionary impact on GDP and private consumption, but contractionary effect on private investment. The impact of spending multipliers were low and less than unity, but cumulative multipliers for GDP exceeded one, after about two years. Furthermore, positive shocks to net taxes resulted in statistically significant negative effects on GDP, private consumption, and private investment. However, both impact and cumulative multipliers generated from net-tax shocks were below unity and lower than government expenditure multipliers. The study also found that the composition of government spending matters in the short- and medium-term. Furthermore, government consumption generated higher impact multipliers than government investment, while government investment generated larger medium-term multipliers.

Mendoza et al. (2009) estimated a VAR model, using the cyclical components of GDP and government consumption. They used quarterly data for 25 developing/emerging and 20 high-income countries from 1960:1 to 2007:4. The results revealed the following: in developing countries, the response of output to public spending increase was smaller and less persistent, compared with high income countries; multipliers were weaker in countries with fixed exchange rate regimes (economies operating fixed exchange rate regimes had long-run multipliers of about 1.5, while those with flexible regimes had basically zero multipliers); relatively closed economies had long-run multipliers of about 1.6, while relatively open economies had negligible or zero multipliers; and multipliers are less persistent and short-lived in highly-indebted economies.

Baum et al., (2012) analysing the G7 economies (excluding Italy), observed differences in fiscal multipliers among the countries. They also noted that fiscal policy could affect output, depending on the situation of the business cycle. Specifically, government expenditure and revenue multipliers were larger in periods of recession. For Germany, Japan, and the United States, where spending multipliers were sizeable and statistically significant, spending shocks had larger effects on output during periods when the output gap was negative.

However, in the UK, multipliers were small, notwithstanding the output gap. For revenue multipliers, the results were less-conclusive.

Batini et al., (2012) used regime-switching VARs for the US, Japan and euro area and observed that fiscal consolidation was significantly more contractionary, if undertaken during periods of recession than expansion. For consolidations, first-year cumulative multipliers during recession ranged between 1.6 and 2.6, for spending shocks; but for tax shocks, it ranged between 0.2 and 0.4. For expansions, it ranged from 0.3 to 1.6 for spending shocks, and for tax shocks, -0.3 to 0.2. Similar sizes were observed for second-year cumulative multipliers and first-year multipliers, suggesting that a larger part of the effects of fiscal shocks on output occurred within 4 quarters.

Karagyozova-Markova et al., (2013) comparing the estimates of a linear VAR model and Bayesian VAR model for Bulgaria, observed similar results from both models. The estimates showed that first-year spending multipliers never exceeded 0.4, suggesting that demand stimulating fiscal policy had no positive impact on output.

Mançellari (2011) employed the SVAR model for Albania, discriminating between two types of fiscal policy - a tax decrease and an expenditure stimulus. They observed that tax cuts had the highest cumulative GDP multiplier, attaining 1.65 after five quarters. Analysing recurrent and capital spending, the multiplier of capital spending was 0.95, after the first quarter, which was higher than the multiplier for recurrent spending.

Benčík (2014) assessed the effects of fiscal policy in the V4 countries (Hungary, Slovakia, Poland and the Czech Republic), by employing a smooth transition VAR (STVAR) model. The estimates revealed the existence of two diverse regimes, associated with both periods, resulting to different impulse-response functions. In periods of expansion, multipliers peaked below one and diminished to zero. However, during recession, they grew faster and remained above unity.

Odugwe (2014) using annual data spanning the period 1961-2012 and an identified four-variable baseline VAR model, estimated a government spending multiplier for Nigeria. The empirical results showed that output responded by approximately 0.4 per cent to a 1.0 per cent positive shocks to government spending (a multiplier of about ₦4 for every ₦1 increase in government spending).

Auerbach and Gorodnichenko (2010) used regime-switching models to estimate the effects of spending and tax policies over the business cycle. Large differences were found in the size of multipliers in periods of recession and expansion. Fiscal policy was observed to be more effective in recession than expansion. A disaggregated analysis showed that military spending had the largest multiplier. The results revealed that controlling for the components of fiscal shocks that are predictable increased the size of the multipliers. In a related study, Auerbach and Gorodnichenko (2012; 2015) also used the STVAR model for OECD countries. During expansion, multipliers were found to be 0.5, and negative in the long-run. During the period of recession, however, they peaked at 2.5 and in the long-run, flattened at 2.3.

Arin et al., (2015) using a regime-switching framework for the US and quarterly data from 1949 to 2006, found that the size of spending multipliers was larger during recession, but the size of tax multipliers was larger during the period of expansion. The size of the effect of fiscal shocks on investment and consumption was quite negligible.

Ambriško et al. (2015) employing a DSGE model, estimated the size of fiscal multipliers for the Czech Republic and found that government investment had the highest multiplier (with first-year multiplier 0.4), while spending had only 0.2. Furthermore, multipliers for the V4 countries were lower, probably due to the convergence process, as well as, the demand and supply shocks that increased the noise in the business cycle. Also, using the SVAR for India, Bose and Bhanumurthy (2015) found that capital expenditure, transfer payments and other revenue expenditure multipliers were 2.45, 0.98, and 0.99, respectively. However, the tax multipliers were about -1.0.

From the foregoing, it is evident that the empirical literature on the size of fiscal multipliers is mixed. It is not very clear whether the expenditure patterns, in those economies, influenced largely the multiplier sizes. Also, there is an extreme dearth of studies for developing countries, with high debt stock and small open economies, such as Nigeria. Taking into consideration the peculiarities of the Nigerian economy, such as oil dependency and the weak nature of tax-related revenue, this study, therefore, would determine the size of the fiscal shock multipliers and assess the impact on output, interest rates and inflation. This is against the backdrop that despite the weakened fiscal space, anecdotal evidence portray fiscal surprises as limiting the desired outcomes of monetary policy.

III. Methodology

III.1 Data and Estimation

To examine the time series properties, the Augmented Dickey Fuller (ADF) and Philips-Perron tests were deployed. The results showed that, except for inflation (dlpy), the rest of the variables, log of real per capita government spending (lrpcgs), log of real per capita taxes (lrpctax), log of real per capita gross domestic product (lrpcgdp) and log of the treasury bill rate (ltbr) contain unit root at 5 per cent level of significance.

According to Sims et al., (1990), the aim for conducting a VAR analysis is to bring out the interactions among the variables and not really to evaluate the parameter estimates. An application of the Sims type VAR was found in the fiscal VAR model of Mountford and Uhlig (2009). Blanchard and Perotti (2002) specified a two-trend fiscal VAR that included deterministic time and stochastic trends. The former specification included time and time squared as additional regressors on the logarithms of per capita net tax, government spending and GDP, while the latter specification was estimated with the first differences. This second application could lead to loss of information, if co-integrating relationship exists among the variables, leading to misspecification problems (Enders, 2004).

The presence of unit roots, as reported in Table 1, gave the plausibility of co-integration among the variables. First, government expenditure and tax revenues were examined for the presence of co-integration, using Johansen's approach. However, there was no evidence of such relationship between expenditures and revenues. In the five variable case, using the same procedure, revealed only a single co-integrating relationship. Thus, rather than estimate the initial VAR in first difference, inclusion of the deterministic time trend and intercept, was preferred to treat all common trends and drift in the time series. Except for the GDP deflator that was a quarterly per cent change, all other data were in natural logarithm, real and per capita terms. The VAR was estimated with a lag length of 1, as the 5 recommended most information criteria failed the stability test.

Table 1: Results of Unit Root Test Statistics Showing the Order of Integration

Variables	Augmented Dickey-Fuller		Order of Integration	Phillips-Perron		Order of Integration
	Test Statistic	Critical Value		Test Statistic	Critical Value	
lrpcgs	-9.6572	-3.4851***	*I(1)*	-11.3968	-3.4847***	*I(1)*
lrpctax	-10.0820	-3.4851***	*I(1)*	-11.6448	-3.4847***	*I(1)*
lrpcgdp	-3.1634	-2.8863**	*I (1)*	-17.2023	-3.4847***	*I (1)*
dlpy	-4.0910	-3.4861***	*I (0)*	-11.9743	-3.4847***	*I (0)*
Tbr	-9.9052	-3.4847***	*I (1)*	-10.0091	-3.4847***	*I (1)*

Note: *** and ** denoted level of significance at 1% and 5 %, respectively

III.2 The Model

There are various methods of estimating fiscal multipliers. In general, however, the major approaches used include: structural econometrics; vector auto-regressions (VARs); dynamic stochastic general equilibrium (DSGE); and macroeconometric forecasting models.

Structural econometrics is perhaps the earliest approach to calculating multipliers. It involves estimating behavioural equations in an economy. This method relies heavily on the estimates of the consumption function, particularly as the multiplier depends a lot on the marginal propensity to consume. According to Chinn (2013), it has been closely linked with the Cowles Commission approach to econometrics, where models are estimated with simultaneous equations, usually based on a priori economic theory so as to capture the size of multipliers. The structural econometric approach has been highly criticised by a number of economists. For example, Sims (1980) argued that the approach was cumbersome as it required "incredible" identifying assumptions.

Vector auto-regressions (VARs) models are also commonly used as they provide a suitable alternative to the structural econometric approach, as they typically employ relatively fewer equations. VARs are based on historical data and do not require specification of a large number of behavioral relationships, making them easy to implement. Batini, et al. (2014) give support to the use of VAR models in estimating fiscal multipliers, because the usual variables of interest (revenue, spending and output) are interrelated with multiple causal relationships. However, isolating exogenous shocks becomes a major challenge. Thus, structural VAR models (SVAR), which employ certain identifying

assumptions to extract structural shocks, are more reliable in estimating fiscal multipliers.

DSGE models have also been widely used to calibrate fiscal multipliers, as they have the ability to describe the behaviour of the economy in totality, as opposed to VAR models, which analyse the interactions of only a few variables. DSGE models also require less historical data, thus, they can be very useful in analysing the impact of variations in fiscal policies, which have not been previously observed. Notwithstanding, the DSGE models also pose some challenges.

Unlike the DSGE model, macroeconomic forecasting models rely on historical relationships between variables, as well as by theories of how such variables are determined. The reliability of macroeconometric forecasts depends a lot on the validity of the economic assumptions, employed. Thus, estimates forecasted by such models may not be reliable when policies and/or economic conditions change.

This paper uses an SVAR suggested by Blanchard and Perotti (2002), as applied in Parkyn and Vehbi (2013) and Jain and Kumar (2013). The SVAR framework applied, in this paper, follows the approach by Favero and Giavazzi (2007) to augment for a feedback mechanism, arising from the level of debt, especially given Nigeria's rising debt stock. Thus, taxes, spending and interest rates (non-policy shocks) are permitted to react to the time-varying dynamics of debt, as captured by the policy shocks (tax and government expenditure). Not doing this, Pagan et al. (2008) show that the SVAR fails to be invertible. As in Parkyn and Vehbi (2013), we do not include the debt-to-GDP in the structural identification of the VAR and would remain deterministic in way so that the debt process can be derived outside the model. An inclusion of the indicator endogenously has been found to produce an explosive debt sustainability path.

Consequently, the five variable SVAR model is specified to examine the responses of key macro-variables, inflation, interest rate and output to changes in fiscal variables, i.e. revenue and expenditure.

Expressing the identification scheme, as an AB model, such that:

$$A\mu_t = B\varepsilon_t \tag{1}$$

we can set out the matrix representation as:

$$\begin{bmatrix} 1 & 0 & -\alpha_{govy} & -\alpha_{gov\pi} & -\alpha_{govR} \\ 0 & 1 & -\alpha_{taxy} & -\alpha_{tax\pi} & -\alpha_{taxR} \\ -\alpha_{31} & -\alpha_{32} & 1 & 0 & 0 \\ -\alpha_{41} & -\alpha_{42} & -\alpha_{43} & 1 & 0 \\ -\alpha_{51} & -\alpha_{52} & -\alpha_{53} & -\alpha_{54} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{gov} \\ \mu_t^{tax} \\ \mu_t^{y} \\ \mu_t^{\pi} \\ \mu_t^{R} \end{bmatrix} = \begin{bmatrix} \beta_{11} & \beta_{12} & 0 & 0 & 0 \\ \beta_{21} & \beta_{22} & 0 & 0 & 0 \\ 0 & 0 & \beta_{33} & 0 & 0 \\ 0 & 0 & 0 & \beta_{44} & 0 \\ 0 & 0 & 0 & 0 & \beta_{55} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{gov} \\ \varepsilon_t^{tax} \\ \varepsilon_t^{y} \\ \varepsilon_t^{\pi} \\ \varepsilon_t^{R} \end{bmatrix} \quad (2)$$

From Equation (2), each of the rows above shows a relationship among the reduced residuals and the structural shocks. The above relationship, however, failed the identification test and needs the imposition of restrictions. From (1), we can write the relation for the structural shocks and reduced form disturbances as:

$$u_t = A^{-1}Be_t \quad (3)$$

which can then be used to derive the variance-covariance matrices. Consistent estimates of the reduced form parameters, errors and variance-covariance matrix (once the VAR is properly identified) can be obtained from OLS estimations. The maximum number of identifiable parameters in matrices A and B is 15. The number of free parameters to be estimated in the A and B matrices in Equation (3) is, however, 22 (i.e., coefficients, excluding zeros and ones). Therefore, the system is under-identified and needs additional 7 identifying restrictions. Using Blanchard's identification strategy, the six parameters in the first two rows of matrix A are identified using external information (Parkyn and Vehbi, 2013). For this paper, as in Parkyn and Vehbi (2013), the identification of structural shocks in the first two rows of the matrix A is germane and can help, not only in the determination of the fiscal multipliers, but also, in the understanding of the effects of fiscal policy shocks on output, inflation and interest rate. Hence, the structural output, prices and interest rates shocks follow a recursive identification structure, as applicable in the VAR literature.

To identify the off-diagonal elements of the B matrix (b_{12}, b_{21}), our understanding of how fiscal policy works is paramount. It is assumed that decisions of the government to spend come before tax decisions (b_{12}), and, particularly for Nigeria, such decisions are oil-dependent. Parkyn and Vehbi (2013) has shown that results are not usually sensitive to this assumption.

$$\begin{bmatrix} 1 & 0 & 0 & -0.5 & 0 \\ 0 & 1 & 1 & -0.2 & 0 \\ -\alpha_{31} & -\alpha_{32} & 1 & 0 & 0 \\ -\alpha_{41} & -\alpha_{42} & -\alpha_{43} & 1 & 0 \\ -\alpha_{51} & -\alpha_{52} & -\alpha_{53} & -\alpha_{54} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{lrpcgs} \\ \mu_t^{lrpctax} \\ \mu_t^{lrpcgdp} \\ \mu_t^{dlpy} \\ \mu_t^{ltbr} \end{bmatrix} = \begin{bmatrix} \beta_{11} & 0 & 0 & 0 & 0 \\ \beta_{21} & \beta_{22} & 0 & 0 & 0 \\ 0 & 0 & \beta_{33} & 0 & 0 \\ 0 & 0 & 0 & \beta_{44} & 0 \\ 0 & 0 & 0 & 0 & \beta_{55} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{lrpcgs} \\ \varepsilon_t^{lrpctax} \\ \varepsilon_t^{lrpcgdp} \\ \varepsilon_t^{dlpy} \\ \varepsilon_t^{ltbr} \end{bmatrix} \quad (4)$$

In line with Parkyn-Vehbi's identification scheme (Parkyn and Vehbi, 2013), to identify Equation (2), an understanding of the behaviour of the elasticities of real per capita taxes and real per capita government spending with respect to output, inflation and the interest rate is required. The coefficients requiring identification are listed in the table below.

Table 2: Coefficients

S/no	Coefficient	Elasticity of
1.	α_{taxgdp}	real per capita tax revenue to output
2.	α_{gsgdp}	real per capita government spending to output
3.	$\alpha_{tax\pi}$	real per capita tax revenue (price)
4.	$\alpha_{gs\pi}$	real per capita government spending (price)
5.	α_{gsR}	Real per capita government spending to interest rate
6.	α_{taxR}	Real per capita tax revenue to interest rate

The assumption of Claus et al. (2006), as confirmed in Girouard and Andre (2005), provides a consistent guide to restrict the elasticity of tax revenue with respect to GDP to 1 (α_{taxgdp} = 1.0). In the case of the elasticity of government spending to output, there is a delayed response of real government spending (excluding transfers) to changes in GDP in a quarter as noted in the literature (Claus et al., 2006; Blanchard and Perotti, 2002), hence α_{gsgdp} = 0. The price elasticity of tax revenue is calibrated, $\alpha_{tax\pi}$ = 0.2. This is against the backdrop of anecdotal evidence that Nigeria's environment is driven less of taxes, hence, we view taxes as not the major driver of prices in Nigeria and can at best be one-off.

The price elasticity of real government expenditure restricted to $\alpha_{gs\pi}$ = 0.5, as used in Favero and Giavazzi (2007), based on Perotti (2005). According to Perotti, the wage component of government spending does not change in a

given quarter. This means the elasticity of real government expenditure on wages, with respect to the GDP deflator, is 1. Arguably though, the price elasticity for non-wage expenditure is likely to be near 0. In Nigeria, direct wage costs account for a significant proportion of real government expenditure, thus, it can reasonably be assumed that the price elasticity of real government expenditure is lower than 0, but higher than -1.

The elasticity of government expenditure with respect to the interest rate is set to zero ($\alpha_{gsR} = 0$). In our clime, where fiscal dominance is common and the economy faces costly adjustments when price of oil is low, borrowing can be done at any level of interest rate. Similarly, elasticity of tax revenue, given interest rate, is zero ($\alpha_{taxR} = 0$), following the assumption of Favero and Giavazzi (2007) and Perotti (2005). Though we note that the tax base includes interest income, the effects may not be direct, considering the fact that interest rate movements may affect dividend streams.

IV. Empirical Findings

While the coefficients for the contemporaneous effect of government expenditure on income have the expected sign, those for revenues did not (Table 3). Higher government expenditure has a positive contemporaneous effect on income on impact (0.362), while the immediate effect of increasing revenues on income is positive (0.221). Both are statistically significant. Figure 9 provides the interpretations of these coefficients in terms of dollar. Government spending has a positive and significant effect on interest rates. A one per cent shocks to government spending increases the interest rates by approximately 100 basis points on impact. The impact of increases in tax on interest rates, is also positive but insignificant.

Table 3: Estimates of A and B Matrix

$$\begin{bmatrix} 1 & 0 & 0 & -0.5 & 0 \\ 0 & 1 & 1 & 0.2 & 0 \\ -0.362* & -0.221* & 1 & 0 & 0 \\ 0.782* & -0.049** & 0.217* & 1 & 0 \\ -1.060* & -0.0447 & -0.1745 & -0.969* & 1 \end{bmatrix} \begin{bmatrix} u_t^{lrpcgs} \\ u_t^{lrpctax} \\ u_t^{rpcgdp} \\ u_t^{dlpy} \\ u_t^{ltbr} \end{bmatrix} = \begin{bmatrix} 0.178* & 0 & 0 & 0 & 0 \\ 0.028 & 0.283* & 0 & 0 & 0 \\ 0 & 0 & 0.092* & 0 & 0 \\ 0 & 0 & 0 & 0.525* & 0 \\ 0 & 0 & 0 & 0 & 0.214* \end{bmatrix} \begin{bmatrix} e_t^{lrpcgs} \\ e_t^{lrpctax} \\ e_t^{rpcgdp} \\ e_t^{dlpy} \\ e_t^{ltbr} \end{bmatrix}$$

IV.1 Interpreting the Structural Shocks

The spending shocks as observed in Figure 1, suggest negative spending shocks for most of the periods, especially in the era of expenditure restraint, as well as fiscal consolidation of the Obasanjo era, and the era associated with drag in the budget process.

Figure 1: Quarterly Government Spending Shocks

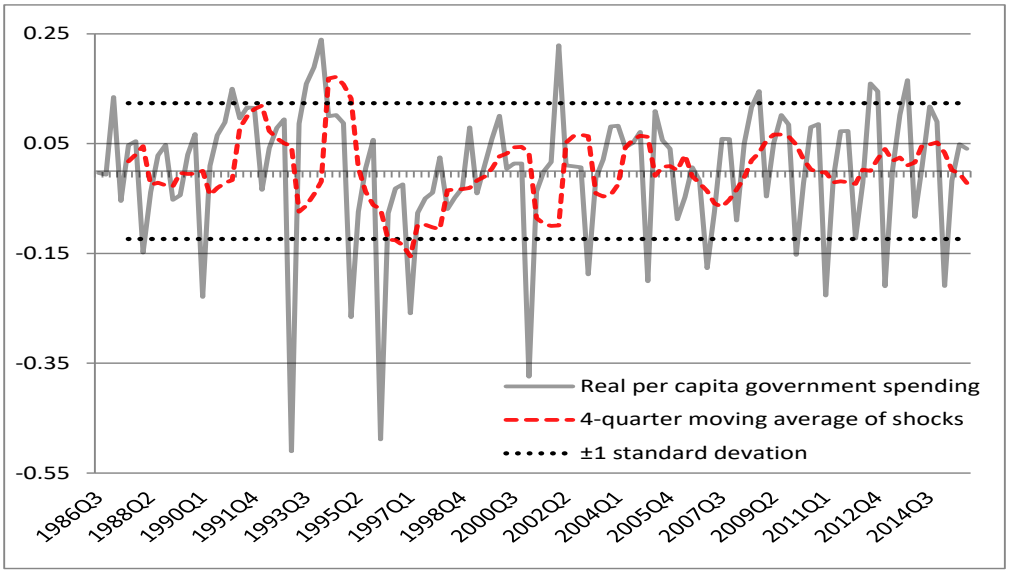
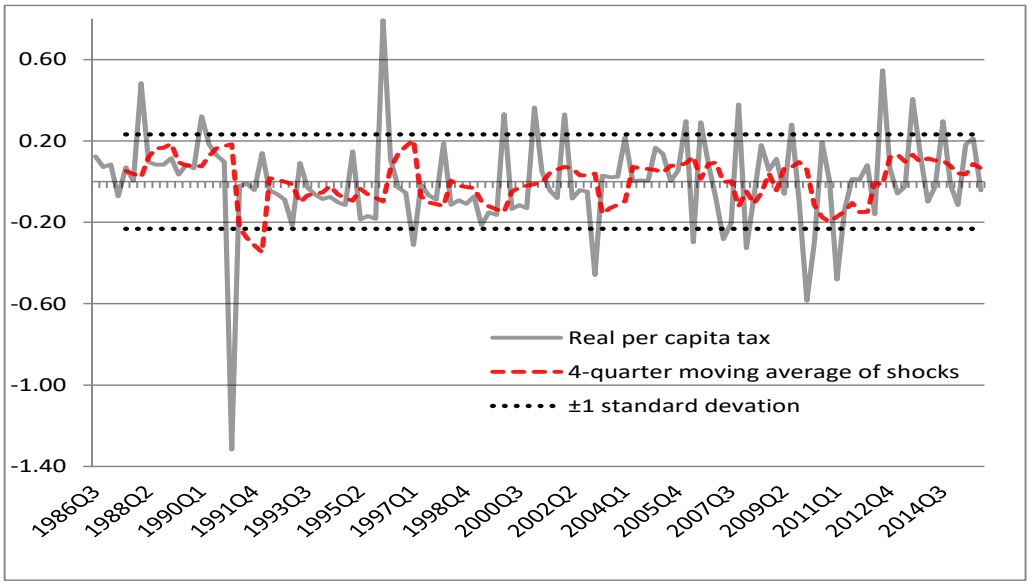


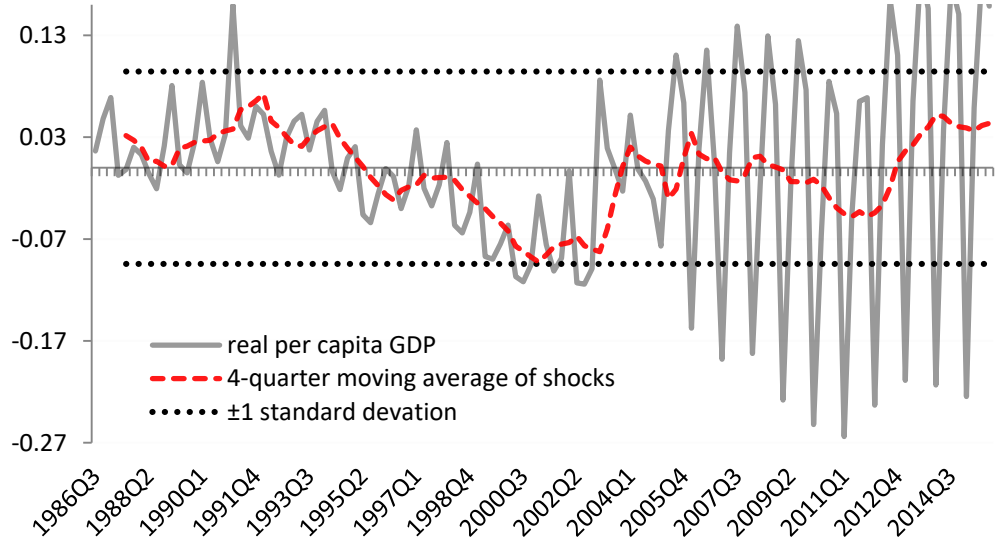
Figure 2 shows relatively large negative tax shock in 1991q1, while a pocket of other negative tax shocks about half the size in 1991q1, 2003q1, 2006q2, 2008q1, 2010q1 and 2011q1. Considering the inefficiencies in tax administration and leakages, these shocks cannot be associated with a reduction in the tax rate, but more to ineffective tax collections and shocks arising from drop in crude oil prices and challenges with refineries. The positive shocks are due largely to increase in the petroleum profit tax. As Parkyn and Vehbi (2013, pp. 12) puts it: "... it's difficult to relate to changes in policy, as structural revenue increases tend to occur over time through fiscal drag rather than through announced tax rate increases".

Figure 2: Quarterly Tax Shocks



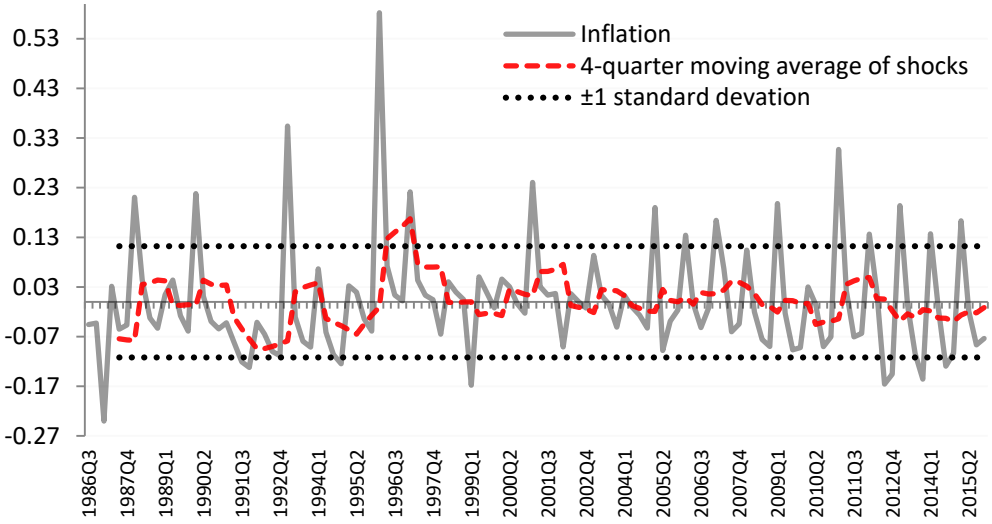
In Figure 3, it was discernible that growth oscillated between negative and positive shocks, reflecting the data generating process that became pronounced since 2005q4.

Figure 3: Real Per Capita GDP Shocks



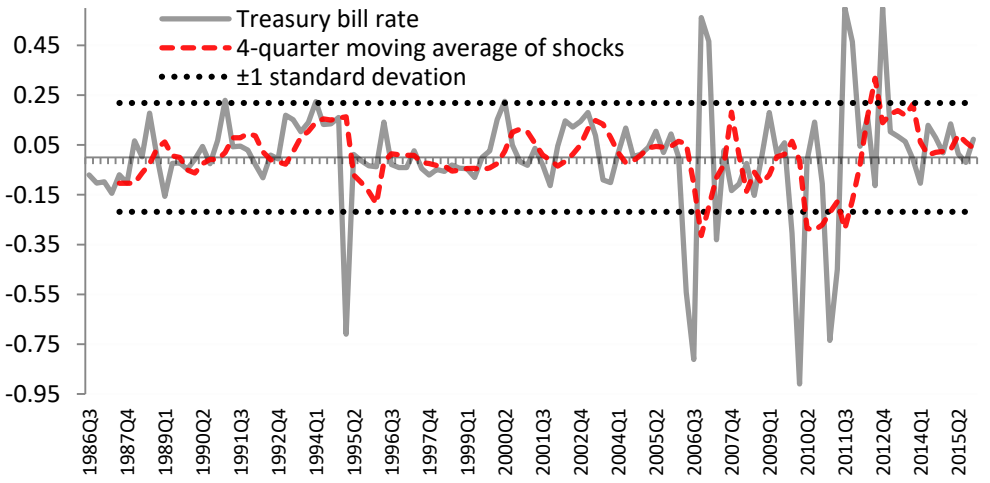
In Figure 4, it was observed that in the 1990s, there were some pockets of positive implicit GDP deflator shocks. The rebasing of the GDP and transition to new base year had consequently narrowed the size of the deflator shocks.

Figure 4: GDP Inflator Shocks



Episodes of negative shocks to treasury bill rate was observed in the earlier regime of interest rate liberalisation in the early 1990s, and the subsequent bank failures that streched from 1994 – 1995. It was also obseved in 2006q3 and at the outset of the global financial crises, following the expanded discount window facility.

Figure 5: Treasury Bill Rate Shocks



IV.2 Impulse Response Functions

This section discussed empirical outcomes for government spending and tax shocks. To determine the effect of fiscal shocks on the key macroeconomic variables, the impulse and response of output and fiscal indicators were expressed in constant naira multipliers. To do this, first, the standard deviation of the underlying fiscal shock was determined; and second, the ratio of each variable shock to the standard deviation of the fiscal shocks was taken. Third, we estimate at the mean, the impulse responses by dividing each by this ratio. These normalised impulses for the responses of output to the fiscal shocks were thus, viewed as constant naira multipliers. These was interpreted as the reaction of the response variable to a fiscal shock of 1.0 per cent of real GDP.

Analysing Government Expenditure and Tax Shocks

The initial response that reflects the fiscal variable shocks was displayed in Figure 6, indicating that both spending and revenue shocks led to positive outcome on output. In Nigeria, tax revenues are dominated largely by petroleum related taxes and are not likely to have a dampening effect on output as it is known in the literature. The strong correlation between crude oil price and growth is apparent in explaining the positive influence of tax revenues.

Figure 6: Spending and Revenue Shocks

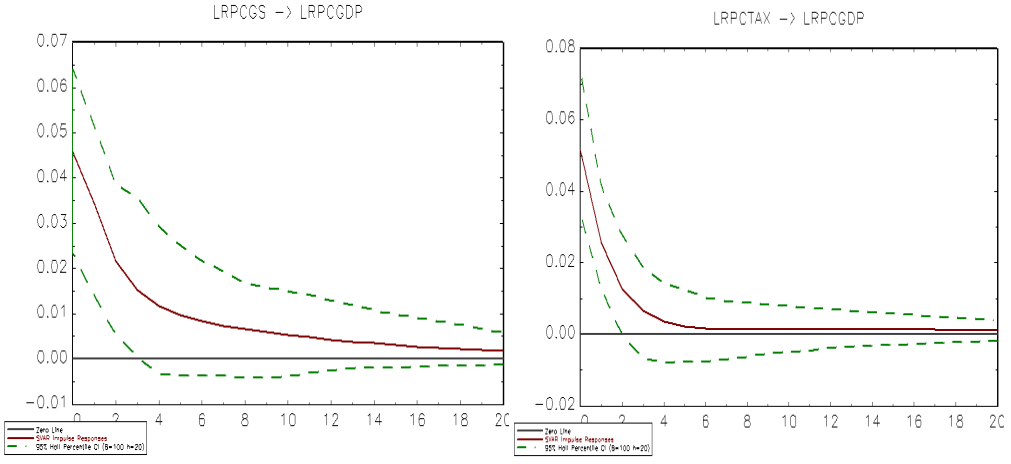
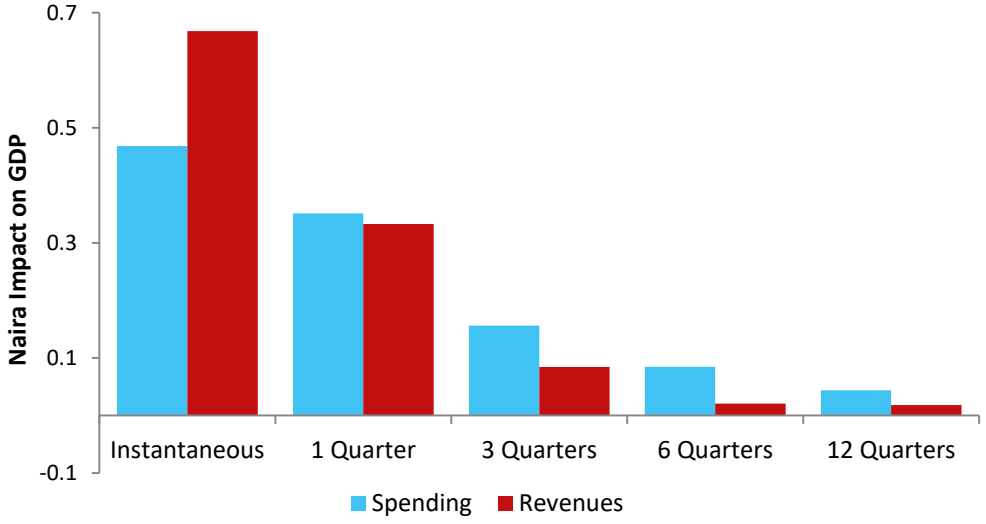


Figure 7 shows the fiscal multipliers estimated for Nigeria over 12 quarter horizons. The multipliers are constant naira multipliers concomitant with naira changes in output, given the change in government spending and tax revenues. Instantaneous government spending multiplier impact was approximately 0.67 and died off gradually to 0.35 and 0.16, within the first and third quarter, respectively. To better understand the dynamics of multiplier, it is important to

refer to the impulse response, as it offers a better impression of the timing of the multiplier effect, arising from government expansionary spending.

From the impulse response functions, the impact of the fiscal variables shocks can also be evaluated. The shocks reported as follows: government spending, tax revenues (% of GDP); real GDP (%), deflator and interest rate (percentage points). It was observed that inflation (0.15) and interest rates (0.38) within the first quarter to a spending shock was positive. In terms of the revenue shocks, it was neutral initially, thereafter causing a slack in spending and rose afterwards, when tax decisions would have been made to meet the expected expenditure decisions.

Figure 7: Fiscal Impact Multipliers (GDP response to naira increase in spending and revenues)



V. Policy Implication and Conclusion

This paper estimated the size of the fiscal multiplier associated with government spending and tax-related revenue shocks. Also, it carried out an analysis of the potential impact of fiscal policy on output, inflation and interest rates, using a structural vector autoregression that permitted the flexibility of assigning theoretically consistent restrictions in line with the extant literature.

The paper revealed that at 0.47 on impact and at 0.35 within a quarter, the government spending multiplier for Nigeria was high and indicated substantial output gap, suggesting the ample productive capacity that could leverage fiscal policy to expand. Delays in spending and costly procurement processes

could only accentuate negative output gaps and deepen recession, when it occurs.

Similarly, the tax revenue multiplier, at 0.67 on impact and 0.33 within a quarter, underscored the challenges government could face when revenue due to tax falls. In the case of Nigeria, these taxes are petroleum dependent and shocks to the oil and gas sectors are likely to affect the size of the revenue multipliers. In recent times, government revenue mobilisation has been weak, suggestive of the needed administrative tax reforms to bolster the space and create buffers to support inclusive growth in the longstanding constraints of infrastructural deficit, job creation and poverty reduction.

In conclusion, a reform programme that is aimed at rejuvenating the economy can leverage on the impact of these multipliers in assessing expenditure requirements and tax plans that will achieve government objectives over the programme period.

References

Ambriško, R., Babecký, J., Rysanek, J., & Valenta, V. (2015). Assessing the Impact of Fiscal Measures on the Czech Economy. *Journal of Economic Modelling*, Vol. 44, pp 350-357.

Arin, K. P., Kolay, F., & Spagnolo, N. (2015). Fiscal Multipliers in Good Times and Bad Times. *Journal of Macroeconomics*, Vol. 44, pp 303 – 311.

Auerbach, A. J. & Gorodnichenko, Y. (2010). Measuring the Output Responses to Fiscal Policy. *NBER Working Paper Series*, 16311.

Auerbach, A. J., & Gorodnichenko, Y. (2012). Measuring the Output Responses to Fiscal Policy. *American Economic Journal: Economic Policy*, Vol. 4, Issue 2, pp 1-27.

Auerbach, A. J., & Gorodnichenko, Y. (2015). How Powerful are Fiscal Multipliers in Recessions? *NBER Reporter*, Issue 2, pp 21-24.

Barrell, R., Holland, D., & Hurst, I. (2012). Fiscal Multipliers and Prospects for Consolidation. *OECD Journal. Economic Studies*, Vol. 2012/1.

Batini, N., Callegari, G., & Melina, G. (2012). Successful Austerity in the United States, Europe and Japan, *IMF Working Paper* 12/190.

Batini, N., Eyraud, L. & Weber, A. (2014). A Simple Method to Compute Fiscal Multipliers, *IMF Working Paper* WP/14/93.

Baum, A., Poplawski-Ribeiro, M. & Weber, A. (2012). Fiscal Multipliers and the State of the Economy. *IMF Working Paper* WP/12/286.

Benčík, M. (2014). Dual Regime Fiscal Multipliers in Converging Economies – A Simplified STVAR Approach. *Národná banka Slovenska* Working Paper 2/2014.

Blanchard, O. & Perotti, R. (2002). An Empirical Characterisation of the Dynamic Effects of Changes in Government Spending and Taxes on Output. *Quarterly Journal of Economics*, Vol. 117, No. 4, pp 1329-1368.

Borg, I. (2014). Fiscal Multipliers in Malta, *Central Bank of Malta Working Paper* WP/06/2014.

Bose, S. & Bhanumurthy, N. R. (2015). Fiscal Multipliers for India, *Journal of Applied Economic Research*, Vol. 9, Issue 4, pp 379-401.

Chinn, M. (2013). Fiscal Multipliers, The New Palgrave Dictionary of Economics.

Claus, I., Gill, A., Lee, B. & McLellan, N. (2006). An Empirical Investigation of Fiscal Policy in New Zealand. *Treasury Working Paper Series*, No 06/08.

Delong, J. B. & Summers, L. H. (2012). Fiscal Policy in a Depressed Economy, *Brookings Papers on Economic Activity*, Vol. 43, Issue 1, pp 233-297.

Enders, W. (2004) *Applied Econometric Time Series*, 2nd Edition. Wiley (New York).

Favero, C. A. & Giavazzi, F. (2007). Debt and the Effects of Fiscal Policy, *NBER Working Papers*, No. 12822.

Girouard, N. & Andre, C. (2005). Measuring Cyclically-Adjusted Budget Balances for the OECD Countries. OECD *Working Paper*, No. 434.

Ilzetzki, E., Mendoza, E. G. & Vegh, C. A. (2013). How Big (Small?) are Fiscal Multipliers? *Journal of Monetary Economics*, Vol. 60, Issue 2, pp 239-254.

Jain, R. & Kumar, P. (2013). Size of Government Expenditure Multiplier in India: A Structural VAR Analysis, *RBI Working Paper Series*, No. 07/2013.

Karagyozova-Markova, K., Deyanov, G. & Iliev, V. (2013). Fiscal Policy and Economic Growth in Bulgaria, *Bulgarian National Bank Discussion Papers* DP/90/2013.

Mançellari, A. (2011). Macroeconomic Effects of Fiscal Policy in Albania: A SVAR Approach, *Bank of Albania, Working Paper*, No. 05 (28).

Mendoza, E. G., Vegh, C. A. & Ilzetzki, E. (2009). How Big are Fiscal Multipliers? *Centre for Economic and Policy Research (CEPR). Policy Insight*, No. 39.

Mountford, A. & Uhlig, H. (2009). What are the Effects of Fiscal Policy Shocks? *Journal of Applied Econometrics*, Vol. 24, Issue 6, 960-992.

Odugwe, T. (2014). Estimating a Government Spending Multiplier for Nigeria: A Structural VAR Study of a Developing Country", Retrieved from https://www.academia.edu/8453527/Estimating_a_Government_Spending_Multiplier_for_Nigeria_A_Structural_VAR_Study_of_a_Developing_Country

Pagan, A.R., Catao, L. & Laxton, D. (2008). Monetary Transmission in an Emerging Targeter: The Case of Brazil. *IMF Working Papers*, pp 1-42.

Parkyn, O. & Vehbi, T. (2013). The Effects of Fiscal Policy in New Zealand: Evidence from a VAR Model with Debt Constraints, *New Zealand Treasury Working Paper* 13/02.

Perry, N. (2014). Debt and Deficits: Economic and Political Issues, Global Development and Environment Institute Tufts University, Retrieved from http://www.ase.tufts.edu/gdae/education_materials/modules/debtanddeficits.pdf

Perotti, R. (2005). Estimating the Effects of Fiscal Policy in OECD Countries, *CEPR Discussion Paper* No. 4842.

Sims, C. (1980). Macroeconomics and Reality. *Econometrica*, Vol. 48, No. 1, pp 1-48.

Sims, C. A., Stock, J. H., & Watson, M. W. (1990). Inference in Linear Time Series Models with some Unit Roots. *Econometrica*, pp 113-144.

Spilimbergo, A., Symansky, S. & Schindler, M. (2009). Fiscal Multipliers. *IMF Staff Position Note*, SPN/09/11.

Whalen, C. J. & Reichling, F. (2015). The Fiscal Multiplier and Economic Policy Analysis in the United States, *Working Paper Series*, No. 2015-02.

APPENDIX 1

Figure 8: Responses to Government Expenditure Shocks (% of GDP)

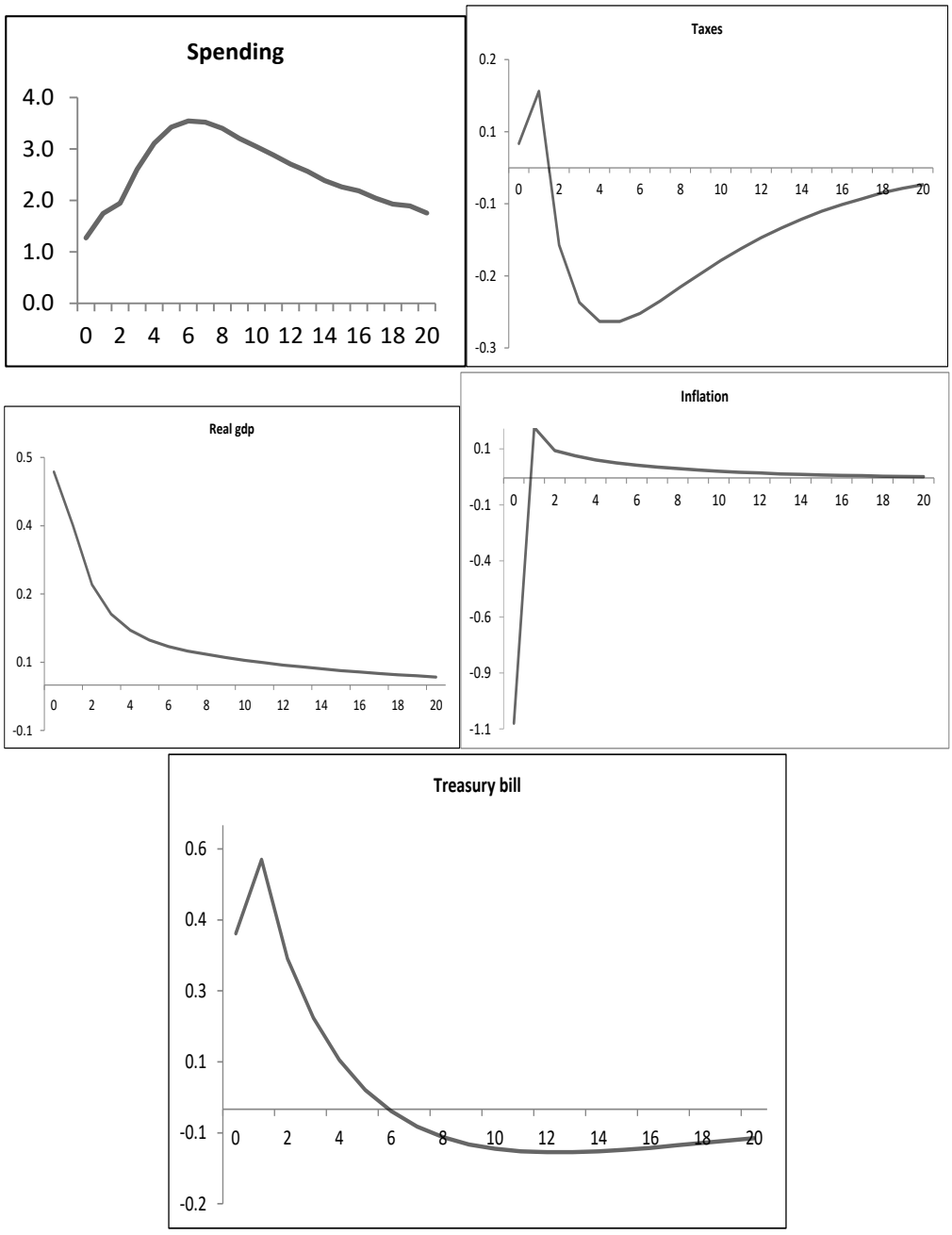


Figure 9: Responses to Revenue Shocks (% of GDP)