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Analysis of fiscal deficits and interest rates in Nigeria

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This study investigates the effect of fiscal deficits on nominal interest rate in Nigeria. Cointegration techniques and structural analysis were adopted for the study. Empirical evidence emerges that the coefficient of fiscal deficit variable is positive and statistically significant. This indicates that the elasticity of fiscal deficit with respect to income is 0.114, an indication that large deficit causes higher interest rates. In addition, money supply has an inverse relationship with interest rates in Nigeria, but there exist a positive and significant relationship between inflation and interest rate. The coefficient of government expenditure is positive with a short run effect of 0.229. It is recommended that government should consider the option of bond financing of budget deficit as an alternative to monetary financing.

Key words: Fiscal deficit, nominal interest rate, cointegration, Nigeria.

INTRODUCTION

The rate of interest is the reward for parting with liquidity for a specified period. In a sense, it is seen as a measure of the unwillingness of those who possess money to part with their liquid control over it. It is the "price" which equilibrates the desire to hold wealth in the form of cash with the available quality of each that is the price of credit. Interest rate as the price paid for the right to borrow and use loanable funds, are the costs of holding money (Anyanwu and Oaikhanem, 1995). There are two types of interest rates; the nominal and real interest rates. The market rate of interest is roughly equivalent to the sum of the two forms of cost of holding money, that is: the market or nominal rate of interest equals (approximately) the real rate of interest plus the rate of increase in the price level. The nominal rates of interests are the rates of interest actually paid. They are the sum of expressed inflation and a real rate of return (Edward, 2004). The real rates are the nominal rates minus the expected rate of inflation (Anyanwu and Oaikhenam, 1995; Jhingan, 2004).

The persistence of fiscal deficits in developing countries which are mostly financed by government borrowing from the banking system has been blamed for much of the economic crises that beset them, since the 1980's, including debt overhang and the accompanying debt crises, high inflation, poor investment performance and growth (Anyanwu, 1998; Onwiduokit, 1999). According to Anyanwu (1998) large fiscal deficits being financed through creation of money have, or will soon produce high interest rates, thus hindering capital formation and economic growth in developed and developing countries. The views held by the popular press on fiscal deficit interest rate relationship is "deficits are the major reason that an interest rate stay close to record high levels" (American Banker, 1982). Again, a trade group asserted that "more than anything else, it is the spectre of an overwhelming volume of deficit financing which haunts housing and financial markets" (Wall Street Journal, 1982). Edward (2004) posits that since nominal interest rates are the sum of an expected inflation component and a real interest rate of return, a non-accommodative monetary policy stance not only implies that the expected inflation component of nominal rates will be unchanged in the face of higher deficits, but that monetary policy will not resist any upwards pressure on real interest rates that arise from greater government borrowing.

Fischer and Easterly (1990) argues that when debt is used to finance government expenditures, consumers' income will be increased as more money is injected into the economy. In the short-run, given that resources are not fully utilized, crowding out of private investments by

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high interest rates would not occur. If on the other hand, the economy is at full employment, the Keynesian School views deficit financing to be identical to the classical view, which entails reduction in private capital formation, increased interest rates and consumption. This according to Ubogu (1982) will lead to inflation if not accompanied by a reduction in money stock.

Over thirty seven years, between 1970 and 2006, the fiscal operations of the Nigerian government resulted in deficits in 33 years. This is as a result of the volatile revenue base which combines with increasing expenditure profile of government, thus making the incidence of fiscal deficits inevitable. In Nigeria, fiscal deficits were generally financed from the banking system and external sources (NCEMA, 2004; CBN, 2006). However, a number of studies have attempted to examine the relationship between fiscal deficits on interest rates. Such studies (Evans, 1998; Perrotti, 2004; Abderrezak, 1987; Feldstein and Eckstein, 1970; Plosser, 1982; Elmendorf, 1996; Cebula, 2005; Easterly and Schmidt-Hebbel, 1993; Aschauer, 1989; Blejer and Khan, 1984; Khan and Reinhart, 1990; Easterly, 1990; Govannini and De Melo, 1990; Anyanwu, 1998; Adams and Bankole, 2000; Ariyo and Raheem, 1991) etc, are replete in the literature. Most of these works were done in countries different from the Nigerian context. Again, the time frame considered in these works is short. Also is the fact that the results in these studies are conflicting. These shortcomings have somehow contributed to the knowledge gap in the literature, thus warranting a more systematic examination of the relationship between fiscal deficits and interest rates in the Nigerian context. This study seeks improve on the past studies by, using a broad data set spanning 1970 and 2006, such data is far more than those used in previous studies. The period also covers all the periods of economic reforms in Nigeria. Using recent developments in time series econometrics as provided by Engle and Granger (1987), Andrews (1991) etc, this study is able to distinguish between long and short run effects of the variables in the model adopted.

LITERATURE

Macroeconomic theory posits that financing budget deficit by increasing the supply of government securities *citeris-paribus* reduces its prices and raises the real interest rates, thus crowds-out private investment. This phenomenon can lead to a debt problem. Thus, if interest rates are not controlled, high fiscal deficits are correlated with strongly negative real interest rates, and the loss of access to external borrowing for financing fiscal deficits often leads to higher taxes on domestic financial intermediation. This phenomenon can even lead to stagnant or declining economic growth. Overall, the literature on the relationship between fiscal deficit, and interest rate has always been concerned with more reliance on domestic financing of fiscal deficits as external finance declines sharply in highly indebted countries (Wijnbergen, 1989).

Many studies such as (Evans, 1988; Plosser, 1982; Feldstein and Eckstein, 1970, etc) have examined the effect of fiscal deficit on nominal interest rates or some measures of interest rates. However, conclusions reached by these studies are mixed and inconclusive. Three views are upheld. The first indicates that interest rates are an increasing function of fiscal deficit. The second argument suggests that budget deficit negatively affects real interest rate. The last view holds that changes in fiscal deficit have a neutral effect on interest rates, thus, rejecting the crowding-out hypothesis.

Evans (1988) rejected the argument that nominal interest rates increases as a result of large fiscal deficits. Perroti (2004) studied five OECD countries between 1960 and 2001 and came to the conclusion that only in the 1980 period is there some evidence of (small) positive effect of government spending on long run interest rates. Abderrezak (1987) postulate that large fiscal deficit causes increases in nominal interest rates. Feldstein and Eckstein (1970) explained interest rates by combining standard liquidity preference theory with the assumption that nominal interest rates reflect the expected rate of inflation. They argue that market interest rates depend on the real quantity of money, real income, inflation, and outstanding government debt. Their finding suggests a statistically significant positive effect of government debt on nominal interest rates. Plosser (1982) assumed that the financial markets are efficient and postulated that only unexpected changes in privately held government debt, monetary authority holding of government debt, and government purchases of goods and services would result in changes in interest rates. His findings suggests that unexpected increase in government spending will lead to an increase in interest rates, and that the method of financing the higher spending has some effect on interest rate. These result tends to suggest that the amount of government debt the public holds has little influence on interest rates and that this depends on the method of financing the debt which according to him heavily affects interest rates.

In the United States, the financial market development following news reports about the deficit reduction laws are consistent with the prediction of economic theory. Higher expected government spending and budget deficits raised real interest rates and the value of the dollar, while lower expected spending and deficits reduced real rates and the value of the dollar (Elmendorf, 1996). Further empirical evidence by Cebula (2005) argue that primary deficits raises the nominal interest yield on bonds in the United States of America. Easterly and Schmidt-Hebbel (1993) argued that debt financing of deficits lead to higher real interest rates or increased financial repression of the financial markets, with fiscal gains coming at an increasingly unfavourable terms.

Domestic borrowing in the form of issuance of domestic debt instruments intermediated through the banking system has its own dangers as its effect on the economy depends entirely on whether there is financial repression or financial deregulation (Easterly, 1990; Govannini and De Melo, 1990). In their separate studies of some developing countries, the authors concluded that excessive government borrowing from the banking system leads to credit squeeze through higher real interest rates when the financial market is deregulated and when in financial repression through credit allocation. Subsequently, this leads to crowding out of credit that would otherwise, be available to the private sector. Similarly, since real interest rate determines how investors and consumer schedule there investments and consumption, assuming they have access to credit, has some salutary effects on investment and consumption. Easterly (1989), Govannini and De Melo (1990) argues that an increase in real interest rate resulting from higher government domestic borrowing could lower private investment and consumption. Nevertheless, this relationship depends entirely on the degree of complementary effects between public investment and private investment. Where the degree of relationship is low, then borrowing by the government could crowd out private investment and then lower growth (Aschauer, 1989; Blejer and Khan, 1984; Khan and Reinhart, 1990). For Nigeria, the empirical work of Anyanwu (1998) has not revealed a significant positive association between overall fiscal deficits and its foreign financing and domestic nominal deposit interest rates, but there appears to be evidence for a significant positive association between domestic financing of fiscal deficits and domestic nominal deposit rates during the period 1987 to 1995. Specifically, the work posits that, domestic financing of fiscal deficits, the level of real income, and foreign interest rates play important roles in the determination of deposit rates in Nigeria, Ghana, and the Gambia.

The study by Adam and Bankole (2000) revealed a positive relationship between interest rate and fiscal deficit. They argue that increasing reliance on domestic financial markets for financing government deficits is likely to lead to steep increases in interest costs. However, Ariyo and Raheem (1991) cited in Tchokote (2004) suggests that fiscal deficits has a significant impact on interest rate in Nigeria.

In conclusion, most of the studies reviewed in the literature have shown inconclusive conclusions on the effect of fiscal deficits on interest rates. Even the results of the extant works conducted in the Nigerian context also shows conflicting results in their conclusions. The observed differences in these conclusions have some how contributed to the knowledge gap in the literature thus warranting a more systematic examination of the relationship between fiscal deficits and interest rates in Nigeria.

THEORETICAL FRAMEWORK

Under the fiscal approach to the balance of payments; the current account balance is defined as the difference between monetary value of domestic output and the aggregate demand (absorption). The budget balance is consequently defined as the gap between government revenues and expenditures. The above definition derives from the national income identity, as:

$$Y = C + I + G + (X - M) \quad (1)$$

Where Y represents GDP, C is private consumption, I stands for private investment, G is government consumption, X and M stand for exports and imports respectively.

Assuming the aggregate demand A = C + I + G then Equation (1) can be rewritten as follows:

$$Y - A = X - M \quad (2)$$

Equation (2) reflects the behaviour of the external sector of the economy. The direct interpretation is that, external imbalances always trigger a series of developments in the economy, which in this case is budget deficit. Therefore, any attempt to restore the balance must include effort to align revenue with expenditure.

In order to isolate the disposable income, tax (T) and international reserve (R) (the latter is introduced basically on the assumption of the fixed exchange rate regime) are introduced into the national income identity. It follows that Equation (1) will become:

$$Y + R - T = C + I + (G - T) + (R + X - M) \quad (3)$$

In the following equation, S (savings) is the disposable income minus private consumption. That is:

S = Y + R – T – C, the private absorption capacity is represented by (C + I), (G – T) is for budget deficit, while the current account balance CAB is represented by (R + X – M), R represents international transfer receipts and T stands for taxes. Substituting S and CAB by their respective components, we get:

$$(S - I) + (T - G) = (R + X - M) \quad (4)$$

It is often argued that deficit in the current account occurs when aggregate investment outweighs aggregate savings. However, if investments equals savings and government expenditure is greater than its revenue then, the current account deficit becomes inevitable. The literature on the current account is quite obvious when it indicates the degree at which the domestic economy interacts with its external assets. Thus, (X + R – M) would also be equivalent to the increase in net official assets plus the rate of capital outflow that is ∆NFA.

$$\text{Hence } CA = \Delta NFA \quad (5)$$

The links between net savings of the private sector and the public sector deficit is easily appreciated through the following illustration.

$$(S - I) + (T - G) = \Delta NFA \quad (6)$$

The direct interpretation of the above equation assuming S = I is that:

(i) a budget deficit will be financed through a reduction in external net claims, which can be done through increase in external public debt or reduction of international reserves in the case of a fixed exchange regime.

(ii) Budget deficit could also be financed domestically, through increase in government debt held by the private economic sector. The relationship in the banking system provides a clear understanding on how domestic borrowing is applied in financing a budget deficit and the balance sheet is given as follows:

$$\Delta NFA^{b} = \Delta M_2 - (\Delta DC^{g} + \Delta DC^{nb}) \qquad (7)$$

The liability of the banking system is represented by M_2, that is the broad money, ΔDC^{g} is domestic credit of the banking system to government and ΔDC^{nb} is the credit of non-banking sector (private sector) to the government. Equation (7) expresses the difference between money expansion and credit expansion and, which works as follows. An increase in money relative to credit expansion will reflect as an increase in the net foreign asset.

In countries where the capital markets are not advanced (such as Nigeria), budget deficit is usually financed through domestic and external borrowing. This expression can be simplified as follows:

$$G - T = \Delta DC^{g} - \Delta NFA^{g} \qquad (8)$$

By substituting (8) into (7), the relationship between the financing of the budget deficit and the banking system is brought to the fore. Thus:

$$G - T = \Delta M_2 - \Delta DC^{nb} - (\Delta NFA^{b} + NFA^{g}) \qquad (9)$$

Equation (9) illustrates the sources through which government deficit can be financed. First, by an increase in money (ΔM_2). Second, borrowing from non-banking sector. Lastly, by a reduction in international reserve or external borrowing. In all, increased budget deficit will translate into increased current account deficit which precipitates new external borrowing or draw down of external reserves. However, all the three means of financing a deficit may lead to appreciation of real and nominal exchange rates under flexible exchange rate regime and capital mobility.

The specification of the interest model mirrors the works of Ariyo and Raheem (1991), cited in Tchokote (2004). The specification of the model considers the following variables: Interest rate (INT) is the independent variable; while Government expenditure (G), fiscal deficit (FD), money supply (MS), and inflation rate (INF) are the, dependent variable; U_t is error term.The model is represented as:

$$INT = f(G, FD, MS, INF, INT_{t-1})$$

The equation for the above relationship becomes:

$$INT = b_o + b_1 G + b_2 FD + b_3 MS + b_4 INF + b_5 INT_{t-1} + U_t \qquad (10)$$

b_o is the intercept and, b_1, b_2, b_3, b_4, are the coefficients of the regression equation.

A priori, it is expected that the following relationship will occur;

$b_1, b_2, b_4, b_5 > 0$; $b_3 < 0$;

The secondary data for the period 1970 to 2006 which were used as the macroeconomic variables in this study were obtained from the statistical bulletin of the Central Bank of Nigeria (CBN). (2006)

Estimation technique – Cointegration and error correction model (ECM) estimation technique

We investigated the time series characteristics of the data to test whether the variables are integrated. The Augmented Dickey-Fuller (ADF), as specified in Dickey and Fuller (1979), and Phillips-Perron (Phillips and Peron, 1988) was employed. For the ADF, the null hypothesis is that the variable being considered has a unit root against an alternative that it does not. The model for the ADF is as specified as:

$$\Delta y_t = \alpha + \beta T + \gamma y_{t-1} + \sum_{i=1}^{P} d_t \Delta y_{t-1} + \varepsilon_t \qquad (11)$$

Where y_t is the variable being considered, T is the time trend (which is only allowed if significant), and ε_t is a random error term. The Akaike Information Criterion is used in selecting p (the lag-length) after testing for first and higher order serial correlation in the residuals. The lagged variables serve as a correction mechanism for possible serial correlation. The Phillips-Peron (PP) test uses models similar to the Dickey-Fuller tests but with Newey and West (1994) non-parametric correction for correcting possible serial correlation rather than the lagged variables method employed in ADF. Also Bartlett Kernel (Andrews, 1991) is used as an automated bandwidth estimator for lag truncation of the Newey and West nonparametric correction. The test statistics of the PP have the same distribution as those of Dickey-Fuller with critical levels as provided by MacKinnon (1996). The fact that two series are unit roots can be an indication of a long run relationship between the two series.

Error correction model

To test for the long run relationships between the variables, we apply the Engle-Granger (1987) two step cointegration test which uses the residuals from the long run equation estimated with the non-stationary variables, and then test for the existence of unit root in the residual using the ADF regression and compare the value to an appropriate asymptotic null distribution. If two time series y_t and x_t are both integrated of order d (that is I(d)), then, in general, any linear combination of the two series will also be I(d); that is, the residuals obtained on regressing y_t on x_t are I(d). If, however, there exists a vector b, such that the disturbance term from the regression ($e_t = y_t - bx_t$) is of a lower order of integration I(d-b), where b>0, then Engle and Granger (1987) define y_t and x_t as cointegrated of order (d,b).

The economic interpretation of cointegration is that if two or more series are linked to form an equilibrium relationship spanning the long run, then even though the series themselves may be non-stationary, they will move closely together over time and their difference will be stationary. Their long run relationship is the equilibrium to which the system converges over time, and the disturbance term can be interpreted as the disequilibrium error or the distance that the system is away from equilibrium at time *t*. In order to estimate the long run relationship between yt and xt it is necessary to estimate the static model:

$$y_t = \beta X_t + e_t \qquad (12)$$

Although the equilibrium long run relationship can be estimated directly using Equation (12), it is also important to consider the short run dynamics of the variables under consideration, since the system may not always be in equilibrium. A simple dynamic model of short run adjustment can be written as:

$$y_t = \alpha_0 + \gamma_0 X_t + \ldots + \gamma_1 X_{t-1} + \alpha_1 y_{t-1} + u_t \qquad (13)$$

Reparameterising and rearranging Equation (13) gives the error correction formulation (ECM):

$$\Delta y_t = \gamma_0 \Delta X_t - (1 - \alpha_1)[y_{t-1} - \beta_0 - \beta_1 X_{t-1}] + u_t \qquad (14)$$

where β_0 and β_1 are coefficients estimated from equation.

The ECM incorporates both short run and long run effects. When equilibrium holds, $[y_{t-1} - \beta_0 - \beta_1 X_{t-1}] = 0$. But in the short run, when disequilibrium exists, this term is non-zero and measures the distance that the system is away from equilibrium during time t. Thus $(1- \alpha_1)$ provides an estimate of the speed of adjustment of the variable y_t. For instance, if $[y_{t-1} - \beta_0 \beta_1 X_{t-1}] < 0$, that is, y_{t-1} has moved below its equilibrium level, since $-(1- \alpha_1)$ is negative, it will boost Δy_t, thereby forcing it back to its long run path. Engle and Granger show that two or more variables are cointegrated of order I(1,1) if and only if an ECM exists.

The first stage in the Engle-Granger framework is to test whether the variables are cointegrated. This is accomplished by testing the residuals of Equation (9) for stationarity. That is, the null hypothesis of it being I(1) is tested against the alternate of it being I(0). Although any unit root test can be used, Engle and Granger advocated the use of Augmented Dickey Fuller tests on the residuals. The second stage of the EG procedure comprises of estimating the short run ECM itself from the residuals of the regression of the first stage. That is, having obtained $\varepsilon_{t-1} = y_{t-1} - \beta X_{t-1}$, we estimate Equation (14) to determine the dynamic structure of the system.

We expect that there is a long-run relationship between money supply, economic activity, domestic interest rates and foreign interest rates. We therefore test for the existence of a cointegrating relationship. This is done using the above ECM methodology. In the first step we estimate the coefficients by OLS and test for the existence of a unit root in the residuals. The analysis is also supplemented by testing for the number of cointegrating relationships using the Johansen procedure. The deviations from the long run path are captured at the second stage. When the coefficients of the lagged residual term from the first stage is negative, it suggests that the system comes back to the long run path or adjusts. Therefore, there exists an error correction mechanism. The parsimonious error correction mechanism (ECM) can be specified as:

$$\Delta INT_t = \alpha_t + \Delta G_{t-s} + \Delta FD_{t-s} + \Delta MS_{t-s} + \Delta INF_{t-s} + \Delta INT_{t-1} + ECM_{t-1} + \mu_t \quad (15)$$

Where the variables are defined in Equation (10).

The Johansen cointegration specification

The finding that many macro time series may contain a unit root has spurred the development of the theory of non-stationary time series analysis. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables. The purpose of the cointegration test is to determine whether a group of non-stationary series are cointegrated or not. Consider a VAR of order *p*:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t \quad (16)$$

Where y_t is a -vector of non-stationary I(1) variables, x_t is a -vector of deterministic variables, and ε_t is a vector of innovations. We may rewrite this VAR as :

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i y_{t-i} A_p y_{t-p} + Bx_t + \varepsilon_t \quad (17)$$

where :

$$\Pi = \sum_{i=1}^{p} A_i - I, \ \Gamma_i = -\sum_{j=i+1}^{p-1} A_p + Bx_t + \varepsilon_t \quad (18)$$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank *r < k*, then there exist *k < r,* matrices *α* and *β* each with rank *r* such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I(0). *r* is the number of cointegrating relations (the cointegrating rank) and each column of *β* is the cointegrating vector. The elements of are known as the adjustment parameters in the VEC model. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π.

Forecast error variance decomposition

A shock to any variable in the vector error correction (VEC) model not only directly affects the variable but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VEC. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VEC, variance decomposition separates the variation in an endogenous variable into the component shocks to the VEC. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VEC. The general form of the VECM for estimating the variance decomposition is therefore expressed as:

$$LnINT_t = \sum_{k=1}^{r} \alpha_{i,k} v_{k,t-p} + \sum_{s=1}^{p} \phi_{1,s} LnG_t + \sum_{s=1}^{p} \phi_{2,s} LnFD_{t-s} + \sum_{s=1}^{p} \phi_{3,s} LnMS_{t-s} + \sum_{s=1}^{p} \phi_{4,s} LNINF_{t-s} + \sum_{s=1}^{p} \phi_{5,s} LnINT_{t-1} + \mu_t \quad (19)$$

where: *p* □*l*(is the optimal lag length of the VAR), $\alpha_{i,.k}$= the adjustment coefficients

$v_{k,t-p}$= is the cointegrating vector, μ_i = intercepts

The amount of forecast error variance of variable *j* accounted for by exogenous shocks to variable *k* is given by $\omega_{jk,h}$:

$$\omega_{jk,h} = \sum_{i=0}^{h-1} (e_j' \Theta_i e_k)^2 / MSE[y_{j,t}(h)] \quad (20)$$

Where MSE is the mean square error (MSE) of an estimator and is one of many ways to quantify the difference between values implied by an estimator and the true values of the quantity being estimated. MSE is a risk function, corresponding to the expected value of the squared error loss or quadratic loss. MSE measures the average of

Table 1. Summary statistics of variables applied in the regression analysis.

	Mean	Median	Maximum	Minimum	Std.Dev.	Obs
LFD	0.111193	0.066115	0.50274	-0.37609	0.182012	37
LINF	1.198114	1.147584	1.862203	0.538775	0.326202	37
LGEXP	10.67595	10.44326	12.26543	8.95612	1.019011	37
LMS	10.7536	10.5844	12.42014	8.990916	1.059701	37
LINT	0.913497	1.004665	1.366273	0.425974	0.289786	37

Source: Author's computation with data derived from CBN statistical bulletin using econometric views 6.0.

the squares of the errors. The error is the amount by which the value implied by the estimator differs from the quantity to be estimated.

The variance decomposition is displayed in a table format which displays a separate variance decomposition for each endogenous variable. A column in the Table gives the forecast error of the variable at the given forecast horizon. The source of this forecast error is the variation in the current and future values of the innovations to each endogenous variable in the VAR. The remaining columns give the percentage of the forecast variance due to each innovation, with each row adding up to 100. As with the impulse responses, the variance decomposition based on the Cholesky factor can change dramatically if you alter the ordering of the variables in the VAR. For example, the first period decomposition for the first variable in the VAR ordering is completely due to its own innovation.

PRESENTATION AND DISCUSSION OF RESULTS

The characteristics of the data series used in the regression analysis are presented in Table 1. The table reports the summary of statistics used in the analysis. It provides information about the means and standard deviations of the main variables. The mean value of log of interest rate stood at 0.913 while the mean of the log of fiscal deficit and monetary supply stood at 0.111 and 10.75 respectively.

The variables for our analysis were subjected to two types of unit roots test to determine whether they are unit roots or stationary series. The tests employed were the ADF test and the Phillips-Perron test (PP) test. For the ADF and PP tests, two models are considered viz, with constant, with time trend. The null in both the ADF and PP test is the presence of unit root.

The ADF results in Table 2 show that 99% of the variables are integrated of order one in the two models of unit root test considered. Only one variable was found to be significant at its level and a reasonable number of the other variables were at the 5% level. One exception was however observable, log of government expenditure (LGEXP). The LGEXP was found to be stationary and significant at 5% level in the model that includes a constant and a linear time trend at levels but insignificant in the model that includes only a constant. One interesting feature noted in the results was that all the variables were stationary in model with constant as well as constant and linear time trend at the first difference level.

The PP test statistics reported in Table 3 reinforces the result in the model that include only constant in the ADF test and also supported those models that include a constant and a linear time trend. The PP test supports the presence of unit roots in nearly all the series. The LGEXP were found to be stationary and significant at 5% level in the model that includes a constant and a linear time trend at levels but insignificant in the model that includes only a constant. It is evident from Tables 2 and 3 that the variables become stationary series when appropriately differenced. From the two types of integration tests carried out (above), it could be concluded that all the variables in our models contain unit roots. Therefore, we can safely proceed to use the co-integration method in analyzing our models as conventional regression models will generate spurious results due to the integration level of the series. Following the findings that the data series are by nature, mostly non-stationary stochastic processes, econometric developments regarding the concepts of cointegration are particularly opposite in testing for equilibrium. Accordingly, the long run properties of the variables in the behavioural equations were examined using the Engle-Granger two-step procedure.

Presented in Table 4 are the results of the unit root tests of the residuals of the static long run models. The regression residuals have zero mean, and as they are not expected to have deterministic trend, the unit roots exercise were conducted by excluding both the models that includes constant and constant with time trend. The ADF test statistics and the Phillip-Perron statistics suggest that the disequilibrium errors are mostly I(0), and as such, the variables in the static equations are cointegrated.

In view of the problems with the Engle-Granger framework for testing cointegration, the results were validated using the Johansen (1991, 1995) approach. The Johansen's framework provides the number of cointegrating equations and estimates of all cointegrating vectors in the multivariate case. The Johansen cointegration test results are presented in the Tables. The trace test and the max-eigen test were conducted to establish the number of cointegrating relations in each of the equations. The trace test results are presented in the

Table 2. Table of the observed result of the augmented dickey fuller test (ADF)*.

Variables	Level		First difference	
	Model 1	**Model 2**	**Model 1**	**Model 2**
LFD	-3.20642	-4.67947	-5.84943	-5.86981
LGEXP	-0.77383	-4.30895	-7.14852	-7.07677
LINF	-3.54217	-3.52697	-6.36578	-6.30673
LINT	-1.98285	-1.95053	-2.84996	-3.08591
LMS	-1.34321	-2.44379	-3.38974	-3.40472

*The Null hypothesis is the presence of unit root. Model 1 includes a constant while model 2 includes a constant and a linear time trend. Lags were selected based on Schwarz Information Criterion. *, **, *** indicate significance at 1, 5, and 10% respectively. Econometric views 6.0 was used in the derivation.

Table 3. Table of the observed result of the Phillips-Perron Test (PP)*.

Variables	Level		First Difference	
	Model 1	**Model 2**	**Model 1**	**Model 2**
LFD	-3.17008	-4.54522	-13.1983	-14.133
LGEXP	-0.66233	-2.14895	-7.12546	-7.05476
LINF	-3.29075	-3.27206	-13.7516	-13.3734
LINT	-1.42665	-1.52242	-6.96867	-7.09702
LMS	-0.78309	-1.90896	-3.42703	-3.42266

The null hypothesis is the presence of unit root. Model 1 includes a constant, model 2 includes a constant and a linear time trend. The Bandwith was chosen using Newey-West method with Barttlet Kernel spectral estimation, **, *** indicate significance at 1, 5 and 10% respectively. Econometric views 6.0 was used in the derivation.

Table 4. Table of observed result of the unit root test of residual of ECM variables.

Equation	Augmented dickey fuller test	Phillips-Perron test
Interest rate equation	-5.2106	-5.2115

(1) Lags were selected based on Schwarz Information Criterion in the ADF test (2) The Bandwith was chosen using Newey-West method with Barttlet Kernel spectral estimation in the Phillip-Perron test (3) *, **, *** indicate significance at 1%, 5%, and 10% respectively. Econometric views 6.0 was used in the derivation.

first part of the table while the max-eigen results were presented in the second part of the table. Test results indicate the existence of one cointegrating equation in the equations at the 1 and 5% significance level. In addition, the normalized cointegrating coefficients show that the variables in the equations are relatively important. The consistency in the test results confirms the existence of long run relationship among the exogenous and dependent variables in the model. As the data series are non-stationary and the vector of variables in the equations appear to be cointegrated, execution of the second phase of the Engle-Granger technique led to the estimation of error-correction forms of the stochastic equations. The equations represent the short-run behaviour and the adjustment to the long run models. The residuals from the cointegrating regressions lagged one period were used as error correction mechanism in the dynamic equations. The ordinary least squares (OLS) estimation method was used as it is an essential component of most other estimation techniques. In addition, the OLS remains one of the most commonly used methods in econometric investigations involving large models. Estimates of the preferred specifications obtained using general-to-specific method are presented in Table 5 and discussed below. The results were evaluated using conventional diagnostic tests.

The general discussion of the error correction models is useful here. All the diagnostic test statistics are quite satisfactory. The magnitude of the coefficients confirms the absence of redundant regressors. Judged by the significance of the t-statistics, the coefficients are well determined. The disequilibrium error term, ECM_{t-1}, is statistically significant and negative (as expected) in the equations. The significance of the error terms confirms

Table 5. Table of observed result of the johansen multivariate cointegration test results for the interest rate equation.

Sample(adjusted): 1971 2006				
Included observations: 36 after adjusting endpoints				
Trend assumption: No deterministic trend (restricted constant)				
Series: LINT LGEXP LFD LMS LINF				
Lags interval (in first differences): No lags				
Unrestricted cointegration rank test				
Hypothesized		**Trace**	**5 (%)**	**1 (%)**
No. of CE(s)	Eigenvalue	Statistic	Critical value	Critical value
None **	0.809525	109.727	76.07	84.45
At most 1	0.501973	50.03044	53.12	60.16
At most 2	0.30273	24.93483	34.91	41.07
At most 3	0.23501	11.95387	19.96	24.6
At most 4	0.062144	2.309734	9.24	12.97
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
Hypothesized		**Max-eigen**	**5 (%)**	**1 (%)**
No. of CE(s)	Eigenvalue	Statistic	Critical value	Critical value
None **	0.809525	59.69652	34.4	39.79
At most 1	0.501973	25.09561	28.14	33.24
At most 2	0.30273	12.98097	22	26.81
At most 3	0.23501	9.644132	15.67	20.2
At most 4	0.062144	2.309734	9.24	12.97
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels				

Source: Author's computation from cointegration test using econometric views 6.0.

the existence of long run relationship between the variables in the error correction model. Of particular interest is the coefficient on the lagged ECM in the interest rate equation. The ECM induces about 83% adjustment per period in these equations. In addition, the equation is statistically significant and the overall statistical fit is good. The marginal significance level of the F-statistics for most of them is zero. Hence, the null hypothesis of the F-statistics is rejected for all choices of significance level. Therefore, the conclusion is that, as groups, the regression coefficients are significantly different from zero. The high value of the Durbin-Watson (DW) in each case indicates absence of autocorrelation. Finally, the relatively low value of the standard error of the regressions is a clear evidence of the goodness of fit of the equation.

In the interest rate equation result presented in Table 6, the coefficient of government expenditure is positive in the second lag, indicating a short run effect of 0.229, with a further adjustment after a one year lag of 0.344. The coefficient of the fiscal deficit variable is positive and statistically significant. The result indicates that the elasticity of fiscal deficit with respect to interest rate is 0.114. This result is consistent with Cebula (2005) and Abderrezak (1987) that large deficit causes higher interest rates. In addition, money supply in the second period lag has an inverse relationship with interest rate in Nigeria. A 1% increase in money supply is capable of decreasing interest rate by about 0.48% in Nigeria during the study period. In addition, there exist a positive and significant relationship between inflation and interest rate in Nigeria. A 1% increase in the level of inflation is capable of stimulating interest rate by about 0.092% at the 10% level of significance. The sample goodness of fit measure, the adjusted R^2, indicates that 55.9% of the variation in interest rate in Nigeria is attributable to the regressors.

Impulse response analysis and forecast variance decomposition

Figure 1 (Appendix) shows that the effect of fiscal deficit, government expenditure and inflation impulse, on interest rate are negative for the period under study. Only the impulses from money supply on interest rate generates positive impulses with it making full impact from the 7th period. In the variance decomposition of the interest rate result presented in Table 1 (Appendix), the estimates of

Table 6. Parsimonious model of interest rate equation.

Dependent Variable: D(LINT)				
Method: Least Squares				
Date: 09/09/08 Time: 13:07				
Sample(adjusted): 1974-2006				
Included observations: 33 after adjusting endpoints				
	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
C	0.009581	0.029643	0.323204	0.7499
D(LGEXP(-2))	0.229169	0.137899	1.661865	0.1121
D(LGEXP(-3))	0.344331	0.148266	2.322391	0.0309
D(LFD(-3))	0.114707	0.086903	1.319934	0.2018
D(LMS)	-0.345192	0.218833	-1.577425	0.1304
D(LMS(-2))	-0.479093	0.265719	-1.803011	0.0865
D(LINF)	-0.092771	0.048222	-1.923840	0.0687
D(LINF(-2))	-0.088251	0.044615	-1.978051	0.0619
D(LINF(-3))	-0.122812	0.040798	-3.010268	0.0069
D(LINT(-1))	1.065569	0.427115	2.494805	0.0215
D(LINT(-2))	0.304673	0.162757	1.871951	0.0759
D(LINT(-3))	0.660788	0.138171	4.782406	0.0001
ECM2(-1)	-0.821744	0.463875	-2.655337	0.0152
R-squared	0.724483	Mean dependent var		0.019110
Adjusted R-squared	0.559174	S.D. dependent var		0.101117
S.E. of regression	0.067136	Akaike info criterion		-2.277082
Sum squared resid	0.090145	Schwarz criterion		-1.687549
Log likelihood	50.57185	Durbin-Watson stat.		1.994232
F-statistic	0.001808			

Source: Regression results from analysis using econometric views 6.0.

the future changes in the variables reveal that fiscal deficit explains about 15.54% in of the future changes in the interest rate in Nigeria. This is followed by government expenditure which explain about 4.88% of the future changes in the interest rate in Nigeria. The interest rate variable was however, found to explain about 74.57%.

SUMMARY AND CONCLUSION

This study was done to determine the fiscal deficits-interest rates relationship in the Nigerian context from 1970 – 2006. After establishing the unit root status of the variables in the structural equation and the existence of cointegration, the OLS two-stage approach as suggested by Engle-Granger (1987) was utilized in deriving the short run and long run estimates. The structural analysis was done using the impulse response analysis and forecast error variance decomposition to trace the one-time shock to one of the innovation in current and future values of the endogenous variables. Empirical evidence emerges that the coefficient of government expenditure is positive in the second lag, indicating a short run effect of 0.229, with further adjustment after one year lag of 0.344. The coefficient of fiscal deficit variable is positive and statistically significant. This result indicates that the elasticity of fiscal deficit with respect interest rate is 0.114, indicating that large budget deficit causes higher interest rates in Nigeria. A 1% increase in money supply is capable of decreasing interest rates by 0.48% during the study period. In addition, there exists a positive and significant relationship between inflation and interest rates. A 1% increase in the level of inflation is capable of stimulating interest rate by 0.092%. It is recommended that monetary financing of government deficits should be de-emphasized, since is accentuates the problem of inflation. In the alternative, bonds should be used to finance government extra-budgetary expenses. It is also important for government to budget in line with resource availability.

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APPENDIX

Table 1. Variance decomposition of the interest rate equation.

	S.E.	LINT	LGEXP	LFD	LMS	LINF
1	0.095527	100	0	0	0	0
2	0.116672	96.99737	0.549945	2.322163	0.066551	0.063975
3	0.148542	87.9227	0.474082	9.028925	0.359462	2.214829
4	0.170078	85.49625	0.741728	10.62883	0.284111	2.849081
5	0.182297	83.10019	1.663729	11.96825	0.331526	2.936303
6	0.191019	80.34623	2.760788	13.2731	0.684418	2.935468
7	0.197446	78.03286	3.725898	14.19015	1.149527	2.901565
8	0.202053	76.36234	4.356228	14.83125	1.563315	2.886862
9	0.205325	75.26015	4.705028	15.26842	1.869597	2.896802
10	0.207579	74.5748	4.883998	15.54655	2.079549	2.915099

Source: Regression results from analysis using econometric views 6.0.

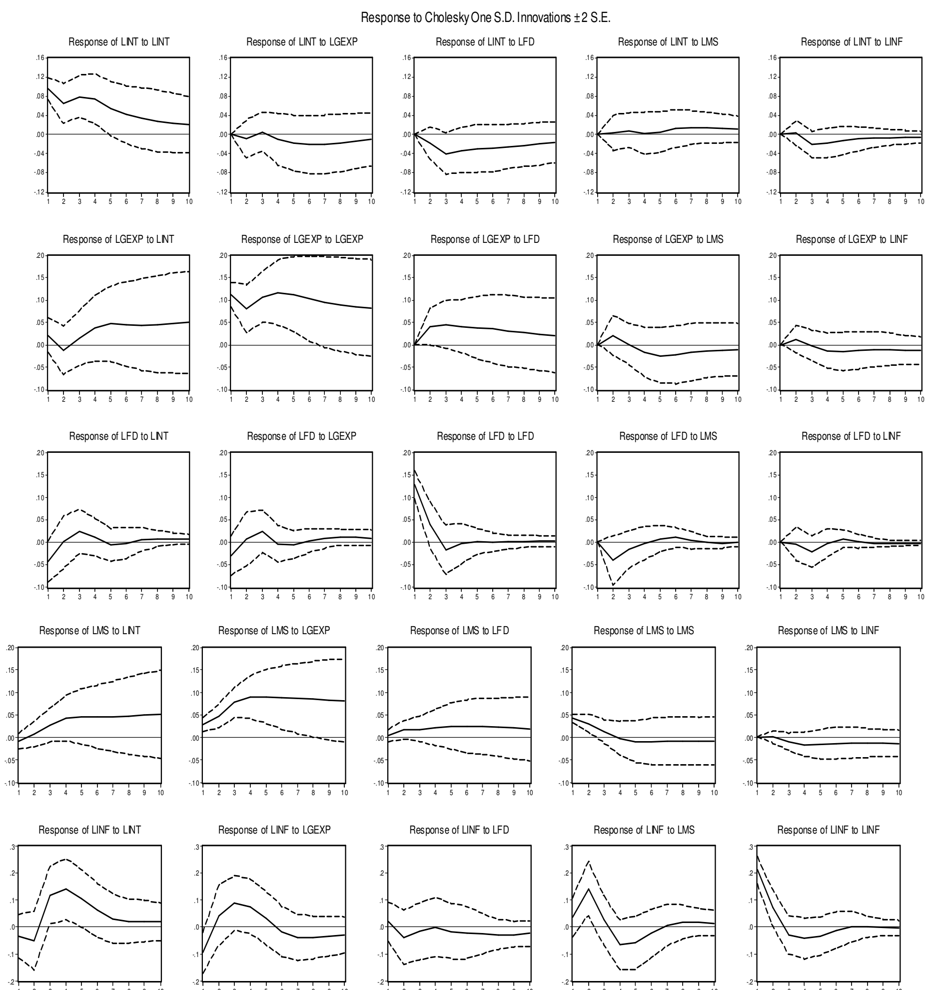

Figure 1. Accumulated impulse response functions for the interest rate equation. The dashed lines are 95% bootstrap confidence bounds. The effects of fiscal deficit, government expenditure and inflation impulses on interest rate are negative for the period under consideration. Only the impulses from the money supply on interest rate generate positive impulses on the interest rate with it making its full impact from the seventh period.