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An Error Correction Model Approach.**

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62- Modeling Nigerian Government Revenues and Total Expenditure: An Error Correction Model Approach.

By

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ABSTRACT

The national total expenditure of a country is precipitated on several factors of which revenue generated could be one and very significant. This paper therefore examines the contribution of some selected sources of Nigerian government revenue to total national expenditure. Secondary data sourced and collected from Nigerian Statistical Bulletin of the Central Bank for a period of thirty nine (39) years were used. Statistical and econometric techniques used for the data analysis are unit root test, cointegration test and the error correction model (ECM). Results showed that the original variables are non stationary but are stationary at first difference. Further investigations resulted into the use of the error correction model whose parameters' estimation was improved by the use of Feasible Generalized Linear (FGLS) Estimator. Findings revealed significant contribution of oil revenue, federation account (federal allocation) and federal retained revenue to the Nigeria total expenditure and that Nigeria may need to be very cautious as non-availability of revenue from these sources points to non-expenditure. These become very essential if the country will have to achieve its developmental goals and objectives towards development and economic growth, among other things.

Keywords: Unit Root Test, Cointegration Test, Error Correction Model, Feasible Generalized Linear Estimator.

1.0 INTRODUCTION

Several fiscal policies have been postulated by numerous authors as to the direction of flow of the economic fiscal policy transpirations based on the behavior of macroeconomic variables like Gross Domestic Product (GDP), inflation rate etc. (Friedman, 1978; Buchanan and Wagner, 1978; Peacock and Wiseman, 1979; Musgrave, 1966; Meltzer and Richard, 1981; Barro, 1990; Romer, 1990; Bloom et al, 2001, among others) without adequate cognizance to the cash flow of the economy in terms of different sources of revenue and total national expenditure. Fiscal policy, a short-run issue having long lasting economic effects, is viewed as an instrument used to mitigate short-run imbalances of output and employment and bring the economy closer to a potential output (Zagler and Dürnecker, 2003). This can be as a result of changes in expenditures, revenues, or both. On the revenue side, taxes can distort private agents' decisions with respect to factor accumulation and supply. Turnovsky (1996) emphasized that as in the endogenous growth, framework externalities are always present; distorting taxation can internalize the effect of the externality in private decision rules, and thus induce the efficient allocation of resources.

In the short run, fiscal policy can be considered expansionary when public expenditures exceed public revenues and the resulting deficit can be interpreted as a means to finance additional government expenditures. If these expenditures are considered growth enhancing, then a government deficit exhibits an indirect effect on long-term economic growth. In a Ricardian world, however, where agents view the deficit simply as taxes delayed, there should be no difference between tax and deficit finance of government expenditures, as long as the tax structure remains unchanged in the future (Ludvigson, 1996). As argued by Araújo and Martins (1999), running a debt-financed deficit can induce the government to absorb additional resources from the private sector, which could have been used instead for the accumulation of private physical capital. If the revenue raised in that fashion is spent in a less productive way than it would be by the private sector, the overall growth effect would be negative.

Current trends in fiscal policy has proposed various ways of reducing expenditure that contributes none/little to the developmental goals of national economy. Alongside this thought is the adoption of Medium Term Expenditure Framework (MTEF, 1998) as part of budget reforms to encourage cooperation across various tiers of government in planning and strategizing for reduction of wasteful expenditure. The effect of a change in government spending on aggregate activity is a central question in the economic theory. However,

there appears to be no uniform consensus on this issue. In particular there is no clear understanding of the effect on government revenues, which is aggregated as cash inflow. This has always been a pivotal cause of out-lashes in major sections of public offices.

Understanding various sources of government revenues and expenditure especially in Nigeria important becomes important as this presently appears to be the bedrock of nation's economy. Consequently, in this work, effort is made to study the inter-temporal relationship among these different sources of Nigerian government revenue and total expenditure and at the same time examine effect or contribution of the formal on the latter using a model based on the assumption that government generated income (revenue) enhances spending (expenditure).

2.0 LITERATURE REVIEW

The growth impact of fiscal policy has generated several comments in both theoretical and especially empirical studies. There is a popular assertion in the empirical literature that public spending is negatively correlated with economic growth due to inefficiency of the public sector especially in the developing countries where large proportion of public spending is attributed to non-development expenditure like defense and interest payments on debt (Husnain et al., 2011). Moreover, most of these studies paid more attention to developed economies and the inclusion of developing countries, in case cross-country studies generate enough degrees of freedom in the course of statistical analysis (Aregbeyen, 2007).

Several hypotheses have been proposed to describe the inter-temporal relationship between government revenues and expenditures. First, the tax-and-spend hypothesis advanced by Friedman (1978) contended that changes in government revenues lead to changes in government expenditures. Friedman inferred that tax increases would only lead to expenditure increases, resulting in an inability to reduce budget deficits. Curiously, Buchanan and Wagner (1978) argued for the opposite relationship that decreased revenues lead to increased spending as consumers demand more programs. Empirically, this hypothesis is characterized by unidirectional causality running from government revenues to government expenditures.

The spend-and-tax hypothesis proposed that changes in government expenditures lead to changes in government revenues. Peacock and Wiseman (1979) advocated that temporary increases in government expenditures due to economic and political crises could lead to

permanent increases in government revenues from taxation, often called the “displacement effect”. Empirically, the spend-and-tax hypothesis is characterized by unidirectional causality running from government spending to government taxes.

Musgrave (1966) as well as Meltzer and Richard (1981) hypothesized that voters usually compare the marginal benefits and marginal costs of government services when formulating a decision in terms of the appropriate levels of government revenues and government expenditures. Thus, revenue and expenditure decisions are jointly determined under this fiscal synchronization hypothesis. Empirically, this hypothesis is characterized by contemporaneous feedback or bidirectional causality between government revenues and government expenditures.

A fourth hypothesis stated by Baghestani and McNown (1994) related to the institutional separation of the expenditure and taxation decisions of government. This perspective suggested that revenues and expenditures are independent of each other. Empirically, this hypothesis is characterized by non-causality between government revenues and government expenditures.

Although the tax-and-spend, spend-and-tax, fiscal synchronization, and institutional separation hypotheses are easy to distinguish from one another, different studies on the same country result in different conclusions. The results from these empirical studies are sensitive to the sample period under examination, the degree of temporal aggregation, the inclusion of macroeconomic controls, and the choice of econometric methodology. In the case of the United States, Blackley (1986), Ram (1988), and Hoover and Sheffrin (1992) provided evidence to support the tax-and-spend hypothesis, while Anderson et al. (1986), Furstenberg et al. (1986), Jones and Joulfaian (1991), and Ross and Payne (1998) found support for the spend-and-tax hypothesis. Manage and Marlow (1986), Miller and Russek (1990), and Owoye (1995) suggested the fiscal synchronization hypothesis is valid for the United States, while Baghestani and McNown (1994) supported the institutional separation hypothesis.

In a study of Organisation for Economic Co-operation and Development (OECD) countries, Joulfaian and Mookerjee (1991) found support for the tax-and-spend hypothesis in Italy and Canada; support for the spend-and-tax hypothesis in the United States, Japan, Germany, France, the United Kingdom, Austria, Finland, and Greece; and support for the fiscal synchronization hypothesis in Ireland.

3.0 METHODOLOGY

As mentioned earlier, this study focuses on modeling Nigerian total national expenditure (TotExp) and selected sources of revenue which are oil revenue (OilRev), non-oil revenue (NonOilRev), federation account (FedAcc) and federal government retained revenue (FedRetRev). Yearly secondary data on these variables were sourced and collected from Nigerian Statistical Bulletin of the Central Bank for a period of thirty nine (39) years between 1970 and 2008. The selection of these periods is based on the available information as to studying the relationship between cash flow from the aforementioned sources from which the Nigerian monetary flow is estimated.

The generic linear regression model to examine the effect or contribution of the various sources of revenue on the total expenditure takes the form:

$$\text{TotalExp} = \beta_0 + \beta_1\text{OilRev}_t + \beta_2\text{NonOilRev}_t + \beta_3\text{FedAcc}_t + \beta_4\text{FGRetRev}_t + \varepsilon_t \quad (1)$$

Statistical and econometric techniques used for the data analysis are unit root test, cointegration test and the error correction model (ECM).

3.2 UNIT ROOT TESTS

The most widely adopted test of stationarity (or non-stationarity) over the past several years is the unit root test. Test of the stationarity of the variables is paramount to avoid a spurious result. There are several methods for testing the presence of unit roots. The most widely used methods are Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), which were both applied in this study (Gujarati, 2003).

3.3 COINTEGRATION TEST

The cointegration analysis is to be performed after the order of integration of each variable has been determined. This is to examine whether the time series of these variables display a stationary process in a linear combination $y = f(x)$. Cointegration means that data from a linear combination of two or more variables can be stationary despite those variables being individually non-stationary (Gujarati, 2003). A presence of cointegration implies the existence of a long-term relationship between the endogenous and the exogenous variables.

A number of methods for testing cointegration have been proposed in the literature. This study utilizes the Augmented Engle-Granger (AEG) test. This test is the same as DF or ADF unit root test on the residuals estimated from the co-integrating regression. The procedure of the EG or AEG is to (i) estimate the long-run generic model as in (1), (ii) obtain the residuals

of the model, and (iii) use the DF or ADF tests on the residual. Cointegration is said to exist if the individual exogenous variables are non-stationary and the unit root hypothesis is rejected for the residual of the error term of the linear combination.

3.3 ERROR CORRECTION MODEL

The presence of cointegration indicates that at least one of the variables tested react to deviations from the long-run relationship. Here, the role of revenues in correction for disequilibrium was investigated. The dynamic causal link (or short-run dynamics) between the revenue variables and total expenditure was modeled as:

$$\Delta\text{TotalExp}_t = \alpha + Y_1\Delta\text{OilRev}_t + Y_2\Delta\text{NonOilRev}_t + Y_3\Delta\text{FedAcc}_t + Y_4\Delta\text{FGRetRev}_t + Y_5\text{ECT}_{t-1} + v_t \quad (2)$$

where ECT_{t-1} is the revenues' error correction term (lagged residual of static regression equation (1)).

The significance of ECT_{t-1} , implies that the lagged revenue variables are important in predicting current movement of the total expenditure and total expenditure adjusts to the previous equilibrium error and negativity of ECT_{t-1} is an indication of movement back to equilibrium.

The Ordinary Least Square Estimator (OLS) and the Feasible Generalized Least Square Estimators (FGLS) namely; Cochrane Orcutt Estimator of the Time Series Processor (TSP, 2005) were used to estimate the model parameters.

4.0 EMPIRICAL RESULTS AND DISCUSSION

4.1 UNIT ROOT TEST

The results of the unit root test of the variables are provided in Table 1. From the table, it can be seen from the use of Phillip-Perron and Augmented Dickey-Fuller unit root tests that all the original variables are non-stationary but their first differencing are. Thus, they are integrated of order one i.e. $I(1)$. This is also verified in the table 2 employing both the Augmented Dickey-Fuller and Phillip-Perron tests of unit root.

TABLE 1: SUMMARY OF THE UNIT ROOTS TEST RESULTS

VARIABLES	Original		First Differencing	
	PP	ADF	PP	ADF
TotExp	(7.2889)	(3.7819)	(-8.7364)	(-9.3367)

	0.99	1	0.01**	0.000***
OilRev	(2.9161)	(3.3182)	(-2.5668)	(-4.1358)
	0.99	1	0.3518	0.0055***
NonOilRev	(2.4846)	(3.3182)	(-8.1696)	(-8.0192)
	0.99	1	0.01**	1.683e-6***
FGRetRev	(11.0299)	(5.0579)	(-6.4414)	(-6.081)
	0.99	1	0.01**	7.338e-04***
FedAcc	(6.3651)	(2.3747)	(-3.8696)	(-3.3971)
	0.99	1	0.02437**	0.05169*

Source: Computer Output.

Note: (i) ***, ** and * indicate 1%, 5% and 10% level of significance respectively.
(ii) Values in parenthesis refer to “t-statistics”.

4.2 COINTEGRATION TEST

The estimated linear regression model of the non-stationary original variables according to (1) is obtained as:

$$\widehat{\text{TotalExp}} = 27753.755 - 0.106*\text{OilRev} - 0.069*\text{NonOilRev} + 0.243*\text{FedAcc} + 0.927*\text{FedRetRev} \quad (3)$$

Using the residual based test, the AEG test gives a statistics value of -3.5054 with an asymptotic p-value of 0.03873 which suggests the stationarity of the error term of the model in equation (1) at 5% level of significance. Hence, there exists a long-run equilibrium between the variables.

4.3 ERROR CORRECTION MODEL (ECM)

The OLS estimation of the model parameters of equation (2) is provided in Table 2. From the table, it can be seen that the estimated coefficient of ECT_{t-1} , -7.1% , is not significant at all levels of significance; this could be a consequence of the presence of mild autocorrelated error terms as suggested by the Durbin-Watson statistic value of 1.531. Hence, the need for the correction of autocorrelation of the error terms by Cochrane-Orcutt (CORC) method. The results of the parameter estimation of the model are also shown in Table 2 very clearly. Thus, CORC estimation of the model parameters of equation (2) is obtained as:

$$\Delta\widehat{\text{TotExp}} = 25101.5 - 0.033\Delta\text{NonOilRev} - 0.083\Delta\text{OilRev} - 0.115\Delta\text{FedAcc} + 1.116\Delta\text{FedRetRev} - 63.885EC_{t-1} + 0.772 \hat{u}_{t-1} \quad (4)$$

The results of the CORC estimation shown in Table 2 reveal significant contribution of oil revenue, federation account (federal allocation) and federal retained revenue to the Nigeria total expenditure. The non-significance of the constant term and the non-oil generated revenue show that the total expenditure largely relies on these significant variables and thus, the country may need to be very cautious as non-availability of revenue from these sources has a direct pointer to non-expenditure. Also, a very crucial worry as the non-oil generated revenue does not contribute significantly to Nigerian total expenditure. Does this then mean no oil no expenditure? These findings thus become very essential if the country will have to achieve its developmental goals and objectives towards development and economic growth, among other things.

The significant contribution of the estimated coefficient of ECT_{t-1} suggests that the last period (year) disequilibrium in revenues is corrected in the following year by 63.88%. This speed of adjustment of the total expenditure to equilibrium is averagely paced.

TABLE 2: ESTIMATES OF THE MODEL PARAMETERS OF THE ERROR CORRECTION MODEL

Model Parameters	Estimators					
	OLS			CORC		
	Estimate	Std. Error	Sig.	Estimate	Std. Error	Sig.
Constant	11927.563	9715.41	0.229	25101.5	30761.1	0.414
Δ OilRev	-0.042	0.033	0.217	-0.083	0.022	0.00***
Δ NonOilRev	0.077	0.148	0.608	-0.033	0.088	0.706
Δ FedAcc	-0.131	0.097	0.185	0.115	0.064	0.073*
Δ FedRetRev	1.116	0.098	0.000***	1.1161	0.071	0.00***
ECT_{t-1}	-0.071	0.190	0.709	-0.639	0.157	0.00***
RHO				0.772	0.115	0.00***
R^2	93.6%			95.47%		
Adjusted R^2	92.0%			94.56%		
Durbin-Watson Statistics	1.531			1.87		
Prob(F-stat.)	0.00***			0.00***		

Source: Computer Output.

Note: ***,**and* indicate significance at 1%, 5% and 10% level of significance respectively.

5.0 CONCLUSION AND POLICY IMPLICATION

In this study, using annual data for government expenditures and revenues over the period 1970 to 2008 and modern time series econometric techniques, it has been established that expenditures and revenues share a long-run relationship, indicating that deviations in the short-run total expenditure will be adjusted towards the long-run value. However, from the value of the coefficient of the error correction term (63.88%), it has been observed that this adjustment is well paced and that the total expenditure will take a considerably short period to be in equilibrium with the revenues. The government total expenditure and revenues exhibit a stable relationship in the long run; and that it can be concluded that the revenue variables - oil revenue, federal statutory allocation and federal government retained revenue have significant contribution to Nigeria total expenditure. Consequently, they could be very instrumental to stabilize the Nigeria monetary activities.

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