OUTPUT - EXPENDITURE RELATION: A MACROECONOMETRIC EVIDENCE FROM NIGERIA

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BACKGROUND OF STUDY

The World Bank and the IMF appear to be involved in a development-policy controversy in recent years on the use of fiscal policy not only for economic stabilization but also to promote economic growth and increase per capita income. A major issue in this debate is not unconnected with the effect of the components of public expenditure (such as capital and recurrent) on economic growth. Policy makers and some researchers have argued that spending on growth-stimulating activities would enhance future revenue and justify the provision of "fiscal space" in the budget. But it appears that there are no simple ways to identify the growth maximizing composition of public expenditure. The World Bank (2006, 2007) was of the contention, in two policy reports, that governments carrying out fiscal policy design should seek to ensure macroeconomic stability as well as promote growth and the long-run welfare of a country. These are not new policy thrusts in economic and finance theory, anyway. However, what is worthy of note is the resuscitation of interest and emphasis on the use of fiscal policy and not the long-trumpeted monetary policy of the IMF school. More specifically, the growth impact of the composition of public expenditure has been elevated as an important aspect of the design of fiscal policy that is consequently the focus of research interest. The current trend suggests a general model of fiscal policy and growth in an economy.

Semmler et al (2007) inter alia responded to the development policy debate spearheaded by the World Bank and the IMF and explored the effects of fiscal policy, including the composition of public expenditure, on economic growth, using a time series approach. Their primary interest in this paper was to explore whether countries could better use fiscal policy (and in particular, the level and composition of public expenditure) to promote sustainable increases in growth and welfare for low- and middle-income countries. Based on the modeling procedure suggested in Greiner, Semmler and Gong (2005), Semmler et al (2007) specified their model that recognized a government that taxed its citizens optimally and undertakes public expenditure on (a) education and health facilities, (b) public infrastructure such as roads and bridges, (c) public administration, (d) transfers and public consumption facilities, and (e) debt service. Their general aim was to

explore the impact of shifts in the composition of expenditure on long-run per capita income and other macroeconomic variables. The remote consideration was to set up the model in a way that allows a concerted study of whether fiscal policy is sustainable. The model was solved, and generally explored the impact of foreign aid, the allocation of human and public capital and fiscal expenditure on per capita income and other macro variables.

However, and regrettably too, the other macroeconomic variables, it can be gleaned from the study, excluded the inflation and employment, which are foremost in the economic stabilization policy thrusts. Many countries, it must be observed, have in the recent time pursued a policy of inflation targeting, while others have full employment of resources as a cardinal economic objective that drives their policy constructs. Others yet have economic growth as their overriding objective. It is advocated that a complete study should examine the influence of the nominated fiscal policy variable, namely government expenditure, on the macroeconomic indicators of growth, inflation and employment. This is the major thrust of this present study.

The IMF can be loosely termed an apostle of monetary policy in view of the conditionality it prescribes for needy economies over time. They bother more on the money or price variables such as money supply, exchange rates, and external reserves. Their prescription appears to favor monetary policy as the most potent tool of achieving economic growth, stable prices, employment, and balance of payment equilibrium. What has not augured well among countries may have been the way and manner IMF effect their conditionality and not necessarily their support for the efficacy of monetary policy, or the supremacy of monetary policy over fiscal policy in developing countries. Evidently, the role of monetary policy in economic causation has been severally examined in recent studies.

For instance, Ezirim, Amuzie and Elike (2010) investigated the relationships between the GDP, money supply and government expenditure in order to ascertain whether or not money matters, on one part; and whether monetary policy matters more than fiscal policy in developing countries or vice versa, on the other part. The paper adopted the Vector Autoregressive (VAR) modeling procedure implicated in the St. Louis Models as well as the Granger Causality tests. The results showed that causality flowed from money to the GDP variable but not strictly vice versa. Also the there was no causality between the fiscal policy variable and GDP. Thus, money, it was claimed by the study, was a causative variable in determining the magnitude and directions of economic activities in developing countries. As revealed, money supply was also noted to be causally prior to GDP as well as causally superior to government expenditure in economic causation. These findings made the study to agree with the monetarist that not only did money matters but it is the 'only thing' that matters. The findings suggested that whereas monetary policy should be emphasized both in the short- and long- runs; fiscal policy should only be emphasized in the longrun. However, in view of the

procedure employed, the study basically analyzed the short-run equilibrium relationships using VAR and causality models. A more robust explanation would include a long-run equilibrium analysis that informs the cointegration procedure to examine possible long-run equilibrium relationship among the variables.

Thus, in a follow-up study by Ezirim, et al (2012), extension was made to the previous work in a bid to: (a) determine whether or not monetary policy impacts aggregate output in the long-run; and (b) determine whether or not fiscal policy also impacts aggregate output in the long-run. The results indicated that both the real GDP and nominal GDP have long-run equilibrium relationships with money supply and total government expenditure. However, the money supply variable was seen to be positively and significantly related to the GDP while the government expenditure variable revealed an inverse but significant relationship with the real GDP. This appeared to suggest that not only does money matter, it matters more that the use of fiscal policy in economic causations. Thus, well ordered monetary policy would give rise to desired levels of economic performance. The above studies extolled the virtues of monetary policies over fiscal policy in economic causation in Nigeria. But one cannot just dismiss the age long contention of the Keynesians and by default, the World Bank, that fiscal policy is superior in economic causation simply on the evidence of two studies based on a single developing country, Nigeria. It behooves us in this study therefore to examine the real impact of government expenditure on the gross domestic product of typical developing countries like Nigeria. By default, it will further reveal the causation imperatives of fiscal policy in Nigeria.

OBJECTIVES OF THE STUDY

Three cardinal objectives are formulated for this study:

i. Determine whether or not fiscal policy (measured by government expenditure) impacts the gross domestic product of the country
ii. Determine the existence or otherwise of long-run equilibrium relationship between government expenditure and economic growth (growth in GDP).
iii. Determine the existence and direction of causality between GDP and total government expenditure.

METHODOLOGY

The Data. The data for this research relates to measurements over the indicated time period, the research data is described as time series data, that is, the information on variables of a study over various time periods. This time-based data adopted is secondary data since they are obtained from already existing publications, journals, financial statements, which constitutes secondary sources of information. The source of this research data however, is from Central Bank of Nigeria (CBN) publications, namely CBN Economic Reports, Annual Reports and Statement of Accounts, and Statistical Bulletin.

Descriptive Analytical Tools

Descriptive Statistical analyses are used to present the collected data and also to do preliminary analysis of the data. The study utilizes such measures as the mean, median, standard deviations, skewness and kurtosis, and the Jarque-Bera statistic. As in Amuzie (2011), the skewness is a measure of asymmetry of the distribution of the series around its mean. It is calculated as

$$S = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i - \bar{y}}{\hat{\sigma}}\right)^3$$

The skewness of a symmetric distribution, such as the normal distribution, is zero. Positive skewness means that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail. The Kurtosis measures the peakedness or flatness of the distribution of the series. It is calculated

$$K = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i - \bar{y}}{\hat{\sigma}}\right)^4$$

Also in Amuzie (2011), the kurtosis of the normal distribution is 3. If the kurtosis exceeds 3, the distribution is peaked (leptokurtic) relative to the normal; if the kurtosis is less than 3, the distribution is flat (platykurtic) relative to the normal. Jarque-Bera is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. It is calculated as:

$$\text{Jarque-Bera} = \frac{N}{6}\left(S^2 + \frac{(K-3)^2}{4}\right)$$

Under the null hypothesis of a normal distribution, the Jarque-Bera statistic is distributed as with 2 degrees of freedom. The reported Probability is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis—a small probability value leads to the rejection of the null hypothesis of a normal distribution (Amuzie 2011). The research work also uses of graphical analytical techniques such as line graphs.

Econometric Tools

Econometric modelling that gave rise to estimable equations is used to examine the relationship between the variables identified in the hypotheses. Estimation was done following the Ordinary Least Square Method while the Eviews and Microfit softwares were used. Analysis done includes global analysis (that reveals the overall utility of the models) and analysis of relative statistics that test the hypotheses. The study also conducts some diagnostic tests of the models specified. Accordingly the F-statistic, t-statistic and adjusted coefficient of determination are used to test the hypotheses. The Granger Causality test and the Johansen Cointegration tests were also carried out.

Model and Variables

The hypothesized relations can be captured by a number of econometric models. First the empirical literature is awash with the expressed relation between gross domestic product (GDP) and total government expenditure (TGE). Thus

$$GDPt = f(TGEt) \text{----------} (1)$$

And where total government expenditure is decomposed into capital and recurrent expenditure, the relation turns multiple in the functional form:

$$GDPt = f(CEXt, REXt) \text{ ----------} (2)$$

The expression above can be expressed explicitly in the form:

$$GDPt = \alpha 0 + \alpha 1 CEXt + \alpha 2\ REXt + Ut \text{----------} (3)$$

$$\alpha 1>0,\ \alpha 1>0$$

Where

CEXt = Capital expenditure of government over time, t
REXt = Recurrent expenditure of government over time, t
$\alpha 0$ = Intercept $\alpha 1 + \alpha 2$= Parameters or coefficients
Ut = Stochastic error term.
Other variables are as previously defined.

ESTIMATION RESULTS AND TEST OF HYPOTHESES

Stationarity Analysis Between GDPR, REXR, AND CEXR

The relationships between the gross domestic product variable (GDPR) and the public expenditure variables (REXR and CEXR) are estimated starting with the group unit root tests namely Levin, Lin & Chu t, Im, Pesaran and Shin W-stat, ADF - Fisher Chi-square, and PP - Fisher Chi-square test statistics. These are followed by the Unrestricted Cointegration Rank Tests (Trace and Maximum Eigenvalue) after the order of linear deterministic trend in order to determine the long run effects. The next were the study used the Generalized Method of Moments method to estimate the short-run effects. Finally the Pairwise Granger Causality Tests of the Granger procedure to determine the causal effects. The results of these procedures are summarized on Tables 1 through 6 respectively. These aided the test of relevant hypotheses.

Table 1 depicts the results of the group unit root tests of the variables: GDPR, REXR, CEXR. As shown, the results of the Levin, Lin & Chu t, Im, Pesaran and Shin W-stat, ADF - Fisher Chi-square, and PP - Fisher Chi-square test statistics indicate the absence of unit roots among the variables. These suggest that they are integrated jointly since the respective probabilities are less than alpha 0.05.and thus we cannot accept the hypotheses of no stationarity in all the cases.

TABLE 1
Group Unit Root Test: Summary - Series: GDPR, REXR, CEXR

Method	Statistic	Prob.**	Cross-Sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.34939	0.0004	3	77
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.29562	0.0000	3	77
ADF - Fisher Chi-square	30.0016	0.0000	3	77
PP - Fisher Chi-square	28.1011	0.0001	3	78

Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel
** Probabilities for Fisher tests are computed using an asymptotic
Chi -square distribution
. All other tests assume asymptotic normality.

Cointegration Between GDPR, REXR, AND CEXR being integrated as a group, the analysis was pushed further to ascertain whether the variables are co-integrated or not. Thus, the study employed the Unrestricted Cointegration Rank Tests (Trace and Maximum Eigenvalue) after the order of linear deterministic trend. The results of which are on Table 2 and 3 respectively.

TABLE 2
Unrestricted Cointegration Rank Test (Trace): Series: GDPR REXR CEXR Trend Assumption: Linear Deterministic Trend

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.702626	41.27900	29.79707	0.0016
At most 1	0.271898	10.95986	15.49471	0.2140
At most 2	0.114036	3.026987	3.841466	0.0819

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level;
**MacKinnon-Haug- Michelis (1999) p-values

From Table 2, it can be seen that the Trace Statistic is computed to be 41.27 while the critical value at alpha 0.05 is 29.8, which indicates a rejection of the null of no co-integrating equation. Thus the alternate hypothesis of one cointegrating

equation is accepted. Equally, the Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level (statistic = 30.32; critical value = 21.13). These results indicate that there exist a sustainable long run equilibrium relationship between the GDPR and the duo of REXR and CEXR.

TABLE 3
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.702626	30.31915	21.13162	0.0019
At most 1	0.271898	7.932868	14.26460	0.3856
At most 2	0.114036	3.026987	3.841466	0.0819

Series: GDPR REXR CEXR Trend assumption: Linear deterministic trend
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values

Table 4 depicts the long run cointegration equation showing the nature and magnitude of the observed long run relationships. The equation is normalized for GDPR – the dependent variable.

TABLE 4
Normalized Cointegrating Coefficients (Standard Error in Parentheses)

GDPR	REXR	CEXR
1.000000	33.20469	0.821355
	(4.17053)	(4.57943)

The normalized beta coefficient representing the long run relative statistical relationship between the GDPR and REXR is shown to be 33.2 and Standard error of 4.17, suggestion a t-statistic of 7.96. This is significant at 5% level. By implication, there exist a statistically significant relationship between the GDPR and the REXR variables. The sign implication suggests a positive relationship which agrees with a priori expectation. On the other hand the normalized beta coefficient representing the long run relative statistical relationship between the GDPR and CEXR is calculated to be 0.82 with a standard error of 4.57 (t-statistic = 0.179). The computed t-statistic is far from being significant at 5% significant

level. Thus though the relationship between GDPR and CEXR is positive as a priori expected, it is not statistically significant at the conventional 5% level.

Relative Short Run Relationship between GDPR AND REXR AND CEXR As stated earlier, the study employed the Generalized Method of Moments method to estimate the short-run relationship between GDPR and REXR and CEXR. The results are summarized on Table 5.

TABLE 5
Method: Generalized Method of Moments: Dependent Variable: GDPR Instrument specification: LNGDPR LNREXR LNCEXR; Constant Added to Instrument List

Variable	Coefficient.	Std. Error	t-Statistic	Prob.
REXR	7.175488	2.662265	2.695257	0.0148
CEXR	5.061116	3.199388	1.581901	0.1311

As can be seen, the beta coefficient representing the relationship between GDPR and REXR is 7.175, while observed t-statistic is 2.695 which is significant at 5% level (prob. = 0.014). Given these, we cannot accept a null hypothesis of no significant relationship between GDPR and REXR in the short run. More so, the observed relationship is positive, which is in line with a priori expectation. On the other hand, though the relationship between GDPR and CEXR is positive, it is not statistically significant at 5% level (Beta = 5.06; t-stat = 1.58; prob = 0.13). Thus we cannot reject the null hypothesis of no significant relationship between GDPR and CEXR in the short run.

Causality between GDPR AND REXR AND CEXR

That there exist relationships between variables does not necessarily imply causality. To test the existence of causality, the study employs the Granger Causality procedure to test the direction of causality among the nominated variables of GDPR, REXR, and CEXR. The results of the pairwise Granger Causality test are summarized on Table 6. It can be seen from the Table that REXR granger-caused GDPR (F= 3.57; prob = 0.033), On the other hand, GDPR does not granger-cause REXR (F=0.55; prob = 0.70). This implies that causality flows from REXR to GDPR and not vice versa. Thus we cannot accept a null hypothesis of no causal relationship between GDPR and REXR.

TABLE 6
Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
REXR does not Granger Cause GDPR	23	3.57586	0.0329
GDPR does not Granger Cause REXR		0.55324	0.7000
REXR does not Granger Cause GDPR	23	3.38777	0.0389
GDPR does not Granger Cause CEXR		0.38394	0.8165
CEXR does not Granger Cause REXR	23	2.01677	0.1472
REXR does not Granger Cause CEXR		0.51297	0.7274

Furthermore, it can also be seen from the Table 6 that CEXR granger-caused GDPR (F= 3.39; prob = 0.039). GDPR does not granger-cause CEXR (F=0.38; prob = 0.81). This implies that causality flows from CEXR to GDPR and not vice versa. Thus we cannot accept a null hypothesis of no causal relationship between GDPR and CEXR. In each of the two cases, there exists a uni-directional causality between GDPR and REXR and between GDPR and CEXR respectively. This implies there are no feedback effects, which agrees with *a priori* reasoning. It is noteworthy that from the Table there is no causal relationship between CEXR and REXR in the interaction with GDP. This goes to explain, in part, that the possibility of multicollinearity is remote, and as such, the observed causation flowing from REXR and CEXR to GDPR can be seen as plausible.

CONCLUDING REMARKS

The thrust of this study was to econometrically investigate the relationships between the various aspects of government expenditure, namely capital and recurrent expenditure, and the aggregate output of the country. The procedure included the estimation of stationarity status of the variables using the group unit root tests namely Levin, Lin & Chu t, Im, Pesaran and Shin W-stat, ADF - Fisher Chi-square, and PP - Fisher Chisquare test statistics. The results show that, as a group, the variables are jointly integrated since the respective probabilities are less than alpha 0.05.and thus we cannot accept the hypotheses of no stationarity in all the cases. The study also

attempted to ascertain whether the variables are cointegrated or not and thus employed the Unrestricted Cointegration Rank Tests (Trace and Maximum Eigenvalue) after the order of linear deterministic trend. The results depicted that there exist one cointegrating equation and a sustainable long run equilibrium relationship between the GDP growth and the growth in government expenditure variables. Furthermore, the study employed the Generalized Method of Moments procedure to estimate the short-run relationship between GDPR and REXR and CEXR. From the results, there is a positive and significant relationship between GDPR and REXR in the short run, which is in line with a priori expectation. On the other hand, though the relationship between GDPR and CEXR is positive, it is not statistically significant at 5% level in the short run. Equally, the causality test results indicate that, in each of the two cases, there exists uni-directional causality between GDPR and REXR and between GDPR and CEXR respectively, implying no feedback effects.

From the above results, since growth in both capital and recurrent spending of the government reserve the potential to cause growth in aggregate output of the country, the normal recommendation would be for the economic managers to increase overall government expenditure which in line with Wagner's prescription. However, due to the theorized effects of recurrent expenditure in aggravating inflationary pressures, the suggested policy direction in this paper would be to increase more of capital expenditure and less of the recurrent counterpart. The only caution, however, is to ensure proper channeling and utilization of allocated funds.

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APPENDIX

TABLE 1

Growth in GDP, Government Capital and Recurrent Expenditure, Inflation and Unemployment in Nigeria during the Post-SAP Period

YEAR	GDPr	REXr	CEXr	INFr	UNEr
1985	9.5	0.016	0.560	0.053	6.6
1986	2.5	1.033	-0.253	0.100	5.3
1987	-0.6	0.241	0.309	0.591	7.0
1988	7.4	0.339	0.803	0.514	5.3
1989	7.6	0.393	0.510	0.075	4.5
1990	13.0	2.056	0.178	0.123	3.5
1991	-0.8	0.387	0.403	0.438	3.1
1992	2.3	1.578	0.371	0.576	3.4
1993	1.3	-0.342	0.301	0.572	2.7
1994	0.3	0.419	0.708	0.728	2.0
1995	2.1	-0.025	0.758	0.292	5.6
1996	4.4	0.274	0.266	0.106	5.4
1997	2.8	0.123	1.046	0.078	4.9
1998	2.9	1.525	0.612	0.068	4.5
1999	0.4	0.027	-0.519	0.068	4.3
2000	5.4	0.255	0.832	0.189	13.1
2001	8.4	0.203	-0.267	0.129	13.6
2002	21.3	0.413	-0.248	0.141	12.6
2003	10.2	0.049	0.454	0.150	14.8
2004	10.5	0.185	0.479	0.178	13.4
2005	6.5	0.054	0.063	0.083	11.9
2006	6.0	1.132	0.375	0.053	12.3
2007	6.5	0.332	0.480	0.116	12.7
2008	6.0	0.086	0.026	0.561	14.9
2009	6.6	0.439	-0.233	0.687	19.7
2010	7.1	0.567	0.336	0.768	20.1
2011	8.2	0.578	0.442	0.798	21.2