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Impact of Foreign Aid on Public Expenditure in Nigeria: Application of Vector Error Correction Model

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Abstract: *This study explores the relationship between government expenditure and foreign aid in Nigeria using cointegration analysis and vector error correction model. Applying data for 43 years from 1970 to 2012, the results of Johansen and Enger- Granger cointegration test suggest that there is positive and long run relationship between foreign aid and government expenditure. We found also, that the coefficient estimate of the foreign aid is not significant in the long run but, in the short run effect of increase in foreign aid is more insignificant both in magnitude and level of significance. The study also finds that foreign direct investment and real gross domestic product have positive impact on the government expenditures i.e. they provide important information as determinants of government expenditure in Nigeria.*

Keywords: *Foreign Aid, Public Expenditure, Development, Nigeria*

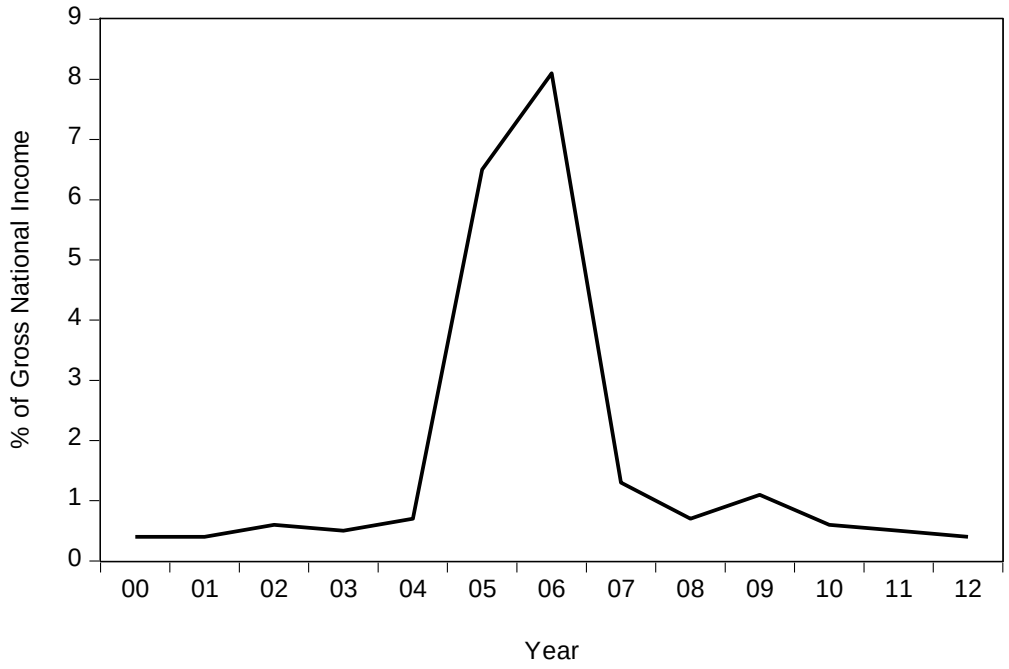
I. Introduction

1.1 Background to the Study

Foreign aid consists of resource transfers from the public sector, in the form of grants and loans at concessional financial terms, to developing countries. Many studies in the empirical literature on the effectiveness of foreign aid have tried to assess if aid reaches its main objective, defined as the promotion of economic development and welfare of developing countries. When focusing on the traditional purpose of foreign aid - promotion of the economic growth of developing countries -, one notes that the results obtained differ according to the approach used.

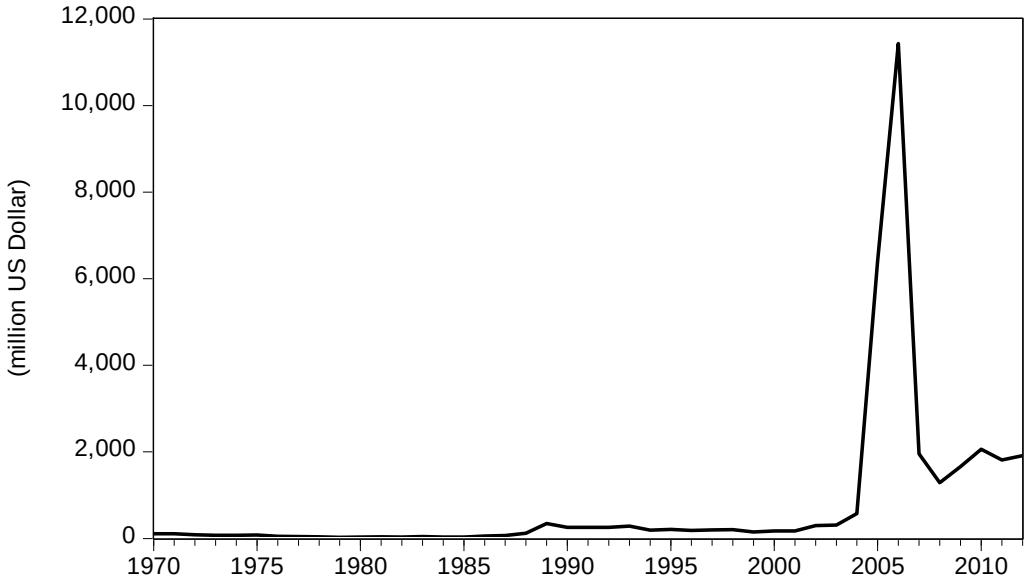
It is interesting to note that in recent years there has been a significant increase in aid flows to developing countries although other types of flows such as foreign direct investment and other private flows are declining. For example, according to the Organization for Economic Corporation and Development (OECD, 2009b), foreign direct investment and other private flows are on the decline, and remittances are expected to drop significantly in 2009. Specifically for Nigeria, Net official development assistance (foreign aid) as percentage of GNIgiven in Figure 1 shows that foreign aid reached its peak in 2006 and thereafter drop by about 480 percent in 2007 and become stable at 0.4 percent of GNI in 2012.

Figure 1: Net Official Development Assistance (Foreign Aid)



In absolute term, over the past 42 years, foreign aid has fluctuated between $11,428 million in 2006 and $72 million in 1974. As depicted in Figure 1, net official development assistance is $11,428 million in 2006 and falls to $1,916 in 2012.

Figure 2: Net Offical Development Assistance and Official Aid Received



1.2 Statement of problem

Foreign aid through the government expenditure has contributed to economic growth in Nigeria but there are few empirical studies on Nigeria (Odusanya et al, 2011). The studies will add to body of literature on the impact of foreign aid on government expenditure.

1.3 Research Question:

The research question the study set out to answer is how does foreign aid affects the public expenditure in Nigeria?

1.4 Objective of Study:

The main objective of the study is to analyze the effect of foreign aid on government expenditure in Nigeria.

The paper is structured as follows: The next section presents a survey of literature, whereas Section 3 presents Data and methods. The empirical results are presented and discussed in Section 4 and finally, Section 5 summarizes the main results and conclusions.

II. Literature Review

Bevan et al (1993) observed increase in public expenditure, non-developing expenditure, during coffee boom (as cited in Shahzad et al, 2011). Government reallocates the resources instead of lowering its expenditure. Further more Heller (1975) confirmed by the empirical literature on thepanel and time series data, foreign aid used as to treat interim reduction.

Boone (1996) found that aid finance is consumption rather than in-vestment. Financing consumption of a few poor people is not so bad, butthe proponents of aid hoped for the kind of society-wide transformationthat would come from aid financing investment and growth. Some proponents have argued that aid could also buy time for reformers to implement painful but necessary changes in economic policies. This seemsplausible buthas notbeensystematicallytested.Onecould trytoaltertheincentives to consume aid by tying transfers to purchases of investmentgoods, as in Bruce and Waldman (1991).

III. Methods And Data

In the analysis of the data, the study will relyon the framework of Durbarry, et al (1998) as modified by Odusanya et al (2011) in the case of Nigeria. Odusanya et al (2011) hypothesized that economy growth in Nigeria can be related to foreign aid as stated in equation 1.

Growth = ß0+ß1FAID + ß2PRIV + ß3SAV + ß4TRADE + ß5GOV + e (1)

In order to meet the objectives of this study in terms of its concentration, the model is modified and we estimate equation 2:

$$gexp = \psi_0 + \psi_1 faid + \psi_2 fdi + \psi_3 rgdp + \varepsilon \quad (2)$$

wheregexp is government expenditure and faid is foreign aid. We included two macroeconomic control variables (CV): real gross domestic product (rgdp), and foreign direct investment (fdi) to avoid simultaneous bias (Gujarati, 2006) in our regressions. The incorporation of control variables also helps to make our analysis multivariate as against bivariate. This is important because bivariate causality leads to erroneous causal inferences (Lutkepohl, 1982). We use the natural log of all the variables because natural logarithm of a series effectively linearizes the exponential trend (if any) in the time series data since the log function is the inverse of an exponential function (Asteriou and Price, 2007). Moreover, opting for log of the variables may prevent cumbersomeness in the modelling and inference and it allows the regression coefficients to be interpreted as elasticity (Rahaman and Salahuddin, 2010).

The study first examines the stationarity of our variables, government expenditure, foreign aids, foreign direct investment and real GDP. A non-stationary time series has a different mean at different points in time, and its variance increases with the sample size (Harris and Sollis (2003). A characteristic of non-stationary time series is very crucial in the sense that the linear combinations of these time series make spurious regression. In the case of spurious regression, t-values of the coefficients are highly significant, coefficient of determination (R^2) is very close to one and the Durbin Watson (DW) statistic value is very low, which often lead investigators to commit a high frequency of Type 1 errors (Granger and Newbold, 1974). In that case, the results of the estimation of the coefficient became biased. Therefore it is necessary to detect the existence of stationarity or non-stationarity in the series to avoid spurious regression. For this, the unit root tests are conducted using the Augmented Dickey-Fuller (ADF) test and Philips-Perron (PP). If a unit root is detected for more than one variable, we further conduct the test for cointegration to determine whether we should use Error Correction Mechanism.

Cointegration Analysis

Cointegration can be defined simply as the long-term, or equilibrium, relationship between two series. This makes cointegration an ideal analysis technique in ascertaining the existence of a long-term unit proportionate relationship between our variables of interest. The cointegration method by Johansen (1991; 1995) has become the most cited cointegration technique used in Fisherian literature, and is used in this study. The Vector Autoregression (VAR) based cointegration test methodology developed by Johansen (1991; 1995) is described as follows;

The procedure is based on a VAR of order p:

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + Bz_t + \varepsilon_t \quad (3)$$

where$y_t$is a vector of non-stationary I(1) variables (interest rate and expected inflation), $z_t$is a vector of deterministic variables and ε_t is a vector of innovations. The VAR may therefore be reformulated as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} + \Gamma_i \Delta y_{t-p} + Bz_t + \varepsilon_t \quad (4)$$

$$\text{Where } \Pi = \sum_{i=1}^{p} A_i - I \quad (5)$$

$$\text{and} \Gamma_i = \sum_{j=i+1}^{p} A_j \quad (6)$$

Estimates of Γ_i contain information on the short-run adjustments, while estimates of Π contain information on the long-run adjustments, in changes in y_t. The number of linearly dependent cointegrating vectors that exist in the system is referred to as the cointegrating rank of the system. This cointegrating rank may range from 1 to n-1 (Greene 2000:791). There are three possible cases in which $\Pi y_{t-1} \sim I(0)$ will hold. Firstly, if all the variables in $y_t$are I (0), this means that the coefficient matrix Π has r=n linearly independent columns and is referred to as full rank. The rank of Π could alternatively be zero: this would imply that there are no cointegrating relationships. The most common case is that the matrix Π has a reduced rank and there are $r<(n-1)$ cointegrating vectors present in β . This particular case can be represented by:

$$\Pi = \alpha\beta' \quad (7)$$

where α andβ are matrices with dimensions n x r and each column of matrix α contains coefficients that represent the speed of adjustment to disequilibrium, while matrix β contains the long-run coefficients of the cointegrating relationships.

In this case, testing for cointegration entails testing how many linearly independent columns there are in Π , effectively testing for the rank of Matrix Π
(Harris, 1995:78-79). If we solve the eigenvalue specification of Johansen (1991), we obtain estimates of the eigenvalues $\lambda_1 > \ldots > \lambda_r > 0$ and the associated eigenvectors $\beta = (v_1, \ldots v_r)$. The co-integrating rank, r, can be formally tested with two statistics. The first is the maximum eigenvalue test given as:

$$\lambda\text{- max} = -T \ln (1- \lambda_{r+1}), \quad . \qquad (8)$$

Where the appropriate null is r = g cointegrating vectors against the alternative that r ≤ g+1. The second statistic is the trace test and is computed as:

$$\lambda\text{-trace} = -T\sum_{i=r+1}^{n} \ln (1 - \lambda i), \qquad (9)$$

where the null being tested is r = g against the more general alternative r ≤ n. The distribution of these tests is a mixture of functional of Brownian motions that are calculated via numerical simulation by Johansen and Juselius (1990) and Osterwald-Lenum (1992). Cheung and Lai (1993) use Monte Carlo methods to investigate the small sample properties of Johansen's λ-max and λ-trace statistics. In general, they find that both the λ-max and-λ trace statistics are sensitive to under parameterization of the lag length although they are not so to over parameterization. They suggest that Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC) can be useful in determining the correct lag length.

The empirical analysis was presented by time series model. The study uses long and up-to-date annual time-series data (1970-2012), with a total of 43 observations for each variable.The data for the study are obtained from Central Bank of Nigeria Statistical Bulletin and IMF Statistical data. Foreign aid data are in million (US Dollar) while the data for other series are in billion naira. We therefore estimate Equation (7) using the ordinary least square (OLS) method. The software application utilized was E-views 7.0.

IV. Results And Interpretation

Unit root test

Appropriate tests have been developed by Dickey and Fuller (1981) and Phillips and Perron (1988) to test whether a time series has a unit root. Table 1 shows the Dickey and Fuller (ADF) and the Phillips and Perron (PP) tests with constant only. The hypothesis of unit root against the stationary alternative is not rejected for all the variables under ADF test while only the RGDP is reported stationary at level under PP test. However, the first differences of these variables are stationary under the two tests. Hence, we conclude that these variables are integrated of order 1.

Table 1: Results of (ADF) and (PP) unit root test, constant only

	ADF Test		PP	
Variable level	At level	At 1st difference	At level	At 1st difference
Faid	-0.756495	-5.726603***	-0.792138	-5.03168***
gexp	-1.083955	-7.889261***	-0.917035	-7.845646***
fdi	-1.063904	-12.73320***	-0.695592	-12.66785***
rgdp	-2.378031	-5.975573***	-5.353217***	-
ADF Critical values: -3.4533 at 1% (***) and -2.8715 at 5% (**) (PP) Critical values: -3.4529 at 1% (***) and -2.8714 at 5% (**)				

Following from the results presented in Table 1, it therefore necessary to determine whether there is at least one linear combination of the variables that is l(0). The Cointegration test performed for the long run relationship among series by using Johansen and Juseliuscointegration test is presented in Table 2. The result show a cointegration rank of one in trace test and max-eigen value test indicate no cointegrationat 5% significance level.

Table 2: Cointegration Rank Test Assuming Linear Deterministic Trend

Null Hypothesis	Alternative Hypothesis	Test Statistics	0.05 Critical Value	Probability Value
		Trace Statistics		
r=0	r=1	49.52554[a]	47.85613	0.0345
r=1	r=2	24.846331	29.79707	0.1670
		Max-Eigen Statistics		
r=0	r>0	24.67922	27.58434	0.1127
r≤1	r>1	17.49319	21.13162	0.1500

[a]Denotes rejection of the null hypothesis at 0.05 level

We further applied Engel - Granger cointegration test to complement Johansen test and found that the residual is not stationary at level, that is, it is integrated of order one under ADF test, thus suggesting that the variables are no cointegrated. With PP and Dickey Fuller Generalized least square (DF-GLS) tests, the Engel - Granger cointegration test suggest that there is a long run relationship among the variables. The existence of a long-run relationship has been established, the short-run dynamics of the model can be established within an error correction model.

Table 3: Stationarity Test of the Residual from g equation

Variable- Residual	ADF	PP	DF-GLS
At level	-1.922235	-2.971256**	-1.944236
At 1st diff.	-10.36502***	-	-9.732609***

Based on the cointegration results, we therefore estimate the long-run relationships using the ordinary least squares (OLS) model and present the result in Table 4.

Table 4: OLS Result (with $gexp_t$ as dependent variable)

	Static Model		ECM model in 1st difference	
Variable	Coefficient	Probability	Coefficient	Probability
c	-0.530306	0.4540	0.151580	0.0016
faid	0.183127	0.3001	0.001753	0.9807
fdi	1.085611	0.0000	0.060238	0.4494
rgdp	0.805489	0.000	0.529948	0.0179
ecm	-	-	0.029042	0.6079
R-squared Adjusted R Durbin-Watson Prob(F-Stat)	0.918457 0.912020 0.705743 0.0000		0.165438 0.070059 2.589686 0.164457	

Using OLS with the HAC or Newey-West standard error that takes into account the autocorrelation, we found that the coefficient estimates of the foreign aid is not significant both in the short and long runs. For example, a percentage increase in foreign aid to Nigeria will only lead to about 0.18 percent in government expenditure. In the short run, such increase is more insignificant in magnitude and level of significance.This result is consistent with the finding of Swaroop et al. (2000) for india which give evidence of a negative or insignificant impact of aid on expenditures. A plausible reason for result for Nigeria might be due to the fact that much of the official development assistance (ODA) inflows in Nigeria by-pass national budgets. Most of the aid fund goes directly to the ministries, department or agency (MDA) that uses the fund, contrary to what is obtainable inother Sub Sahara African Countries such as Kenya and Ghana in which foreign aid is treated as part of the budget (Iyoha, 2003). However, foreign direct investment and real gross domestic product have positive impact on the government expenditures i.e. they provide important information as determinants of government expenditure in Nigeria.

V. Summary And Conclusion

This study explores the relationship between government expenditure and foreign aid in Nigeria using cointegration analysis and vector error correction model. The results of Johansen and Enger-Granger cointegration test suggest that there is positive and long run relationship between foreign aid and government expenditure. We found that the coefficient estimate of the foreign aid is not significant in the long run but, in the short run effect of increase in foreign aid is more insignificant both in magnitude and level of significance. The study also finds that foreign direct investment and real gross domestic product have positive impact on the government expenditures i.e. they provide important information as determinants of government expenditure in Nigeria.

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Appendix

Data on foreign aid (FAID - in million US dollar), government expenditure (GEXP - in billion naira), real GDP (RGDP - in billion naira) and foreign direct investment (FDI - in billion naira).

obs	FAID	GEXP	RGDP	FDI
1970	107.54	0.904	4.219	0.205
1971	107.11	0.997	4.715	0.286
1972	83	1.463	4.892	0.305
1973	76.38	1.529	5.309	0.373
1974	72.61	2.74	15.919	0.257
1975	81.38	5.942	27.172	0.47
1976	51.82	7.856	29.146	0.339
1977	42.01	8.823	31.52	0.441
1978	40.15	8	29.212	0.211
1979	25.74	7.406	29.948	0.31
1980	34.4	14.968	31.546	-0.739
1981	39.25	11.413	205.222	0.5420
1982	34.95	11.923	199.685	0.431
1983	46.75	9.635	185.598	0.364
1984	32.39	9.927	183.563	0.189
1985	31.71	13.041	201.036	0.486
1986	58.12	16.223	205.971	0.193
1987	67.62	22.018	204.806	0.611
1988	118.08	27.749	219.875	0.379
1989	344	41.028	236.729	1.884
1990	255.08	60.268	267.55	0.588
1991	258.32	66.584	265.379	0.712
1992	258.82	92.797	271.365	0.897
1993	288.42	233.806	274.833	1.345
1994	189.66	160.893	275.45	1.959
1995	210.96	248.768	281.407	1.079
1996	188.75	337.217	293.745	1.593
1997	199.75	428.215	302.022	1.539
1998	203.15	487.113	310.89	1.051
1999	151.8	947.69	312.183	1.005
2000	173.7	701.059	329.178	1.14
2001	176.17	1018.025	356.994	1.191
2002	297.93	1018.155	433.203	1.874
2003	308.22	1225.965	477.533	2.005
2004	576.94	1426.201	527.576	1.874
2005	6408.81	1822.1	561.931	4.982
2006	11428.02	1938.002	595.821	4.854
2007	1956.26	2450.896	634.251	6.035
2008	1290.16	3240.818	672.202	8.196
2009	1657.07	3456.925	716.949	8.555
2010	2061.96	4194.57	776.332	6.049
2011	1813.06	4712.06	834	8.840
2012	1915.82	4605.310	888.892	9.199