DUTSE JOURNAL OF ECONOMICS AND DEVELOPMENT STUDIES (DUJEDS)
DEPARTMENT OF ECONOMICS AND DEVELOPMENT STUDIES
FEDERAL UNIVERSITY DUTSE
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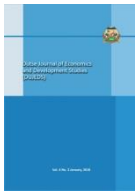

REVENUE ALLOCATION AND ECONOMIC DEVELOPMENT NEXUS IN NIGERIA: DYNAMIC ORDINARY LEAST SQUARES (DOLS) APPROACH

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Abstract
This paper examined the impact of revenue allocation on economic development in Nigeria. Johansen cointegration technique and Dynamic Ordinary Least Squares (DOLS) are used to analyze the data. The results indicated that only revenue allocation to the federal government has positive and significant impact on economic development in Nigeria. However, revenue allocation to state and local government has positive but not significant impact on economic development. The study therefore recommended that federal government should increase sources of revenue through economic diversification. This is expected to reduce heavy reliance of the government on crude oil and eventually promotes economic development in Nigeria. The study also recommended that state and local government should improve their internally generated revenue so as to augment allocation received from federal government. This is expected to improve economic development through increase in their capacity to take care of capital and recurrent expenditure.

Keywords: DOLS, Revenue Allocation, Co-integration, Economic Development.
JEL Classification: H20

Introduction

Investigating the impact of revenue allocation in understanding the economic development of countries has a long history in economics. Over these years, both theoretical and empirical arguments have been offered as explanations for the contribution of the revenue allocation to the process of economic development. However, theoretical ambiguities and empirical inconclusiveness remain (Ohiomu and Oluyemi, 2018).

According to Arowolo, (2011), one of the major challenges of economic development in Nigeria has been the issue of revenue allocation. Revising the revenue allocation system accordingly will facilitate fast economic development and a sense of inclusion (Ogbonna & Osadume, 2017). Though some researchers are calling for restructuring, it is unlikely that restructuring by itself will deliver these outcomes because there is little reason to assume that the mere fact of restructuring will eliminate corruption and inefficiency in the allocation of scarce revenue. Indeed, the real structural change Nigeria needs is in the informal architecture of values and norms, a cultural revolution that does not tolerate corruption and emphasizes quality education. Structural change

helps the legal institution to counter corruption regardless of who is involved.

Although number of studies exists on the relationship between revenue allocation and economic development, those studies did not account for structural breaks in the data gathering process (see Dang, 2013; Owolabi, 2011; Ikeji, 2011; and Adesanmi, 2010). Zivot and Andrews, (1992) and Lee and Strazicich (2003:2013) has shown how important it is to account for structural break in handling time series data. More importantly, data from developing countries those are prone to structural changes.

This paper also used a disaggregated approach to revenue allocation. This is in an attempt to see the disaggregated effects of revenue allocation to the three levels of government. The remaining sections of the paper are organized as follows: section two presents review of literature; Section 3 deals with data and methodology; Section 4 discusses the empirical results and section 5 gives conclusions and recommendations.

Literature Review

The conflicting theoretical views on the relationship between revenue allocation and economic development are briefly highlighted before the empirical evidence is presented. Theoretically, the initial thinking popularized by the work of Chenery and Cretschmer (1956) was that revenue allocation plays a significant role in influencing the course of economic development via the provision of improved quality and quantity of investment in education, health and other infrastructure. These potentially development promoting services include, but are not exclusive to, the construction of roads, building of health centers, establishment of educational institutions, identification and allocation of investment to high return yielding ventures as well as risk hedging (Ogbonna & Osadume, 2017).

Chenery and Kretschmer (1956) and Rosenstein-Rodan (1943) hypothesized that it is a function of social welfare, and that variables in the function other than the availability of various commodities must generally be taken account of by less formal methods. Similarly, to Tinbergen (1952), the relationships between alternative institutional arrangements and their economic effects can rarely be reduced to a precise form. Where such a formulation is possible, however, it can be included in the model in the same way as institutional reforms. The formal model which will be set up to analyze the development problem therefore covers primarily the productive aspects of the economic system and how efficient recourses are allocated. According to Scitovsky (1954), it consists of three sets of structural relationships; statement of social goals in terms of economic variables; set of production functions; specifications of the productive resources available. The instrumental or "policy" variables in the system are the levels of production, investment, institutional reforms and resource allocation in each sector of the economy (Fleming, 1955; Mandelbaum, 1955).

Ohiomu and Oluyemi (2018) analysed the impact of revenue allocation on economic growth in Nigeria employing Autoregressive Distributed Lag (ARDL) model with a time series data spanning from 1984 to 2016. The result indicated significant positive effect of revenue allocation on economic growth in Nigeria, in both the short run and the long run. Sylvester and Ade (2018) investigated the impact of revenue allocation on sustainable national development in Nigeria. The study employed Error Correction Model (ECM) and Johansen cointegration techniques for data analysis. The result indicated that revenue allocation has significant positive relationship with sustainable national development in Nigeria.

Ogbonna & Osadume (2017) examined the effect of revenue allocation on economic growth in Nigeria. The study employed Ordinary Least Squares (OLS) and Granger causality to analyze the data. The result of the OLS indicated no significant impact of revenue allocation on economic growth and there exist no Granger causality from any direction. Dang (2013) used Error Correction Model (ECM) and Pair-wise Granger Causality test to ascertain the causal relationship and the direction of causality between revenue allocation and real GDP in Nigeria. The result shows that the lag values of all the independent variables (revenue allocations to federal government, states, and local governments) jointly affect real domestic product (RGDP) of Nigeria, with only revenue allocation to states showing a negative significant result.

Furthermore, Owolabi (2011) adopted Ordinary Least Square (OLS) estimation technique to analyze the impact of statutory revenue allocation on economic growth in Nigeria. The results obtained from his regression analysis showed a direct positive relationship between the revenue allocation as proxies by the share of federal, state, and local government from the federation account and economic growth in Nigeria. Usman (2011) used Ordinary least squares (OLS) technique and found that both shares of federal government and local governments' revenue from federation account contributed to economic growth in Nigeria. The study finds no contribution of share of states revenue from federation to economic growth process in Nigeria.

Aladesanmi (2010) Used Johansen Cointegration to examine the impact of revenue allocation to the state government, federal and local government on economic growth in Nigeria. The study used annual time series data spanning from 1980 to 2005. The results showed that revenue allocation and economic growth are significant and positively related at the federal level, least positive at the local government level, but significant and negatively related at the state level. Furthermore, Omotosho (2010) investigated the effect of revenue allocation on development of Niger Delta Region. The result indicated significant negative impact of revenue allocation on development of Niger Delta Region. Akujuobi and Kalu (2009) also employed Nigerian data to determine the effect of statutory revenue allocation on economic development. Using econometric technique of ordinary least squares (OLS), the study found significant positive effects of statutory revenue allocation on economic development.

Saibu and Adedokun (2006) examined the effects of the state and federal government share of revenue allocation on economic growth in Nigeria using annual time series data from 1980 to 2004. The relationship was examined using the Ordinary Least Square estimation technique. The result showed that the federal government share of revenue has positive significant effects on economic growth. However, the relationship for the state government share is not statistically significant. Jimoh (2003) utilized Error Correction Model (ECM) to ascertain the long-run relationship and short-run dynamics between revenue allocation and economic growth in Nigeria. The study found out that revenue allocation has significant positive relationship with economic development.

Yilmaz (2000) determined the impact of revenue allocation on macroeconomic performance for the period 1971-1990 in Nigeria using ordinary least squares techniques. The result indicated that revenue allocation increases the growth of real Gross Domestic Product (GDP) per capita in Nigeria for the period under study. Aigbokhan (1999) also employed ordinary least squares (OLS) method in investigating the relationship between revenue allocation and economic growth in Nigeria. The result indicated a significant positive relationship between revenue allocation and economic growth. Akinlo (1999) used ordinary least squares (OLS) techniques to examine the impact of revenue allocation on economic growth in Nigeria. The result showed a significant positive relationship between revenue allocation and economic growth for the period under study.

The literatures reviewed are not without shortcoming as none has accounted for structural breaks in the data gathering process despite employing a time series data for analysis. Zivot and Andrews (1992) and Lee and Strazicich (2013) stated the advantage of accounting for structural breaks. This study is also different from the previous studies as it used a disaggregated revenue allocation approach.

Methodology

The paper used time series annual data from 1970 to 2018. The data on Real gross domestic product (proxy for economic development), credit to private sector and revenue allocation (Allocation to Federal, state and local government) were all collected from Central Bank of Nigeria (CBN) statistical bulletin. The choice of the period is informed by the availability of data.

Unit Root

Stock and Watson (1993) stated that to apply Dynamic Ordinary Least Squares (DOLS), it is necessary to ascertain that the variables are integrated of I(1). Hence the need to ensure that all the variable are integrated of order I(1). In addition to ADF proposed by Dickey & Fuller (1979), Lee and Strazicich (2013) Minimum Lagrange Multiplier (LM) Test with one structural break is employed to determine the maximum order of the integration in addition to accounting for structural break existence in the series. The test is unaffected by size or location distortion, it is also not affected by incorrect estimation whether the break exist or not. Unlike other traditional methods, rejection of null hypothesis in this method implies stationarity in the trend series.

Dynamic Ordinary Least Squares (DOLS)

This paper examines the effect of revenue allocation on economic development in Nigeria using Stock and Watson (1993) estimator which employs a semi-parametric correction to eliminate the problems caused by the long run correlation between the cointegration equation and stochastic regressor's innovations. The resulting Dynamic OLS (DOLS) estimator is asymptotically unbiased and has fully efficient mixture normal asymptotic allowing for standard Wald tests using asymptotic Chi-square statistical inference. The DOLS estimator employs preliminary estimates of the symmetric and one-sided long run covariance matrices of the residuals (Choi, Young, Hu and Ogaki, 2008). Provided all series are I(1), then DOLS procedure is employed to estimate the single cointegration vector that characterizes the long-run relationship among the variables. One simply regress one of the variable onto contemporaneous levels of the remaining variables, leads and lags of their first differences, and a constant, using ordinary least squares (Stock and Watson, 1993).

However to determine the cointegration vectors, Johansen (1988) cointegration is preferred over other cointegration techniques like Engle and Granger (1987). According to Bahmani-Oskooee & Brooks (2003), the technique of Johansen's (1988) and Johansen and Juselius (1990) is more efficient and more powerful. The method does not only allow for a feedback effect among the variables that enter into cointegration space, but also based on the maximum likelihood procedure for estimating the long-run cointegration vectors. Similarly, when there are more than two variables in any reduced form model, it identifies the number of cointegration vectors.

Model Specification

Stock-Watson DOLS model is specified as follows:

$$Y_t = \beta_0 + \bar{Q}X + \sum_{j=-q}^{P} \bar{o}_j \Delta X_{t-j} + \mu_t \quad (1)$$

Y_t dependent variable, X matrix of explanatory variables, $\bar{Q}$ cointegration vector; i.e represent the long run cumulative multipliers or alternatively, the long run effect of a change in x on y, P lag length, q lead length Lag and lead terms included in DOLS regression have the purpose of making its stochastic error term independent of all past innovations in stochastic regressors.

Following the theory of Economic development based on Chenery and Cretschmer (1956), the relationship between revenue allocation and economic development can be specified as:

$$ECD = F(RAFG, RASG, RALG, CPS, DUM) \quad (2)$$

Where;

ECD = Economic Development
RAFG = Revenue Allocation to Federal Government
RASG = Revenue Allocation to State Government
RALG = Revenue Allocation to Local Government
CPS= Credit to Private Sector
DUM = Dummy (The dummy was introduced in the model to capture the break dates)

Econometrically, the model is specified in equation (3):

$$lnECD_t=\beta_0+\beta_1 lnRAFG_t+\beta_2 lnRASG_t+\beta_3 lnRALG_t+\beta_4 lnCPS_t+\beta_5 DUM_t+ \sum_{j=-q}^{P} \bar{o}_1 \Delta lnRAFG_{t-j} + \sum_{j=-q}^{P} \bar{o}_2 \Delta lnRASG_{t-j} + \sum_{j=-q}^{P} \bar{o}_3 \Delta lnRALG_{t-j} + \sum_{j=-q}^{P} \bar{o}_4 \Delta lnCPS_{t-j} + \sum_{j=-q}^{P} \bar{o}_5 \Delta DUM_{t-j} + \mu_t \quad (3)$$

Where;

μ_t denotes the white noise error term, β_0 is a constant parameter, while β_1 to β_4 are parameter coefficients.

Empirical Results

Unit Root Result

The stationarity of the series employed are checked first using ADF test proposed by Dickey & Fuller (1979). Tables 1 presents the estimations of the ADF unit root test on the macroeconomic variables. The ADF results show that all the series are not stationary at level. However, they become stationary after taking their first difference under both intercept without trend and intercept with trend. In other words, the variables are established to be characterized by I(1).

Table 1: Augmented Dickey Fuller Unit Root Test

Series	Intercept without trend	Intercept with trend

	Level	1st Difference	Level	1st Difference
LECD	-.0.29	-2.32*	-2.21	-3.58*
RAFG	-1.53	-2.99**	-2.62	-3.14*
RASG	-2.55	-3.79**	-2.11	-5.05***
RALG	-2.34	-4.44***	-1.31	-3.36**
CPS	-1.97	-3.78**	-1.69	-4.46***

Source: Researcher's Computation

Note: ***, ** and * represent significance level at 1%, 5% and 10% respectively. The figures are the *t*-statistics for testing the null hypothesis that the series has unit root. The lag length is determined and fixed as 4 based on Schwert (1987). The critical values for intercept without trend are -3.479, -2.883 and -2.578 whereas, for intercept with trend the values are -4.028, -3.443 and -3.146 for 1%, 5% and 10% respectively.

The result also indicated that I(1) is the order of integration in the LS test in table 2 for all the variables. In other words, all the series are found to be nonstationary at level under both crash and trend models. The series become stationary only after taking their first differences. However, the test established that the break dates are not statistically significant

.

Table 2: Lee and Strazicich One-Break LM Unit Root Test

	MODEL A					MODEL C				
Series	*K*	$\check{T}_B$	t'_{rj}	Test Stat.	Critical value break points Λ	*K*	$\check{T}_B$	t'_{rj}	Test Stat.	Critical value break points Λ
*d*LECD	2	2010	1.21	-3.390[C]	0.03	2	1989	-1.434	-4.596[B]	0.07
*d*RAFG	2	1988	3.519***	-4.133[A]	0.10	2	2007	1.945*	-4.329[B]	0.06
*d*RASG	2	1975	2.251**	-4.082[B]	0.07	2	1988	3.760***	-4.968[A]	0.10
*d*RALG	2	1998	2.282**	-2.748	0.07	2	2005	-3.409***	-3.874[C]	0.10
dCPS	2	2007	2.231**	-2.449	0.09	2	2009	-3.755***	-3.846[C]	0.08
Critical Values		1%	5%	10%						
MODEL A		-4.084	-3.487	-3.185						
MODEL C		-4.699	-4.128	-3.839						

Source: Researcher's Computation

Note: *k*ˆ is the optimal number of lagged first-difference terms included in the unit root test to correct for serial correlation. $\check{T}_B$ denotes the estimated break points. t'_{rj} is the *t* value of DTjt, for *j*=1. A, B and C indicate significance of the LM test statistics at 99%, 95% and 90% significance level, respectively. While ***, ** and * indicates the two-tailed significance level of the break date at 99%, 95% and 90% respectively.

The Johansen cointegration technique is employed to test for the presence of co-integrating relationships among the non-stationary variables. The result is presented in Table 3:

Table 3: Johansen Cointegration

Null Hypothesis	Trace Statistic	0.05 Critical Value	Null Hypothesis	Max-Eigen Statistic	0.05 Critical Value
r = 0*	133.22	132.41	r = 0*	68.56	59.34
r ≤ 1*	86.08	76.35	r ≤ 1	34.19	40.08
r ≤ 2	75.28	97.86	r ≤ 2	17.97	27.58
r ≤ 3	19.30	29.79	r ≤ 3	10.49	21.13
r ≤ 4	65.39	79.12	r ≤ 4	21.59	33.97

Source: Researcher's Computation

Note: *r represents number of co integrating vectors. * denotes rejection of the hypothesis at the 0.05 level*

The results of Johansen Cointegration revealed that there is co-integration among the variables. The Trace and Max-Eigen Statistic of 133.22, 86.08 and 68.56 are greater than the critical values of 132.41, 76.35 and 59.34 at

5% level of significance respectively. Therefore, the Johansen co-integration showed the existence of long run relationship among the variables.

After the establishment of cointegrating relationships, we used the Dynamic Ordinary Least Square (DOLS) estimation technique to obtain the long run elasticity coefficients as presented in Table 4.

Table 4: DOLS Regression Results

Variable	Coefficient
RAFG	0.900**
	(5.32)
RASG	1.040
	(0.85)
RALG	1.774
	(9.34)
CPS	0.712**
	(4.56)

R^2	Adjusted R^2	Wald-Test: F-statistics	S.E.R	Long-run variance
0.544	1.117	9.354***	1.298	0.463

Source: Author's computations

Note: ** ** *** denote significant at the 1, 5 and 10 percent level respectively. The figures in the parenthesis are the t- statistics*

The R^2 (coefficient of determination) measures the goodness of fit of the estimated model. It indicated that the model is reasonably fit in prediction. 54 per cent of the variation in economic development is jointly explained by revenue allocation to federal government, revenue allocation to state government and revenue allocation to local government. While the remaining variations of 46 percent unaccounted for is captured by the white noise error term. Additionally the Wald F-statistic test is used to test the joint significance of the coefficients. The test showed that the joint impact of revenue allocation to federal, state and local government actually have a significant influence on economic development.

The coefficient of RAFG is 0.90 which indicated a positive relationship with economic development. This implies that a percent change in revenue allocation improves economic development by 0.90 percent. The coefficient is found to be statistically significant at 5 percent level. This is contrary to the results of Ogbonna and Osadume (2017) that found positive but not significant impact of revenue allocation on economic development in Nigeria. However, the results are in line with the works of Ohiomu and Oluyemi (2018) and Sylvester and Ade (2018). These two studies employed Auroregressive distributed lag (ARDL) and Error correction model (ECM) respectively. Those studies reported significant positive relationship between revenue allocation and economic development. The possible reason could be based on the fact that this study used a different model (DOLS). This study also used disaggregated revenue allocation data as against aggregate data used in the previous studies.

The coefficient of RASG is 1.04, which indicated positive relationship of revenue allocated to state government with economic development. However, the coefficient is not statistically significant. Similarly, the coefficient of RALG is 1.77 showing a positive but not significant relationship of revenue allocation to local government on economic development. The possible reason why revenue allocated to state and local government are not statistically significant could be the fact that low allocated being received from the federation account. The state and local government also lack the capacity to generate revenue internally. This is possibly the reason why developmental activities are not often seen in the lower levels of government. The control variable of credit to private sector also has the expected positive and significant impact on economic development at 5 percent level.

Conclusion and Recommendations

The study used Johansen cointegration and Dynamic Ordinary Least Squares (DOLS) to examine the impact of revenue allocation to federal, state and local governments on economic development in Nigeria. The study concluded that revenue allocation to federal government has positive and significant impact on economic development. However the revenue allocation to state and local government are not statistically significant. The study therefore recommended that federal government should increase sources of revenue through economic diversification. This is expected to reduce heavy reliance of the government on crude oil and hence promote economic development.

The study also recommended that state and local government should improve their internally generated revenue so as to augment allocation received from federal government. This is expected to improve economic development through increase in their capacity to take care of capital and recurrent expenditure. Strong institutions should also be set up for revenue allocation to have positive impact on economic development in Nigeria. This can be done through intensifying the fight against corruption at all levels of government and by blocking all leakages.

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