

Revenue Mobilization and Investment on Infrastructure of Local Governments in Nigeria

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Abstract

This thesis examined the effects of revenue mobilization and investment of local governments in Nigeria. Secondary data were collected from Central Bank of Nigeria Statistical Bulletin. The dependent variables were proxy by value of basic amenities and value of infrastructural development. The independent variables were proxy by federal government allocation, state government allocation, value added tax, internally generated revenue and grants. Descriptive statistics and multiple regressions were used to examine dynamic long run relationship that exists between revenue mobilization and local government development. Ordinary Least Square (OLS), Augmented Dickey Fuller Test, Johansen Co-integration test, normalized co-integrating equations, parsimonious vector error correction model and pair-wise causality tests were used. The estimated model revealed that value added tax, state allocation, grants and federal allocation have positive effect on value of infrastructural development while internationally generated revenue have negative effect on infrastructural development. The unit root result (ADF) showed that the variables were stationary at the first difference of Order 1 (1). The co-integration tests revealed a long run dynamic relationship between the dependent and independent variables in the models. The parsimonious model summary shows that revenue mobilization explains positive and significant relationship between the revenue and development of local government. However, the direction of causality between revenue and development is mixed indicating uni and bi-directional causality. The study concluded that local government revenue has significant effect on infrastructural investment of Nigeria local governments. Its recommends policies should be directed toward effective utilization of revenue and local government finance should manage in line with international best practices.

Keywords: *Revenue Mobilization, Investment on Infrastructure, Local Governments Nigeria, Federal Allocation*

INTRODUCTION

The public sector plays a crucial role in socio-economic development and is broadly synonymous with the government sector (Schacter, 2000). In Nigeria, public sector operations include federal government, the state and the Local Government Authority as well as government agencies' activities (Mohamed and Farooq, 2008). The public sector is responsible for the development of infrastructure and the provision of basic services to the people, with people of a country having the same right to access all of the amenities provided, by it, whether they are rich or poor (Mohamed and Farooq, 2008). Public sector organizations at large provide public services through the budget appropriations which are based on decisions made about revenue sources and projected expenditure (Sakurauchi, 2002; Chan, 2009).

Local government was created to ensure meaningful development of the grassroots through participatory approach. The failure of local government in the area of service delivery over the years has made the citizens to lose faith and trust in local government administration as an institution in Nigeria. As important as this tier of government has been, there seems to be some impediments that have been infringing on its performance and functions in recent times. Corruption seems to be the most damaging factor.

In Nigeria the legal framework for treasury management as contained in the constitution of the Federal Republic of Nigeria 1999 provides the general framework as regards the power over and controls of public funds and dealt with

the establishment of government funds, receipts into and expenditures out of them. The Finance (Control Management) Act of 1958 established general operation of all public funds and regulates the accounting system, the books of account to be kept and the procedure for preparing final accounts and financial statements. The Audit Act 1956 guides the audit of government financial records and accounts. Financial Regulation 2000 is regulatory documents containing codes and guidelines designed to control the use of public monies. Appropriation Act states the amount to be spent on each programme on the approved estimate. Treasury Letters and Circular serves as periodic communications made, or releases issued, by the ministry of finance while Standard Treasury Management Policy and Practice was designed to achieve established objectives. The public choice theory asserts that political and administrative actors seek organization performance and personal aggrandizement such as having career security, better jobs, higher salaries and the entrenchment of power by maximizing budget appropriations which tend to de-emphasize the operating efficiency (Rainey, 1976; Pina, Torres and Yetano, 2009; Niskanen, 1974).

The major problems facing the local government effective administration in Nigeria are the high rate of corruption. Corruption is the greatest bane of local government administration in Nigeria. At the grassroots level, corruption has been canonically accommodated, entertained, and celebrated within the system. Corruption has been described as a major cause of comatose state of local government administration in Nigeria, and a major hindrance to good government (Onwuemenyi, 2008). It has been identified as one of the problems confronting effective local government administration in Nigeria, also no adherence to provisions of the financial memorandum conspicuous consumption of the part of the local officials, lifestyles that are not commensurate with official sources of income, imposition of leaders on the local government through corrupted political process and low wages of local government officials (Ali, 2008).

Corruption and poor treasury management has remained an issue militating against local governments' performance. Oviasuyi, et al (2010) in this regard observed that as in all levels of government in Nigeria, corruption is predominately widespread, undiluted and unambiguous in the local government. It is a statement of fact that in the local government system, corruption has become all pervading, unabashed uncontrolled and persistent. This perhaps explains the inefficiency and ineffectiveness in local government administration in Nigeria. The system has virtually become superfluous and redundant (Oviasuyi, et al, 2016).

LITERATURE REVIEW

Infrastructural Development

Infrastructure development means to bring the change social organizational, personal or natural into modern facilities. Infrastructure development is mainly related of road, bridge, building, hydroelectric power generation, telecommunication network, transportation facilities and safe drinking water facilities. The term refers to a structure that supports the development of society, such as transport, homes, electricity, the micro-industry, projects and communication between drinking water suppliers. It also refers to the physical components of interconnected systems that provide access to products and services to enable, maintain, or achieve the living conditions of society. Infrastructure development perspectives is a new genuine and on appropriate approach to analyze the socio-economic status, geographical structure, people living standard and environmental condition of countryside, area and country. It focuses about the condition of infrastructure and their impact in the society, socio-economic structure and development activities. Infrastructure developments are at the very heart of the economic and social development. They provide the foundations for economic activities virtually in every aspects of modern day. Infrastructure development is mainly related of road, bridge, building, hydroelectric power generation, telecommunication network, transportation facilities and safe drinking water facilities.

Local Government Revenue Sources in Nigeria

There are basically two major sources of funds for the states and local governments. These are allocation from the Federalism Accounts (including VAT, Stabilization Receipts and General Ecology) and internal revenue generation (tax revenue and non-tax revenue). Intergovernmental transfers are made from the federal account to the states. The funds are meant to provide general revenue to all tiers of government to fund basic operations where their own revenue would not be sufficient to fulfill such responsibilities. The states then transfer funds to local governments. Allocation of funds in Nigeria is decided by the National Revenue Mobilization, Fiscal and Allocation Commission (NRMFAM) based on criteria to ensure that there is equity in allocation, both vertically between tiers of government and horizontally, across Nigeria (Aniakon, 2009). The criteria are as follow:

- Vertical

- Federal government — 52.7%
- State government — 26.7%
- Local government — 20.6%
- Horizontal
- Equality-40%, Population-30%
- Internally generated revenue - 10%
- Land mass and terrain - 10%
- Social development factor - 10%; made up of the following items:
 - Territorial spread- 1.5%
- Rainfall-1.5%
- Primary/secondary enrolment — 4%

- Hospital beds - 3%

The social development factor is used to determine states that have better literacy levels, hospital facilities.

- Value added tax (VAT) Vertical
- Vertical

Federal government- 15%

State government - 50%

Local government - 35%

Horizontal

Equality-50%

Population-30% Derivation-20%

According to Aniakon (2009) since the creation of the 12 states structure in 1967, States and local governments have been dependent on the federalism account. The federalism account is shared among the three tiers of government as detailed in the above vertical formula, which was last amended in 2004. Aniakon (2009) also reveals that there is evidence of monthly payment to all tiers of government since 2003 and the above percentage meant for local governments is usually transferred from the federalism account to state accounts. However, there is no evidence that the state transfers the same percentage to local governments.

Theoretical Framework

Public Choice and Public Budget Efficiency Theory

The Public Choice Theory is a branch of economics, which emerged in the fifties and received widespread public attention in 1986 when its founder, James Buchanan, was awarded the Nobel Prize in economics. Public Choice Theory utilizes principles of economic to analyze people's actions in the marketplace and applies them to people's actions in collective decision-making. The theory is based on four basic assumptions (Ostrom and Ostrom, 1971).

In other words, politicians and government bureaucrats (administrators) basically pursue their own rather than the public interest such as career security, better jobs, higher salaries and entrenchment of power through the budget decision-making processes (Ostrom and Ostrom, 1971). Public Choice Theory posits that self-interest behaviour among the actors can result in accounting information being used for self-promotion, legitimating, and distortion to meet their position, priorities and preferences in budget decision-making processes. This means decision relevant use of accounting information can be applied by actors, as long as it can result positively to their own interest and priorities through budget decision-making processes.

In the public sector, it involves making the best use of the resources available for the provision of public services by reducing numbers of inputs such as people or assets, whilst maintaining the same level of service provision; additional outputs, such as enhanced quality or quantity of service, for the same level of inputs; improved ratios of output per unit cost of input; changing the balance between different outputs aimed at delivering a similar overall objective in a way which achieves a greater overall output for the same inputs.

Empirical Review

Ehule (2015) studied the relationship between internally generated revenue and performance of a public sector. Data were collected using questionnaires with a five point likert response scale from 125 staff of Obio/Akpor Local

Government Council drawn from a random sample. The Pearson product moment was used to determine the nature of relationship. The results show that permits and rates have a positive significant relationship with performance of Obio/Akpor Local Government Council.

Edogbonya et al (2013) studied the impact of revenue generation on government developmental efforts. Data were collected from three local government councils using the stratified sampling method. The ordinary least square (OLS) and the regression analysis were used to determine the nature of the relationship and its statistical significance respectively. Findings reveal a positive relationship between internally generated revenue and government capital projects.

Isaac (2015) studied the impact of indirect taxes on the economic growth of Nigeria. Data were collected from a sample of value added tax, import duties and GDP from 2009-2013 drawn from a systematic random sampling technique. The ordinary least squares and the t-test statistics were used to determine the nature of the relationship and its statistical significance respectively. The result shows that value added tax, import duties and excise duties have positive significant impact on gross domestic product. Export duties were found to have a negative impact on gross domestic product.

Essien (2015) studied the impact of tax revenue on economic growth in Nigeria. Secondary data from the CBN, financial statements, reports from the Federal Inland revenue service and other sources were obtained. The ordinary least square method of multiple regressions was used to establish relationship of tax revenue and economic growth. The results show that petroleum profit tax and company income tax are positively related to economic growth. That is a rise in petroleum profit tax and company income tax will cause a proportional growth in the economy.

Ironkwe and Ndah (2016) investigated the impact of Internally Generated Revenue on the Performance of Local Governments in Rivers State. Two Research questions and Two Hypotheses were formulated to guide the study. The ex-Post Facto Research Design or Causal Comparative design was adopted for the study. Ogba/Egbema/Ndoni Local Government Council was purposefully selected for the study. Statistical analysis was performed using data from the financial statement of the Council from 2006 to 2013 sourced from the office of the Auditor General for Local Government. The t-statistics analysis was employed in testing the hypotheses. A major finding of the study was that Tax revenue displayed a positive but insignificant influence on road construction and maintenance. Notwithstanding the insignificant influence of Tax revenue on road construction and maintenance, the study concluded that Tax revenue and Non Tax revenue are vital ingredients in improving the Performance of Local Government Councils in Rivers State. Some recommendations were therefore offered in this regard.

Dada, Adebayo and Adeduro (2017) assessed the prospects and problems of revenue mobilization in Nigerian Local Governments. It specifically determined the significant impact of development on internally generated revenue of local government in Nigeria; assessed the impact of financial misappropriations on internally generated revenue in the local government in Nigeria. The study employed the use of closed ended and likert scale ranked, well-structured questionnaire as the source of data collection. The responses of the questionnaire were coded and later analyzed with the use of inferential (multiple regression) statistics. The study revealed that development has significant impact of 21.9% ($t= 3.575$ and $p< 0.05$) on internally generated revenue of local government in Nigeria, while financial misappropriation has significant impact of 26.5% ($t= 4.668$ and $p<0.05$) on internally generated revenue of local government in Nigeria. The study concluded that the level of development (human and infrastructural) and the rate of financial misappropriation are determinants to the revenue base of Nigerian local governments. It is recommended that Nigerian local government authorities should ensure both human and infrastructural development in their respective constituencies as this is influential on the level of revenue derivation. In addition, local government authorities should ensure a carrot and stick approach whereby members of staff are rewarded on performance and strictly punished for perpetrating financial misappropriations in order to curb the menace of the anathema on the fabric of the society

Amin (2018) examined the sources of revenue generation, the capacity of Asa Local Government in generating revenues for developmental programmes and the extent to which the generated revenues have been used for community development in Asa Local Government. The study relied on both primary and secondary data, 218 questionnaires were received and analyzed using Statistical Package for Social Sciences (SPSS) software. Finding from the study showed that: Asa Local Government generates revenues from internal and external sources. External sources are the statutory allocation from Federal account and borrowed money from the State government. The local

government generated huge amounts of revenue from market rates and levies and permit fee on land and establishment. Tax enforcement is not efficient and majority of the respondents agreed that local government officers are more efficient than consultants. 3. Majority of the respondents agreed that generated revenue supports availability of borehole and well water but disagreed that grading of roads is executed on quarterly basis through internally generated revenue. Majority of the respondents also disagreed that the level of development has encouraged people to pay taxes and strongly disagreed that Asa is ahead of other local government in the provision of basic amenities and disagreed that Internal generated revenue in Asa is used to build shopping complex and modern market in Asa local government area.

Vincent (2001) studies on tax and public revenue mobilization in Nigeria have shown a high degree of centralization. According to Emenuga (1993), the allocation of revenue to the tiers of government has not adhere strictly to the expenditure requirements of each tier, thus the federal government has become a surplus spending unit while other functions, proposes the determination of a tier's share through the aggregation of its basic expenditure needs. To reduce the gap between tax power and responsibilities, two types of revenue sources are allocated to each tier. These are independent revenue sources and direct allocation from the federation to which centrally collectable revenues are paid. Local government also receives allocations from State Internal Revenues. An agreed formula for vertical revenue sharing is used in sharing funds from the federation account. Another key issue in the practice of public revenue mobilization in Nigeria is how to distribute the bloc share from the federation account among the constituent units of each tier i.e. among the 36 states and the 774 local governments. This is called horizontal revenue sharing. In Nigeria, there are four categories in the vertical allocation list federal, state, local governments, and the special fund. The allocation to the Federal Capital Territory (FCT) is accounted for under the special fund which is administered by the federal government. Public revenue mobilization is one of the most keenly contested issues in Nigeria.

Okolie and Eze (2006) x-rayed the external and internal sources of revenue to the local government. They identified statutory allocation, state governments' mandatory contributions to the local government from her internally generated revenue, borrowing, and grants-in aids from NGO's, Community Development Association (CDA'S) and government, as the external sources of revenue to the local government. They viewed internal sources of revenue to local government as being necessitated by the quest to expand the revenue base of the local government, hence they stated thus; In order to expand its revenue base and to local government's generated revenues internally through a variety of sources (Okolie and Eze, 2006). They further enumerated the internal sources of revenue to local government as storage fee, development rates/capitation rates, advertisements, obstruction levies/fines, liquor license fees, small-scale fees/levies, and sanitary levies and cattle rates.

Ona (2000) focused his attention on the internal sources of revenue to the local government in Nigeria. He classified it as taxes, rates, fines, earnings from economic activities, rent, and interest collection and recording, he outlined the duties and responsibilities of local government revenue collectors. Regrettably, in spite of his regulations put in place, certain conditions, according to him, facilitate fraud in collection, accounting and remittance of the revenue collection by the revenue collectors and these include: shoddy nominal tax roll, issuance of fake receipts, dishonest recording and inadequate recording materials.

METHODOLOGY

This study employs the ex-post facto research design. This is the type of research involving events that have already taken place (Onwumere, 2009). The data already exist as no attempt would be made to control or manipulate relevant one variable and another or the impact of one variable on another.

Nature and Source of Data

Annual secondary data of the variables are used and they include capital expenditure, total capital expenditure, federal allocation to local government, state allocation to local government, value added tax, internally generated revenue and grant and other source of revenue.

Specification of Models

In this study, the researcher followed (Lucky and Uzah, 2017) but in a modified version. The study employs a "multiple regression model to estimate the relationship between treasury management and accounting bases." The estimates models used for analysis by some of the researchers are as follows:

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$$\text{VID} = f(\text{FA}, \text{SA}, \text{VAT}, \text{IGR}, \text{GO}) \quad 1$$

$$\text{VID} = \beta_0 + \beta_1\text{FA} + \beta_2\text{SA} + \beta_3\text{VAT} + \beta_4\text{IGR} + \beta_5\text{GO} + \varepsilon_t \quad 2$$

Where

VID = Value of investment on infrastructural development measured by capital expenditure

FA = Federal Allocation to Local Government

SA = State Allocation to Local Government

VAT = Value Added Tax

IGR = Internally Generated Revenue

GO = Grant and Others

ε_t = Error Term

DATA ANALYSIS TECHNIQUES

Econometric Analysis

Ordinary least squares (OLS) are a method for estimating unknown parameters in a linear regression model. Hutcheson (2011) defined the ordinary least squares (OLS) regression as a general linear modeling technique that can be used to model one response variable stored on at least one interval scale. This method minimizes the square vertical distances between the responses observed in the data set and the linear predicted responses.

The OLS technique can be implemented with one or more explanatory variables as well as categorically explanatory variables that are properly encoded. In the individual explanatory variables, the relationship between the continuous response variable (Y) and the continuous explanatory variable (X) can be represented by the most appropriate line where Y is predicted and to some extent X. the relationship is linear, it can be mathematically represented by a linear equation 'Y = a + β x

For the multiple explanatory variables additional variables are added to the equation. The form of the model is the same as in a single response variable (Y), but this time Y is predicted by multiple explanatory variables (X_1 to X_5).

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 \quad 3$$

The interpretation of the previous model parameters (α and β) is basically the same as for a simple regression model, but the relationship cannot be drawn from one scatter scheme. a shows the value of Y if all values of the explanatory variables are zero. Each parameter β shows the average change in Y related to unit change in X, while controlling other explanatory variables in the model. Model correction is available when comparing the deviation measurements of the entered models.

Unit Root Test/Stationarity Test

"A unit root test is a statistical test for the proposition that in a autoregressive statistical model of a time series, the autoregressive parameter is one." Econtermsy (t), where t a whole number, modeled by:

$$y(t+1) = ay(t) + \text{other terms}$$

If an unknown constant, the unit would be tested for the hypothesis of a = 1, usually for an alternative that |a| is less than 1. Variables such as inflation, interest rates, exchange rate and unemployment rate appear to be persistent and are often modeled as root units. The unit root technique is generally used to investigate whether a series for two variables is stationary or not. Macro-economic time series are usually not fixed. In most of these series, the series becomes stationary when calculating logarithms or calculating the first or second difference. Several tests are used to determine the stationary position, but in this study, the root test of the Dickey-Fuller unit is tested using stationary variables. The Augmented Dickey Fuller (ADF) unit root test is used to test the stationarity property of a time series data in order to avoid the spurious regression problem. The ADF unit root test is specified as

$$\Delta V_t = \eta V_{t-1} + \eta \sum_{i=1}^n \Delta V_{t-j} + \varepsilon_i \quad 4$$

$$\Delta V_t = \alpha_0 + \lambda V_{t-1} + \eta \sum_{i=1}^n \Delta V_{t-j} + \varepsilon_i \quad 5$$

$$\Delta V_t = \alpha_0 + \lambda_{li} + \eta V_{t-1} + \eta \sum_{i=1}^n \Delta V_{t-j} + \varepsilon_i$$

Note: The null hypothesis is rejected on the ground that the absolute value of the calculated ADF test statistic is larger than the absolute value of the Mackinnon critical value.

Cointegration Test

Cointegration is a "statistical property of time series variables; in a situation where two or more series are individually integrated (in the time series sense) but some linear combination of them has a lower order of integration, then the series are said to be cointegrated." According to (C T Eviews 2010) Cointegration refers to a scenario where linear combination of non stationary variables is stationary. For these non-stationary time series variables, there is a possibility of estimation by differencing in cases where the differences are stationary. "For estimation of the co-integrating relationship to be undertaken, it requires that all the time series variables in the model be integrated of order one I(1); the next step after recognizing the order of integration of the variables as I (1) or above is to test whether the variables in question can co-integrate or not."

The "three main methods for testing for cointegration are: The Engle-Granger two-step method (null: no cointegration, so residual is a random walk), The Johansen procedure, Phillips-Ouliaris Cointegration Test available with R (null: no cointegration)."

The VECM is more useful in Multivariate framework. To test for the presence of long-run equilibrium relationship, the Johansen's and Juselius (1990) and Johansen (1991) multivariate co-integration technique is employed. The co-integration test is based on the following equation.

$$\Delta Y_t = \alpha + \eta_1 \Delta Y_{t-1} + \eta_2 \Delta Y_{t-2} + \eta_3 \Delta Y_{t-3} + \eta_4 \Delta Y_{t-4} - \dots - \eta_{k-1} \Delta Y_{t-k+1} + \eta Y_{t-k} + \mu_t \quad 6$$

Where n and n are 4 x 4 matrices and k is the lag length. The tests used here involved co-integration with linear deterministic trend in the vector auto regression (VAR).

Granger Causality Test

When conducting an econometric study, the direction of the casualty relationship between the variables is determined according to the information obtained from the theory. In this study, a Granger casualty relationship test was used to test hypotheses regarding the existence of a causal link and the direction of asset quality and deposit money between banks' profitability. In this sense, the ratio of causal variables is determined and the Granger casualty relationship test has three different directions, they include the following:

The main objective of this study is to investigate the causality between the independent and the dependent variables. Granger (1996) proposed the concept of causality and ergogeneity: a variable Y_t is said to cause X_t , if the predicted value of X_t is ameliorated when information related to Y_t is incorporated in the analysis. The test is based on the following equation below

$$Y_t = \alpha_0 + \sum_{i=1}^n \alpha_i Y_{t-1} + \sum_{i=1}^n \beta_i X_{t-1} + \mu_{1t} \quad 7$$

and

$$X_t = \alpha_0 + \sum_{i=1}^n \alpha_i X_{t-1} + \sum_{i=1}^n \beta_i Y_{t-1} + \mu_{2t} \quad 8$$

Where X_t and Y_t are the variables to be tested while μ_{1t} and μ_{2t} are white noise disturbance terms and n is maximum number of lags. The null hypothesis $\alpha_1 = \beta_1 = 0$ for all 1's is tested against the alternative hypothesis $\alpha_1 \neq 0$ and $\beta_1 \neq 0$, if the coefficient of α_1 are statistically significant, that of β_1 are not, then X causes Y, If the reversal is true than Y causes X. However, where both coefficient of α_1 and β_1 are significant then causality is bi-directional.

Diagnostic Test

This study will conduct important diagnostic tests, namely, autocorrelation, heteroskedasticity and normality test as well as the stability test.

Multico linearity Test

To ascertain the independence of the predictor variables (explanatory variables), we employ the used of correlation matrix. The problem of multicollinearity usually occurs when some predictor variables are highly correlated. Hair et al (2006) opined that "correlation coefficient below 0.9 may not cause serious multicollinearity problem." While Kennedy (2008) argued that any correlation coefficient above 0.7 could cause serious problem of multicollinearity which might lead to inefficient estimation and less reliable result. This work adopted the guideline of Hair et al (2006) for the purpose of solving multicollinearity problem. This is because the scholar is the most famous references in multivariate analysis all over the world.

Autocorrelation Test

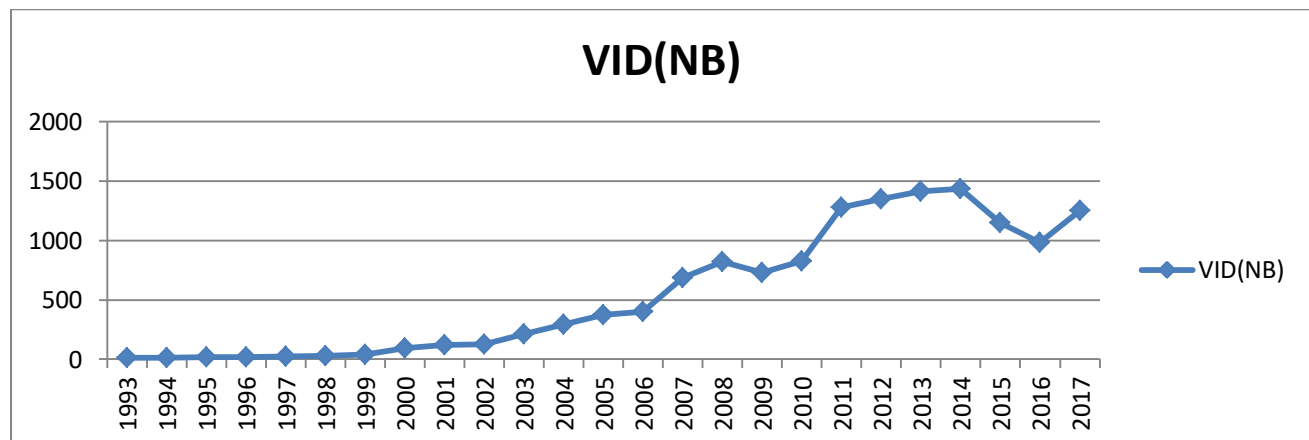
The assumption that the errors are uncorrelated with one another is the reason for the test for autocorrelation. But if the errors are correlated with one another it would be said that they are auto correlated. For the purpose of testing the existence the work employed the used of the famous Durbin-Watson test.

RESULTS AND DISCUSSION OF FINDINGS

Descriptive Analyses of the Variables

From the time series data presented in the above tables, we plot the line graph to illustrate the level of variation in the variables over the period covered in this study.

Line graph showing variation in the value of basic amenities



Source: Author's Computation from Excel, 2018

Figure i illustrate local government value of infrastructural development within the period covered in this study, the trend reveals that local government value of infrastructural development was on steady increase from 1993 to n2009 but slightly reduce in 2010/2011 but rose in 2012 to 2015. The decreeing 2016 and 2017 can be traced to economic recession and other fiscal challenges faced by the local government, for instance local internal generated revenue and state allocations.

Line graph showing variation in the value of federal allocation to local government in Nigeria

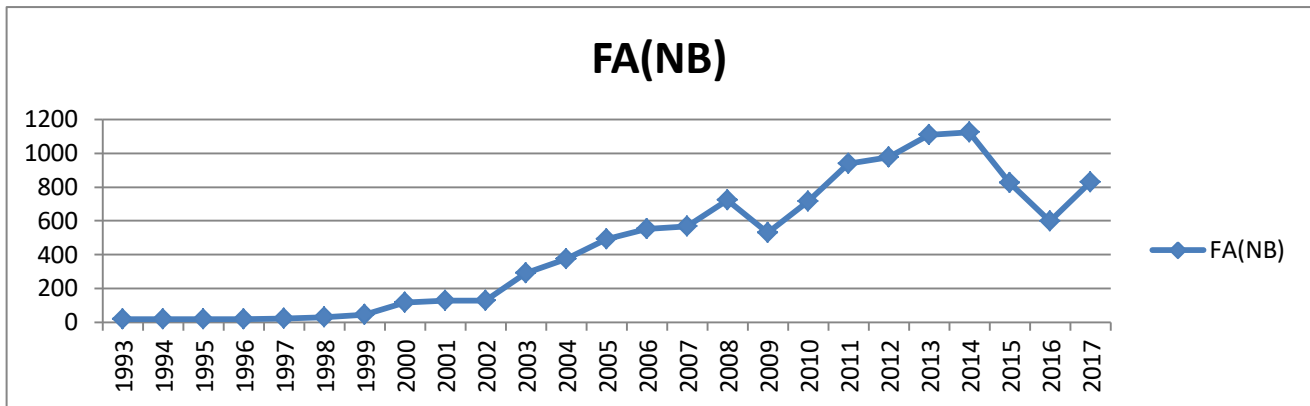
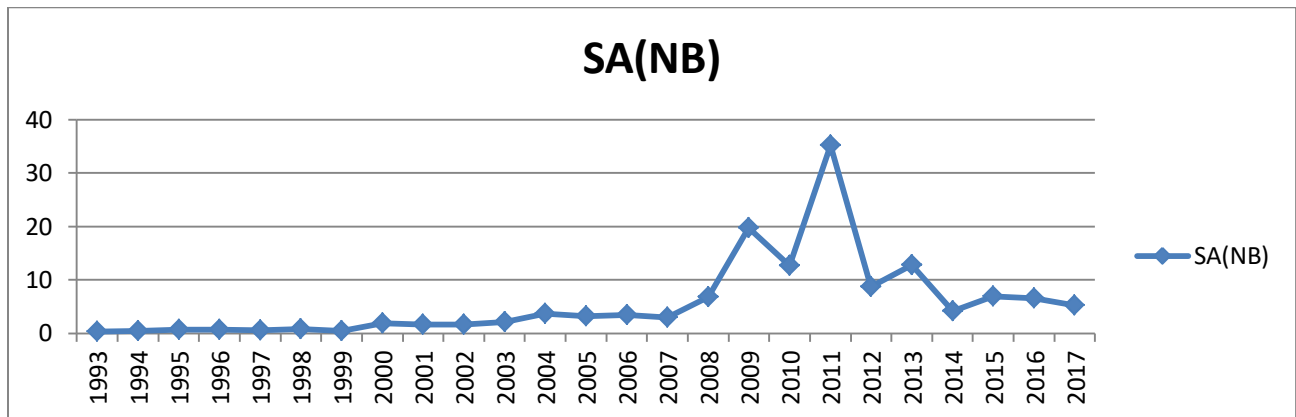


Figure ii illustrate the monetary value of feral allocation to local government within the period covered in this study, the trend reveals that federal allocation to local government was on steady increase from 1993 to 2008 but slightly reduce in 2009 but rose in 2010. The decreeing 2014 to 2016 can be traced to economic recession and other fiscal challenges faced by the local government, for instance local internal generated revenue and state allocations.

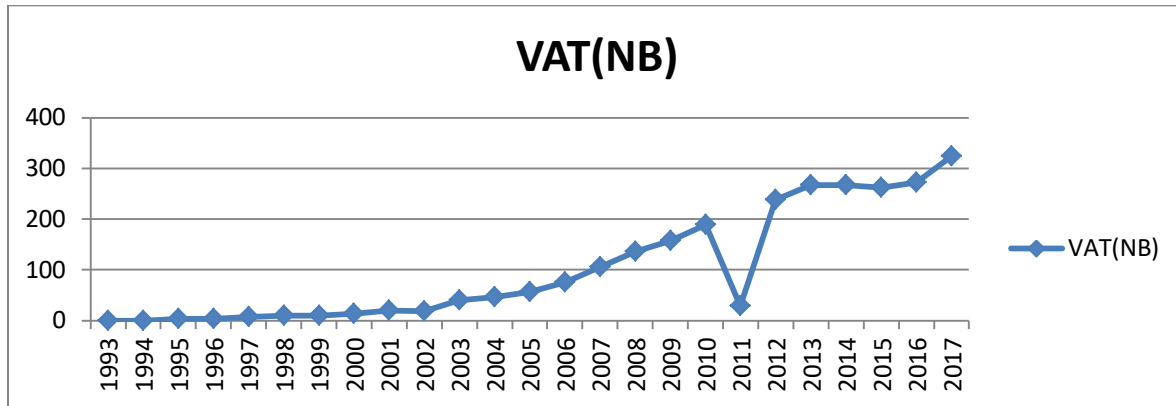
Line graph showing variation in the value of state allocation to local government in Nigeria



Source: Author’s Computation from Excel, 2018

Figure iii illustrate the monetary value of state allocation to local government within the period covered in this study, the trend reveals that state allocation to local government was below 5 million between 1993 to 2008; the value rose to the highest over the period in 2011 and reduce to 5 million in 2017. This could also be traced to financial challenges of local government from the state.

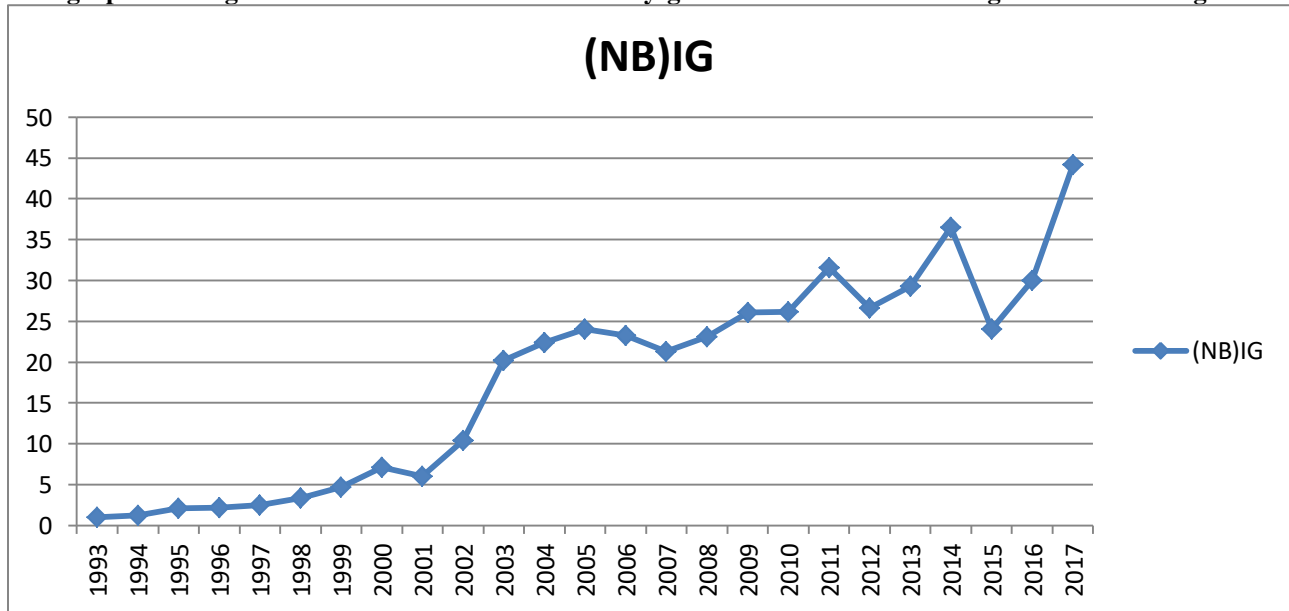
Line graph showing variation in the value of value added tax to local government in Nigeria



Source: Author’s Computation from Excel, 2018

Figure iv illustrate the monetary value of value added tax to local government within the period covered in this study, the trend reveals that value added tax to local government was on steady increase from 1993 to 2010 but fall below 50 million in 2011 and rose to the highest in 2017. The rise from 2015 can be traced to the treasury single account and measures formulated to stop tax leakage.

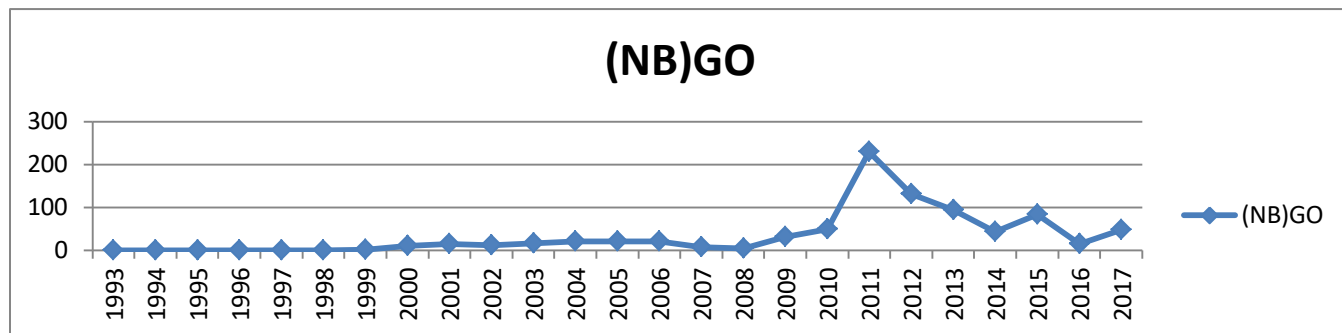
Line graph showing variation in the value of internally generated revenue of local government in Nigeria



Source: Author’s Computation from Excel, 2018

Figure v illustrate the monetary value of local government internally generated revenue within the period covered in this study, the trend reveals that value internally generated revenue of local government fluctuate to the highest in 2017 with 45 million.

Line graph showing variation in the value grants and other revenues of local government in Nigeria



Source: Author’s Computation from Excel, 2018

Figure vi illustrate the monetary value of local government grants and other sources of revenue over the periods covered in this study.

Presentation of Results

The following tables explain the dynamic relationship between local government finance and development of local governments in Nigeria.

Table i: Presentation of Short Run Dynamic Results

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|----------|
| VAT_NB_ | 2.140423 | 0.285225 | 7.504331 | 0.0000 |
| SA_NB_ | 5.955996 | 3.407334 | 1.747993 | 0.0985 |
| IG_NB_ | -3.404519 | 2.834887 | -1.200937 | 0.2462 |
| GO_NB_ | 1.965951 | 0.580055 | 3.389251 | 0.0035 |
| FA_NB_ | 0.656742 | 0.130809 | 5.020611 | 0.0001 |
| C | -8.086197 | 23.72757 | -0.340793 | 0.7374 |
| R-squared | 0.987340 | Mean dependent var | | 483.0039 |
| Adjusted R-squared | 0.983617 | S.D. dependent var | | 497.3107 |
| S.E. of regression | 63.65371 | Akaike info criterion | | 11.36425 |
| Sum squared resid | 68880.51 | Schwarz criterion | | 11.66047 |
| Log likelihood | -124.6889 | Hannan-Quinn criter. | | 11.43875 |
| F-statistic | 265.1721 | Durbin-Watson stat | | 1.979463 |
| Prob(F-statistic) | 0.000000 | | | |

Source: Extract from E-View 9.0 (2018)

The estimated model examined the effect of local government revenue on the value of infrastructural development. The result found R^2 and adjusted R^2 of 0.987 and 0.983 which implies that 98.7 and 98.3 percent variation on the value of infrastructural development can be traced to variation on local government revenue of the local governments. The t-statistics and probability of the independent variables justifies that all the variables are statistically significant except internally generated revenue. Furthermore, the overall fit of model is good given an F-statistic of 265.1721 (P-value = 0.000000). However, the Durbin Watson statistic is found to $d^* = 1.979463$ does not lies between D-Watson critical values of $dL 1.50$; $du = 1.84$ and suggesting test inconclusive in the level series result. "This indicates that there may be some degree of time dependence in the level series result which could lead to spurious regression results, suggesting the need for more rigorous analysis of the stationarity properties of the level series Data."

Table ii: Presentation of Autocorrelation Test

| D.W Coefficient | Critical Value | Relationship | Nature of Relationship | Decision |
|-----------------|----------------|--------------|------------------------|--------------|
| 1.979463 | $1.83 < 1.60$ | Presence | Positive relationship | Accept H_0 |

Source: Source: Extract from E-View 9.0 (2018)

E-views provide an overview of Durbin-Watson (DW) statistics as part of the standard regression output. Durbin-Watson statistics is a first-order sequence correlation test. More formally, the DW statistic measures the linear relationship between adjacent residues in the regression model. If no series correlates, DW statistics are approx. DW statistics fall if the worst case is a positive series correlation, it is close to zero. In the case of a negative correlation, the statistician is somewhere between 2 and 4. Positive series correlation is the most frequently observed form of dependence. Generally, DW statistics with 50 or more observations and only a few independent variables are below 1.5 is a definite reference to a positive first order series correlation.

The DW test has three major constraints on the series as a correlation test. First, the distribution of DW statistics under the zero hypotheses depends on the data matrix. The usual approach to managing this problem is to delineate a critical region by creating an area where the test results are not final. Secondly, if there are late dependent variables on the right side of the regression, the DW test is no longer valid. Finally, you can only test the null hypothesis that there is no sequential correlation between the successive series of correlations with an alternative hypothesis.

Table iii: Variance Inflation Factor

| Variable | Coefficient Variance | Uncentered VIF | Centered VIF |
|----------|-------------------------|-------------------|-----------------|
| VAT_NB_ | 0.081353 | 8.272762 | 4.703454 |
| SA_NB_ | 11.60993 | 6.321013 | 4.147999 |
| IG_NB_ | 8.036583 | 19.92926 | 6.884416 |
| GO_NB_ | 0.336463 | 7.197140 | 5.265845 |
| FA_NB_ | 0.017111 | 27.73501 | 12.06699 |
| C | 562.9975 | 3.195854 | NA |

Source: Extract from E-View 9.0 (2018)

The tolerance level is the amount of variability of the selected independent variable not explained by the other independent variable while the variance inflation factor indicates how the variance is inflated. A large VIF value, threshold of 10.0 corresponds with .10 of tolerance. Conventionally, VIF is not expected to be less than 4 and more than 10 (Gujurati and Deporta, 2005).

Table iv: Unit Root Test at Level

| VARIABLE | ADF STATISTICS | MACKINNON | | | PROB. | ORDER OF INTR. |
|----------|-------------------|-----------|-----------|-----------|--------|----------------|
| | | 1% | 5% | 10% | | |
| VID | 0.007567 | -3.959148 | -3.081002 | -2.681330 | 0.9452 | 1(0) |
| VAT | 2.398459 | -3.831511 | -3.029970 | -2.655194 | 0.9999 | 1(0) |
| SA | -1.490258 | -3.752946 | -2.998064 | -2.638752 | 0.5205 | 1(0) |
| FA | 0.279609 | -3.769597 | -3.004861 | -2.642242 | 0.9715 | 1(0) |
| IG | -0.729591 | -3.808546 | -3.020686 | -2.650413 | 0.8171 | 1(0) |
| GO | -2.448852 | -3.737853 | -2.991878 | -2.635542 | 0.1399 | 1(0) |

Source: Extract from E-View 9.0 (2018)

Weak stationarity requires that the mean (first moment) and variance/covariance (second moments) are independent of time. To confirm these informal checks, formal unit root tests are applied. However, the unit root results above proved that all the variables are stationary at first difference. This means the rejection of null hypotheses of non stationarity and acceptance of null hypotheses of null stationarity.

Table v: Unit Root Test at first difference

| VARIABLE | ADF STATISTICS | MACKINNON | | | PROB. | ORDER OF INTR. |
|----------|-------------------|-----------|-----------|-----------|--------|----------------|
| | | 1% | 5% | 10% | | |
| VID | -4.739064 | -3.886751 | -3.052169 | -2.666593 | 0.0000 | 1(I) |
| VAT | -7.426204 | -3.752946 | -2.998064 | -2.638752 | 0.0000 | 1(I) |
| SA | -9.568767 | -3.752946 | -2.998064 | -2.638752 | 0.0000 | 1(I) |
| FA | -6.701583 | -3.808546 | -3.020686 | -2.650413 | 0.0000 | 1(I) |
| IG | -3.211415 | -3.808546 | -3.020686 | -2.650413 | 0.0344 | 1(I) |
| GO | -6.099550 | -3.752946 | -2.998064 | -2.638752 | 0.0000 | 1(I) |

Source: Extract from E-View 9.0 (2018)

From table v, the results of the unit root tests show that the null hypotheses of a unit root for time-dependent variables of a "non-stationary nature can be made stationary at the first difference." It also shows that all the variables in the three models are integrated of order 1(1). This implies that the dependent variables and all our explanatory variables such became stationary at first differencing and it is integrated of 1(1). Having established the order of integration for the variables, the next step is to carry out a co-integration test to determine whether a long-run relationship exists between the variables. In this study we adopt co-integration test developed by Johansen (1988). The result of the co-integration test is presented in table 4.10). The low R^2 and the adjusted R^2 indicates that the variables are safe for the estimation processes in order to avoid spurious regression estimations that are plagued with the problems of serial correlation.

Table vi: Johansen Co-Integration Test Results: trace statistics

| Unrestricted Cointegration Rank Test (Trace) | | | | | |
|--|------------|-----------|----------------|---------|--|
| Hypothesized | | Trace | 0.05 | | |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** | |
| None * | 0.998245 | 373.1387 | 95.75366 | 0.0001 | |
| At most 1 * | 0.993277 | 246.2352 | 69.81889 | 0.0000 | |
| At most 2 * | 0.989551 | 146.1908 | 47.85613 | 0.0000 | |
| At most 3 * | 0.845195 | 54.96538 | 29.79707 | 0.0000 | |
| At most 4 * | 0.566032 | 17.65359 | 15.49471 | 0.0233 | |
| At most 5 | 0.046766 | 0.957904 | 3.841466 | 0.3277 | |

Source: Extract from E-View 9.0 (2018)

From table vi the results of the Johansen co-integration test shows that we adopt the alternative hypotheses of at most 4 co-integrating equation at the 5% level of significance from model. This implies that, there are linear combinations of the variables that are stationary in the long run" and also confirms the existence of a long-run relationship between accounting bases and treasury management in Nigeria local governments.

Table vii: Normalized Cointegration Test

| VID_NB_ | VAT_NB_ | SA_NB_ | IG_NB_ | GO_NB_ | FA_NB_ |
|----------|-----------|-----------|-----------|-----------|-----------|
| 1.000000 | -3.274155 | -8.608707 | 8.750894 | -2.392428 | -0.602938 |
| | (0.04103) | (0.36131) | (0.07334) | (0.05066) | (0.00793) |

The cointegration test in table 4.8 failed to indicate the nature of long run effect; normalized co-integration test established the nature of long-run effect among the variables. As presented in the table vii. The model found that value added tax, state allocation and grants have negative effect on value of infrastructural development while internally generated revenue have positive effect on value of infrastructural development.

Table viii : Vector Error Correction Estimates

| Error Correction: | D(VID_NB_) | D(VAT_NB_) | D(SA_NB_) | D(IG_NB_) |
|-------------------|------------|------------|------------|------------|
| CointEq1 | 1.830261 | 0.051134 | 0.054603 | -0.023236 |
| | (0.42709) | (0.11237) | (0.01519) | (0.02534) |
| | [4.28545] | [0.45506] | [3.59492] | [-0.91709] |
| C | 596.0224 | 41.78802 | 5.854383 | -5.619159 |
| | (114.032) | (30.0019) | (4.05540) | (6.76487) |

| | | | | |
|---|------------|------------|------------|------------|
| | [5.22680] | [1.39284] | [1.44360] | [-0.83064] |
| R-squared | 0.927879 | 0.982233 | 0.984864 | 0.676229 |
| Adj. R-squared | 0.837729 | 0.960024 | 0.965945 | 0.271516 |
| Sum sq. resids | 18385.54 | 1272.688 | 23.25361 | 64.70557 |
| S.E. equation | 47.93946 | 12.61293 | 1.704905 | 2.843975 |
| F-statistic | 10.29253 | 44.22696 | 52.05497 | 1.670883 |
| Log likelihood | -92.27120 | -66.90208 | -28.87904 | -38.60121 |
| Akaike AIC | 10.87065 | 8.200219 | 4.197793 | 5.221180 |
| Schwarz SC | 11.41743 | 8.747000 | 4.744574 | 5.767961 |
| Mean dependent | 74.54105 | 13.85789 | 0.184211 | 1.809474 |
| S.D. dependent | 119.0069 | 63.08353 | 9.238615 | 3.332082 |
| Determinant resid covariance (dof adj.) | | 23600.44 | | |
| Determinant resid covariance | | 741.7639 | | |
| Log likelihood | | -170.6251 | | |
| Akaike information criterion | | 23.43422 | | |
| Schwarz criterion | | 26.01900 | | |

Source: Extract from E-View 9.0 (2018)

The estimated model found that value of infrastructural development is positive and significant, value added tax is positive but insignificant, state allocation is negative and significant while grant is negative and insignificant. The R^2 and adjusted R^2 also show large explained variation from each of the variables.

Table ix: Persimmons Error Correction Estimates

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|----------|
| C | 11.79741 | 11.39327 | 1.035472 | 0.3766 |
| D(VID_NB_(-1)) | -0.922372 | 0.379311 | -2.431702 | 0.0932 |
| D(VID_NB_(-2)) | -1.014053 | 0.281019 | -3.608481 | 0.0365 |
| D(VID_NB_(-3)) | 0.001064 | 0.637394 | 0.001670 | 0.9988 |
| D(VAT_NB_(-1)) | 2.904354 | 1.228576 | 2.363999 | 0.0990 |
| D(VAT_NB_(-2)) | -2.238311 | 1.096121 | -2.042030 | 0.1338 |
| D(VAT_NB_(-3)) | -3.936173 | 2.212553 | -1.779019 | 0.1733 |
| D(SA_NB_(-1)) | -1.602146 | 6.176248 | -0.259404 | 0.8121 |
| D(SA_NB_(-2)) | -58.93515 | 23.42236 | -2.516192 | 0.0865 |
| D(SA_NB_(-3)) | -4.469001 | 26.56084 | -0.168255 | 0.8771 |
| D(IG_NB_(-1)) | -16.80444 | 5.107260 | -3.290304 | 0.0461 |
| GO_NB_ | 3.416647 | 1.648505 | 2.072573 | 0.1299 |
| FA_NB_ | 0.525787 | 0.153770 | 3.419309 | 0.0419 |
| ECM(-1) | -0.074735 | 0.250770 | -0.298020 | 0.7851 |
| R-squared | 0.993364 | Mean dependent var | | 82.19706 |
| Adjusted R-squared | 0.964607 | S.D. dependent var | | 123.8178 |
| S.E. of regression | 23.29375 | Akaike info criterion | | 9.046705 |
| Sum squared resid | 1627.797 | Schwarz criterion | | 9.732881 |
| Log likelihood | -62.89699 | Hannan-Quinn criter. | | 9.114912 |
| F-statistic | 34.54396 | Durbin-Watson stat | | 3.413272 |
| Prob(F-statistic) | 0.006965 | | | |

Source: Extract from E-View 9.0 (2018)

However, in model the "parsimonious error correction result indicates a good fit with an F-ratio of 34.54396, an R^2 of 99 % and an adjusted R^2 of 96 % meaning that the model explains approximately 99% of the variations" in value of infrastructural development in the model II; the D-Watson statistic of 3.4 suggests absence of any autocorrelation. The error correction term of -0.074 "has the appropriate negative sign is significant and shows that approximately 7% of the deviation from long run approximately 7% of the deviation from long run equilibrium.

Table x: Presentation of Granger Causality Test

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|--|-----|-------------|--------|
| VAT_NB_ does not Granger Cause VID_NB_ | 20 | 2.07857 | 0.1597 |
| VID_NB_ does not Granger Cause VAT_NB_ | | 23.0022 | 3.E-05 |
| SA_NB_ does not Granger Cause VID_NB_ | 20 | 1.18927 | 0.3316 |
| VID_NB_ does not Granger Cause SA_NB_ | | 0.04955 | 0.9518 |
| IG_NB_ does not Granger Cause VID_NB_ | 20 | 2.83768 | 0.0901 |
| VID_NB_ does not Granger Cause IG_NB_ | | 1.88712 | 0.1858 |
| GO_NB_ does not Granger Cause VID_NB_ | 20 | 0.19816 | 0.8223 |
| VID_NB_ does not Granger Cause GO_NB_ | | 1.29484 | 0.3029 |
| FA_NB_ does not Granger Cause VID_NB_ | 19 | 1.44262 | 0.2694 |
| VID_NB_ does not Granger Cause FA_NB_ | | 0.00206 | 0.9979 |

The model the results show that there is bi-directional causality from VID to SA while other variables have no causal relationship in the model.

DISCUSSION OF FINDINGS

To investigate the effect of revenue mobilization on the value of infrastructural development of local government in Nigeria, The result found that the independent variables can explain 98 percent variation on the value of infrastructural development. Coefficient of the independent variables found that with positive coefficient of 2.14 as parameter for value added tax, 5.955 as parameter for state allocation, 1.96 as parameter for grants and 0.656 as parameter for federal allocation indicate that a unit increase on the variables will lead to 2.4, 5.9, 1.9 and 0.6 percent increase on the value of infrastructural development of the local government.

The positive effect of the variables is expected. However, the negative coefficient of 1.96 as parameter for internally generated revenue can lead to 1.9 percent decrease in the value infrastructural development. This negative effect is contrary to expectation of the results. The positive findings confirm the findings of Alshujairi (2014) that provides evidence that developing countries are greatly affected by corruption, the findings Udeh and Sopekan (2015) that IPSAS adoption is expected to improve the level or quality of public sector financial reporting in Nigeria and that accrual-based IPSAS has the ability to improve financial reporting compared to cash based accounting. The positive findings confirm the legitimacy theories whose was found bound to theory of struggling for conformance in Central Government (CG) budgeting (Mkasiwa, 2011) and manipulating Legitimacy in Local Government Authorities (LGAs) accounting practices (Mzenzi, 2013). Theory of navigating legitimacy, the theory of struggling for conformance, and the theory of manipulating Legitimacy are employed by the study to explain external financial legitimacy and organizational efficiency as a result of accounting information use in the budget decision-making process.

CONCLUSION AND RECOMMENDATIONS

The estimated model found R^2 and adjusted R^2 of 0.987 and 0.983 which implies that 98.7 and 98.3 percent variation on the value of infrastructural development can be traced to variation on revenue mobilization of the local governments. The t-statistics and probability of the independent variables justifies that all the variables are statistically significant except internally generated revenue. Furthermore, the overall fit of the model is good given an F-statistic of 265.1721 (P-value = 0.000000). However, the Durbin Watson statistic is found to $d^* = 1.979463$ does not lies between D-Watson critical values of dL 1.50; $du = 1.84$ and suggesting test inconclusive in the level series result. "This indicates that there may be some degree of time dependence in the level series result which could lead to spurious regression results, suggesting the need for more rigorous analysis of the stationarity properties of the level series data. From the findings, the study conclude that revenue mobilization have significant effect on the infrastructural investment in investment

Recommendations

Based on the findings from this study, the following recommendations are proffered:

1. Financial structure of the local government as contain in relevant laws in Nigeria should be reformed. There need for local government financial autonomy, this will enhance local government revenue and investment in infrastructural development. The legal structure should be reformed to prosecute local government employees and elected officers that misappropriate and embezzle local government funds.

2. It was evidence that some of the independent variables affect negatively the dependent variables, this might be due none compliance to international public sector accounting standard, therefore local government should adopt the international public sector accounting standard for effective revenue mobilization and utilization to achieve desired development.

REFERENCES

- Alshujairi, M. (2014). Government accounting system reform and the adoption of IPSAS in Iraq. *Research Journal of Finance and Accounting*, 5 (24), 1- 20.
- Amin, A.(2018).Impact of internally generated revenue on community development :A case study of Asa local government area, Kwara State. *International Journal of Politics and Good Governance*, IX, (9.2)11-29.
- Atuilik, W. (2013).The relationship between the adoption of International Public Sector Accounting Standards (IPSAS) by governments and perceived levels of corruption. *Doctorate dissertation, Capella University, USA*.
- Brooks, C., (2008). *Introductory Econometrics for Finance*. Cambridge University.
- Dada, R. A., Adebayo, I. A., & Adeduro, O. A. (2017). An assessment of revenue mobilization in Nigeria local government: Problems and Prospects. *Archives of Business Research*, 5(9), 119-127.
- Dreze, Jean and Mamta Murthi. (2001). Fertility, education and development: *Evidence from India. Population and Development Review* 27: 33-63.
- Ediagbonya, K. (2013). The roles of entrepreneurship education in ensuring economic empowerment and development. *Journal of Business Administration and Education*, 4(1), 35-46
- Ehule, A. (2015). The impact of internally generated revenue on performance of public sector. *M.Sc. Thesis, University of Port Harcourt*.
- Emenuga, C. (1993). The search for an acceptable revenue allocation formula: *The National Question and Economic Development in Nigeria Ibadan. Nigerian Economic Society*.
- Essien, N. (2015). Impact of tax revenue on economic growth in Nigeria. *M.sc. thesis, University of Port Harcourt*.
- Federal Accounts Allocation Committee (FAAC) Sub Committee (2012).A manual on the implementation of International Public Sector Accounting Standards (IPSAS) for the three Tiers of Government in Nigeria
- Granger, C. W. J. (1996). Investigating causal relations by econometric models and cross spectral models. *Econometrica* 37: 424-438.
- Gupta, I & Arup, M. (2002): Rural migrants and labour segmentation: *Micro-Level Evidence from Delhi Slums (January 12, 2002; Economic and Political Weekly, 37 N0 2)*
- Hair.Jr., J. F,(2006). *Multivariant data analysis*. New Jersey: Pearson International Edition.
- Hutcheson, G. D., (2011). Ordinary least-squares regression. In L. Moutinho and G. D. Hutcheson , *The SAGE Dictionary of Quantitative Management Research*: 224-228
- Ijeoma, N. & Oghoghomeh, T. (2014).Adoption of international public sector accounting standards in Nigeria: Expectations, benefits and challenges. *Journal of Investment and Management*, 3(1), 21-29
- Ironkwe, U. I. & Ndah, E. (2016). Impact of internally generated revenue on performance of local government in rivers state, Nigeria. *International Journal of Business & Law Research* 4(4),42-58.
- Johansen, S., (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2-3), 231-254.
- Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with application to the demand for money. *Oxford Bulletin of Economics and Statistics* 52: 169-210.
- Kennedy, P (2008). A Guide to Econometric. 6th edn. *Blackwell Publishing, Malden*
- Kumar Arun, R.B. (2013). A sociological study on retired government employs in Karnataka. (Special Reference to Shimoga District). *International Journal of Humanities and Social Science Invention*, 1(3), 376-390.
- Kundu, D. (1999). Bivariate generalized exponential distribution. *Journal of Multivariate Analysis*, vol 100, 581 - 593.
- Lucky, A. L., & Uzah, C. K., (2017). Monetary Policy Transmission Mechanisms and Domestic Real Investment in Nigeria: A Time Series Study 1981-2015. *IIARD International Journal of Economic and Financial Management*, 2 (2), 29 – 59.
- Mkasiwa, T. (2011). Accounting changes and budgeting practices in the Tanzanian central government: A theory of struggling for conformance. *PhD thesis, University of Southampton*.
- Ocheni, S. (2012). *Local Government Finance in Nigeria*. JGGSDA.

- Okolie, D., & Eze, F. (2006). Local government administration in Nigeria: *Concepts and applications*. Enugu: John Jacob Classic Publishers Ltd.
- Onwumere, J. U. J. (2009). *Business and economic research methods*. Enugu, Vougasen Limited.
- Ostrom, V, & Ostrom, E (1971). A different approach to the study of public administration. *Public Administration Review*, 31(2) 203-216.
- Oviasuyi, P. O. (2011). Participation of the citizens in governance. *Journal of Social Sciences*, 24 (2), 81-86.
- Oviasuyi, R.O; (2010). Constraints of local government administration in Nigeria. (www.krepublisher.com).
- Sakurauchi, F. (2002) Public Sector accounting system and public governance. *Keizai Sangyo Journal (METI Journal) (Electronic version)*, Retrieved April 20th, 2012.
- Schacter, J, (2000). Paying for high- and low-quality teaching. *Economics of Education Review*, 23(4), 411–430.
- Vincent ,O. O. (2001). Fiscal federalism: the Nigerian experience, public lecture series no.4

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