

ECONOMIC ANALYSIS AND MODELLING OF LOCAL GOVERNMENT MONTHLY EXPENDITURE ON INCOME IN THE SOUTH WEST ZONE OF NIGERIA

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ABSTRACT

This paper presents statistical analyses and modelling of the thirty local governments' monthly expenditure on income in the State of Osun, Nigeria. Three different sources of local governments' income: Internally Generated Revenue (IGR), Statutory Allocation (SA) and Value Added Tax (VAT) were considered as predictor variables while expenditure was taken as response. Multiple Linear Regression was used as statistical tool. Data sets were sourced from Osun State Ministry of Local Government and Chieftaincy Affairs over a period of sixty months. Scatter plots were drawn to show the kind of relationships existing between expenditure and each of the three sources of income. Before conducting ANOVA, the data sets were inspected for normality assumption using normal probability plot of the standardized residual in the *R* statistical package. The plot revealed that normality assumption was not violated. Homoscedasticity assumption was further checked by the use of residual plot and Fligner-Killeen test, and it was revealed that error variances were homogeneous through-out. The tolerance of both autocorrelation and multicollinearity problems were further inspected using Durbin-Watson and Farrar-Glauber tests, and it was discovered that none of these problems existed in the data sets. After the application of All Possible Regression Method of Selection of the Best Regression Model, Statutory Allocation was recommended as the principal determinant of the local government expenditure in the South West Zone of Nigeria.

Keywords: *IGR, SA, VAT, ANOVA, R statistical package, residual plot and Fligner-Killeen test, Durbin-Watson and Farrar-Glauber tests and All Possible Regression Method.*

1. INTRODUCTION

A geographical entity having a well-defined political boundary with distinct settlements such as towns, villages and hamlets is simply termed to be Local Government. In Nigeria, Local Government is defined as the conception of a territorial, non-sovereign community possessing the legal right and the necessary organ to regulate its own affairs. This in turn presupposes the existence of local authority with power to act independently of external control as well as the participation of the local community in the administration of its own affairs. On the other hand, the 1976 Guidelines for Local Government Reforms in Nigeria defined Local Government as 'government at local level, exercised through representative councils established by law to exercise specific powers within defined areas'. These powers should give the councils substantial control over local affairs as well as staff and institutional/financial powers to initiate and direct the provision of services and, to determine and implement projects so as to complement the activities of both State and the Federal Governments in their areas, and to ensure through devolution of functions of these councils and through the active participation of the people and the traditional institutions that local initiative and response to local needs are maximized. Therefore, these definitions connote the existence of a legal authority for the representatives of a non-sovereign community to exercise powers in the provisions of socio-political and economic services over a geographical area. Thus, the relevance of a local government resides in the ability of its organs to meet the socio-political and economic expectations of the people in the area under its jurisdiction.

It is believed that local government system exists in every nation of the world, but with variations in its essential features such as constitutional status, historical structure and level of autonomy [3]. That is why the concept of local government has also been seen from various perspectives, which in real term has led to various definitions by prominent scholars and practitioners. One of the definitions put forward by a prominent writer saw it as a political authority set up by a nation or state as subordinate authority for the purpose of dispersing or decentralizing political power [1]. In his own view, [2], defined local government as a separate tier of government that enjoys some reasonable measures of autonomy, with elected representatives as officials especially in a democratic setting. [5] summarized what local government stands for, when he noted that it is characterized by its autonomy, legal identity, territory, population, localness, democratic representation, specificity of powers, and uniformity of structure. Hence,

the success and effectiveness of local government depends largely on the financial resources available and the way these resources are utilized.

However, Revenue Generation in the local government can be defined as the sum of legislated or legitimate income usually in monetary term collected from citizenry for the purpose of rural developments and for meeting other social needs of people. Internally Generated Revenue (IGR) is the revenue (income) generated in the form of capital receipts and taxes, which includes local rates, market taxes and levies excluding any market where state finance is involved, bicycle, truck canoe, wheelbarrow and cart fees, other than a mechanical propelled truck, permits and fines charged by customary courts, local government business investment, tenement rate, fees from schools, shops and kiosks rates, on and off liquor license fees, slaughter slab fees, marriage, birth and death registration fees. Other sources of IGR include naming of street registration fee excluding any street in the state capital, right of occupancy fees on lands in the rural areas excluding those collectable by the federal and state governments, cattle tax payable by cattle farmers only, merriment and road closure levy, religious places establishment permit fees, signboard and advertisement permit fees, radio and television license fees (other than radio and television transmitter), wrong parking charges, hackney permit fee, earnings from commercial undertakings e.g. sales of farm products, sales of eggs and fowls, sales of fertilizer, income from piggery, fishery and snailery, rent on local government properties e.g. rent on staff quarters, local government conference halls, ambulances, etc [6].

Statutory Allocation is the amount of money shared on monthly basis by the Federal Government from the Federation Account to all government agencies/commissions and establishments from which local government is included. Over the years, Nigeria has been searching for an equitable revenue allocation formula that will meet the yearnings and aspirations of its federating units. The search has remained largely elusive because the debate on revenue allocation, rather than focus on how to meet the nation's economic imperatives, has often been hindered in geopolitical and ethnocentric considerations. Paradoxically, however, the debate has also emphasized more on revenue sharing than on generating. In the present time, 20.6 per cent from the Federal Account is being shared to Local Governments in Nigeria while 26.72 and 52.68 per cents are for State and Federal Governments respectively. In Nigeria, section 7(6) of the 1999 constitution provides that “(a) the National Assembly shall make provisions of statutory allocations of public revenue to local government councils in the federation and, (b) the Houses of Assembly of states shall make provisions for statutory allocation of public revenue to local government councils within the state”, [4].

In this respect, Value Added Tax (VAT) is simply defined as the amount of money generated by state government through indirect taxation and, is shared on monthly basis to all government agencies including local governments. It is a form of a consumption tax. From the perspective of the buyer, it is a tax on the purchase price. From that of the seller, it is a tax only on the value added to a product, material, or service. And, from an accounting point of view, by this stage of its manufacture or distribution, the manufacturer remits to the government the difference between these two amounts, and retains the rest for themselves to offset the taxes they had previously paid on the inputs. The deductions made from the salaries of all workers in both state and local governments (Pay As You Earn - PAYE) are parts of Value Added Tax. From the reliable source, it has been established that 10 per cent of all taxes collected by the State Government of Osun is being distributed accordingly to each of the thirty local governments.

Further to the submissions above, it can be observed that the word *expenditure* has not been mentioned. At the local government level, expenditure means expenses incurred on particular projects or programmes. It could be divided into three major categories: capital expenditure, recurrent expenditure and consolidated revenue fund charges. Any expenditure (expenses) incurred on physical projects such as constructions of roads, buildings, bridges, purchase of machinery (equipment) and so on are all referred to as capital expenditure. On the other hand, any expenses incurred for the smooth running of administrative activities such as payment of salaries, imprests, and any other money considered to be overhead cost are all recurrent expenditure. Consolidated Revenue Fund Charges (CRFC) is the expenditure item that takes its first charge on the available revenue of the local government. It is a mandatory expenditure item that is not subject to the whims and caprices of the local government. Examples of such an expenditure item includes contribution to teachers' salaries, five per cent of the allocation to the traditional councils (rulers), one per cent of the allocation to local government service commission as staff training funds, five per cent of the allocation as contribution to the state owned university, and so on; all these had been legislated by the State of Osun House of Assembly. But in the present study, all these expenditure items are classified as total expenditure.

1.1 Objectives of the Study

- To know the most reliable source of income that determines the expenditure of local government in Osun State.
- To determine suitable model connecting local government expenditure with income.

- To determine the amount of variation in the expenditure that can be explained by only the reliable source of income obtained.

2. METHODOLOGY

Simple Correlation, Coefficient of Determination and Multiple Regression Analysis including All Possible Regression Method of Selection of the Best Regression Model were used for this research work. Total expenditure of the thirty Local Governments of the State of Osun (including the Ife-East Area Office) was considered as dependent variable and the three principal sources of revenue: Internally Generated Revenue (IGR), Statutory Allocation (SA) and Value Added Tax (VAT) were used as independent variables.

2.1 Statistical Legend

* y = Total Expenditure of the thirty local governments within the State of Osun (including Ife-East Area Office);

* x_1 = Internally Generated Revenue (IGR);

* x_2 = Statutory Allocation (SA); and

* x_3 = Value Added Tax (VAT).

3. DATA ANALYSIS

3.1 Scatter Plots of Individual Source of Income with Expenditure of the Local Governments

Some researchers consider scatter plot as the first step in regression analysis. Though, it has been established in some literatures that scatter plot suggests the type of relationship that exists between response and explanatory variables; it is drawn with a view to enabling us studying the kind of relationship that exists between the response variable and each of the explanatory variables. From figures 1 and 3, it is evident that no linear relationships exist between Internally Generated Revenue and Expenditure as well as between Value Added Tax and Expenditure whereas figure 2 pictures out a valid linear relationship between Statutory Allocation and Expenditure. The preview of the type of relationship(s) has already been identified through these various scatter plots.

3.2 Confirmation of Normality Assumption on the Data Sets

One of the basic assumptions for the authenticity of analysis of variance to hold is for normality assumption to exist. In this study, Normal Q-Q Plot is used to confirm whether or not normality assumption is not violated. This is also called Normal Probability Plot of the Standardized Residuals, which is a plot of the ordered standardized residuals versus the so-called normal scores. The normal scores are what we would expect to obtain if we take a sample of size n from a population having equal but unknown variances. If the residuals are normally distributed, the ordered residuals should be approximately the same as the ordered normal scores. Under good atmospheric condition of normality assumption, the plot should resemble a (nearly) straight line. From table 4, it is inferred that normality assumption is not violated when **R** statistical package is employed. Other means to confirm normality assumption in regression analysis include the use of Histogram of the Standardized Residuals and Shapiro-Wilk Test of Normality.

3.3 Confirmation of Homoscedasticity Assumption on the Data Sets

A situation where the variance of the residuals is affected by at least one predictor variable is simply termed to be heteroscedasticity. Another important assumption for validity of analysis of variance is equality of error variances. This means that the errors / residuals must have equal variances. If these errors fail to have equal (sometimes unknown) variances, they will not behave well. Specifically, the assumption is such that residuals are normally, identically and independently distributed with mean zero and constant but unknown variance leading to the test that all samples came from populations with identical variances [7]. In the present study, residual plot is employed for testing homoscedasticity assumption. This is a significant plot for checking homogeneity of sample variances. It has been reported in some literatures that if the residual plot appears structureless by having about the same extension of scatter of the residuals around zero for each of the variables (under study), it is an indication of homogeneous variances. Therefore, as a result of the structureless appearance of the residual plot in figure 5, then homoscedasticity assumption is not violated in the data sets. To further confirm reliability of the sample error variances, Fligner-Killeen Test, which is a median test of the null that the variances in each of the independent variables are the same, was introduced, and the result revealed from **R** statistical package that *p-value* is 1.25 with K-squared of 7.36 with degree of freedom of 2. This is an indication that homogeneity assumption is not violated since *p-value* is greater than value of the type I error ($\alpha = 0.05$).

3.4 Test for the Existence of Autocorrelation Problem on the Data Sets

Autocorrelation problem arises when the errors fail to be independent of each other. It is expected that errors (residuals) should be independent whatever the case may be, but if this condition does not hold as expected, we say there is problem of autocorrelation in the data sets. Therefore, one of the standard assumptions in the regression model is that the error terms are uncorrelated. Correlation in the error term suggests that there is additional information in the data that has not been exploited in the current model. When the observations have a *natural* sequential order, the correlation is referred to as *autocorrelation*. In some literatures, Durbin-Watson Statistic, which is a test that is aimed at determining whether there is dependency among the successive values of the error term, is considered most reliable and mostly used test for detecting existence of autocorrelation in regression analysis. Since $d_u (= 1.727) < d_{cal} (= 1.928) < (4 - d_u)$, we accept the null hypothesis of no autocorrelation and conclude that autocorrelation problem can be tolerated in the data sets.

3.5 Test for the Existence of Multicollinearity Problem on the Data Sets

You will recall that one of the assumptions of regression analysis is that the explanatory variables are independent of each other, that is, two or more explanatory variables do not tend to move together in the same pattern. When this assumption fails, we say there is multicollinearity among the independent variables. Therefore, a crucial condition for the application of ordinary least squares is that the predictor variables are not perfectly linearly related. The term multicollinearity is used to denote the presence of linear relationships among explanatory variables. If the explanatory variables are perfectly linearly correlated, that is, if the correlation coefficient for these variables is equal to unity, the parameters become indeterminate; it is impossible to obtain numerical values for each parameter separately and the method of least squares breaks down. At the other extreme if the explanatory variable are not intercorrelated at all (that is if the correlation coefficient is equal to zero), the variables are called orthogonal and there are no problems concerning the estimates of the coefficients, at least so far as multicollinearity is concerned. In a nutshell, orthogonality in regression refers to a situation whereby all predictor variables are totally independent of one another. Existence of multicollinearity could be sourced from numerous angles most especially from data deficiency. Since $\chi_{cal}^2 (= 6.88)$ is less than $\chi_{3;0.05}^2 (= 7.81)$, we do not reject the null hypothesis which states that no multicollinearity exists, thus it is reasonable to conclude that there is no multicollinearity problem in the data sets.

3.6 Estimation of Regression Parameters by Ordinary Least Squares

Here, we present estimates of regression parameters using ordinary least squares technique. Table I presents summary of results for the estimation and test of significance of regression parameters. It is evident from the results that only statutory allocation (x_2) is significant since its p_{value} ($=0.0022$) is less than significance level (0.05). It is therefore reasonable to buttress the inference observed from the preview of scatter plots shown in figures 1-3 respectively.

3.6.1 Analysis of Variance (ANOVA) on the three Sources of Income under Consideration

The aim of this method is to split the total variation of a variable (around its mean) into components which may be attributed to specific (additive) causes. Let's assume that there is only one systematic factor which influences the variable being studied. Any variation not accounted for by this (explanatory) factor is assumed to be random (or chance) variation, due to various random happenings. Since all assumptions underlying the application of analysis of variance are satisfied, it is reasonable to continue with the use of analysis of variance to verify the reliability of the estimates of the regression coefficients in table I. hence, the ANOVA table presented in table II reveals that the full regression model is not adequate since its p_{value} ($=0.674$) is greater than significance level (0.05). The implication of this is that there is no linear relationship between the local government expenditure and the three sources of income simultaneously, thereby calling for variable screening. As a result of this, we cannot reliably conclude that the estimates obtained in table I can be used to model the relationship between expenditure and the three sources of income under consideration.

3.6.2 Interpretation of the Coefficients of Correlation and Determination

So far, there is a clear indication that only statutory allocation can be statistically modeled with expenditure at the local government level. Therefore, results in table III can further confirm the assertion such that only statutory allocation has approximately 96% positive linear relationship with the expenditure of local government. The implication of this is that the rate at which increase or decrease in statutory allocation leads to corresponding increase or decrease in expenditure is approximately 96%. From the same table III, coefficient of determination is

92% indicating that only 8% variation cannot be explained by statutory allocation. The implication of this is that 92% of all financial activities depend on statutory allocation at the local government level.

3.6.3 R_p^2 -Criterion under All Possible Regression Method of Selection of the Best Regression Model

This method requires that all regression models involving one predictor, two predictors and so on be fitted and the best model is selected according to aforementioned criterion. Suppose we have a design consisting of p -predictors $x_1, x_2, x_3, \dots, x_p$, we shall assume that the intercept term be included in all models. It should be noted that the sample size must be greater than the number of parameters as we already have it in this study. Since we have only three predictor variables, there should be $(2^p - 1)$ models to be partitioned into p -groups indicating that eight models are expected to be built and partitioned into three as follows:

$$\text{1}^{\text{st}} \text{ Group: } \left. \begin{array}{l} y = 41.453 + 24.124x_1 \\ y = 0.2765 + 0.9139x_2 \\ y = 61.6747 - 1.5081x_3 \end{array} \right\}$$

$$\text{2}^{\text{nd}} \text{ Group: } \left. \begin{array}{l} y = 0.2148 + 6.5789x_1 + 0.8806x_2 \\ y = 52.5827 + 22.1502x_1 - 1.0231x_3 \\ y = 2.8233 + 0.9060x_2 - 0.2564x_3 \end{array} \right\}$$

$$\text{3}^{\text{rd}} \text{ Group: } y = 2.1056 + 6.3488x_1 + 0.8769x_2 - 0.1575x_3 \}$$

However, the models in each group are arranged in order of magnitude and the leader in each group is selected and compared according to R_p^2 -Criterion. If two models belonging to different groups have equal or almost equal value on the scale of criterion used, then the model with fewer predictor variables is selected as the best of all. This is called the Principle of Parsimony. From table IV, it is inferred that after the application of the principle of parsimony, only x_2 enters the solution meaning that statutory allocation is statistically significant in connection with the local government expenditure. The implication of this result is that only statutory allocation can, therefore, be modeled with the expenditure. Finally, the suitable model connecting local government expenditure with income is obtained as follows: $y = 0.2765 + 0.9139x_2$. This could be interpreted that Local Government Expenditure in the State of Osun is expected to increase by approximately 91% when, thus, statutory allocation increases by 100%.

4. CONCLUSION

From all indications, it is obvious that statutory allocation at the local government level determines the amount of expenditure to be incurred on monthly basis. Sequel to the analyses so far, it is reasonable to conclude that if there is no allocation from the Federation Account to the local governments in Nigeria, so many projects including salaries and wages of both permanent and adhoc workers would stand still even many of the overhead costs will not be incurred as at when due. Therefore, statutory allocation is recommended as the principal determinant of the local government expenditure in the South West Zone of Nigeria.

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APPENDIX

Figure 1: Scatter Plot showing the relationship between Internally Generated Revenue and Expenditure.

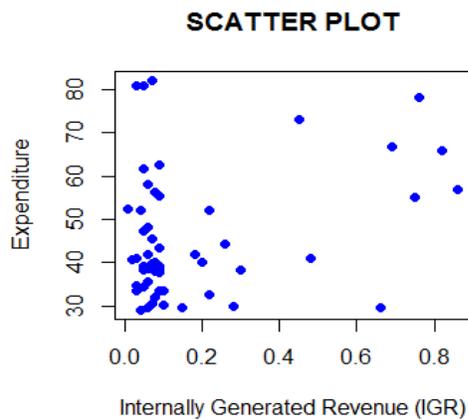


Figure 2: Scatter Plot showing the relationship between Statutory Allocation and Expenditure.

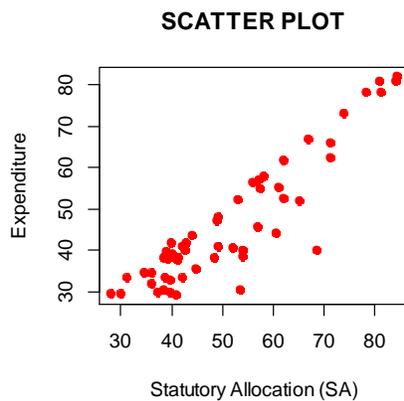


Figure 3: Scatter Plot showing the relationship between Value Added Tax and Expenditure.

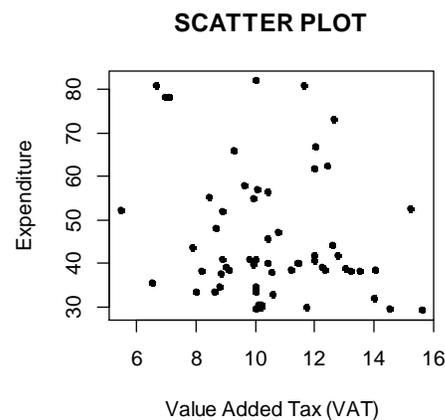


Figure 4: Normal Quantile-Quantile Plot for the Confirmation of Normality Assumption.

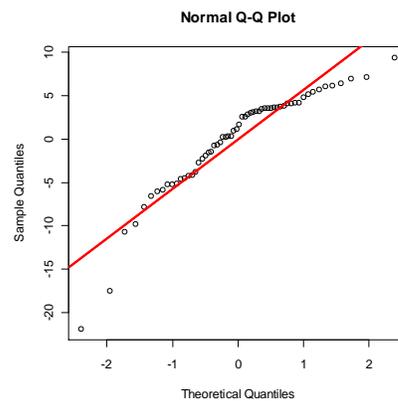


Figure 5: Residual Plot for the confirmation of Homoscedasticity Assumption

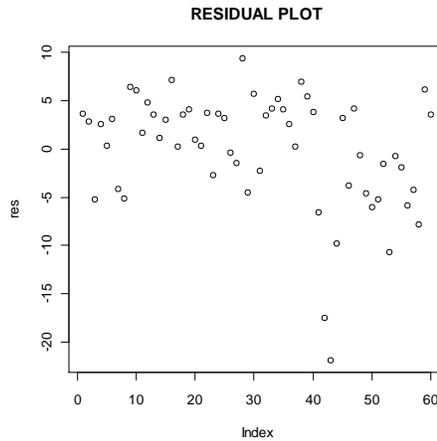


Table I: Results of Computation and Significance Test of Individual Regression Parameters

Variables	Estimates	Standard Error	T_{value}	P_{value}
Intercept	2.1056	5.2877	0.398	0.6920
x_1	6.3488	3.6069	1.760	0.0846
x_2	0.8769	0.0575	15.252	0.0022
x_3	-0.1575	0.3724	-0.423	0.6739

Table II: Analysis of Variance (ANOVA) Results Table for Overall Test of Significance

Source of Variation	Degree of Freedom	Sum of Square	Mean Square	F_{cal}	P_{value}
Regression	3	10,524.9	3,508.3	97.089	0.674
Residual	56	2,023.6	36.1357		
Total	59	12,548.5	-		

Table III: Results of Computation of Simple Correlation Coefficients between expenditure and the three sources of income as well as Coefficient of Determination

Variable	Y	x_1	x_2	x_3	R^2
Y	1	*	*	*	0.92
x_1	0.383	1	*	*	
x_2	0.959	0.318	1	*	
x_3	-0.225	-0.206	-0.207	1	

Table IV: Selection of the Best Regression Model Results using All Possible Regression Method (R_p^2 -Criterion)

Variables	SSR	SSE	R_p^2
x_1	1839.6	10708.9	0.147
x_2	10395.4	2153.1	0.838
x_3	633.4	11915.0	0.051
$x_1 x_2$	10518.4	2030.1	0.838
$x_1 x_3$	2118.8	10429.7	0.169
$x_2 x_3$	10412.9	2135.6	0.830