Quantitative Economics Research
Vol 1, No 1, 2018, pp. 47-55

Empirical Assessment of Selected Financial Indicators and Nigeria Gross Domestic Product

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History Article
Received: January 2, 2018
Accepted: February 14, 2018
Published: April 1, 2018

Keywords: Inflation; Lending rate; Money supply; Gross Domestic Product

JEL Codes: E43, E60, O40

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Abstract
This study undertook an overview of the financial sector and considered the contributions of some selected financial indicators to the gross domestic product (GDP) in Nigeria. Data were obtained from the statistical bulletin of the Central Bank of Nigeria (CBN) for the period, 1990-2016. The variables considered include: Lending rate (LR), Real Interest rate (RIR), Money Supply (M_2), Credit to Private Sector (CPS), Inflation rate (IR). Multiple regression analysis method was used to analyze the data. From the analysis, it is observed that credit to private sector (CPS) has a positive relationship with the GDP whereas the rest had negative relationship with the GDP. Further analysis using analysis of variance (ANOVA) showed that one of the factors (CPS) is significant. The Durbin-Watson value of 0.623155 implied no evidence of autocorrelation and the variance inflation factor (VIF) supported the conclusion. From the result obtained, it is recommended that the private sector should be given more access to credit. This will help in improving the economy since it has shown to have a positive relationship with the GDP.

How to Cite:
Acha, C. K, & Umezurike, C. (2018). Empirical Assessment of Selected Financial Indicators and Nigeria Gross Domestic Product. *Quantitative Economic Research, 1*(1), 47-55.

INTRODUCTION

The economic growth as a proxy of Gross Domestic Product (GDP) is one of the primary indicators used to gauge the health of a country's economy, Nwite (2014). Economic growth is the focus policy objective of any government. Economic growth, proxies by Gross Domestic Product (GDP) confers many benefits which include raising the general standard of living of the populace as measured by per capita national income, making income distribution easier to achieve, enhancing time frame for accomplishing the basic needs of man to a substantial majority of the populace, Uwakaeme (2015); Acha & Acha (2011; 2015). Nigeria has a history of economic growth plans by successive governments. Kelikume (2015) observed that economic development has direct relationship with the environment and whereas economic development is a policy intervention endeavour with aims of economic and social well-being of people, economic growth is a phenomenon of market productivity and rise in GDP. Usifo, (2015) x-rayed some factors which has affected the economic growth to include among the following; corruption, red tape, terrorism, insurgency, overdependence on import, poor infrastructure, inflation, high interest rate, value of the Naira, inability to process raw goods into finished products and government regulations. Researchers have done a lot work on the contributions of various sectors of the economy to the GDP. Olaoye (2016) evaluated the effect of budget implementation on Nigeria's economic growth. The findings from the study revealed that in the short run, public recurrent expenditure will have a positive relationship with GDP while public capital expenditure and public debt service will have a negative relationship with GDP. Lucky & Lyndon (2016) examined the relationship between interest rate, economic growth and bank lending rate in Nigeria. The study found that interest rate had negative relationship with bank lending rate while economic growth has a positive correlation with bank lending rate in Nigeria. Babak et al. (2012) unveiled the relationship that exists between monetary policy and GDP in Malaysia for quarterly data from 1991 to 2011. Co-integration analysis and vector error correction model (VECM) were used and the result showed that money supply is statistically significant and have a long term influence on GDP. Having seen the various factors that affect the economy viz-a-viz the GDP, this paper will be aimed at reviewing and analysing the financial determinants of the GDP. Selected financial determinants will be considered for the study.

METHOD

Data was collected from the statistical bulletin of the central Bank of Nigeria (1980-2016). In analysing the data, we employed the multiple linear regression analysis method. This method can be used to model a series with more than two independent variables. The multiple linear regression model can be represented as

$$Y = a + b_1 X_1 + b_2 X_2 + \ldots + b_k X_k + e \qquad (1)$$

where
a is a constant term, $b_1, b_2, ..., b_k$ are regression slopes or regression coefficients, Y is the response variable while $X_1, X_2, ..., X_k$ are k explanatory variables and e is the error term. The regression coefficients can be represented in matrix form as follows:

$$b = \begin{pmatrix} a \\ b_1 \\ b_2 \\ . \\ . \\ . \\ b_k \end{pmatrix} \qquad (2)$$

Ordinary least squares estimate for the regression coefficients obtained by maximum likelihood method is given as

$$\hat{b} = \begin{pmatrix} \hat{a} \\ \hat{b}_1 \\ \hat{b}_2 \\ . \\ . \\ . \\ \hat{b}_k \end{pmatrix} = \left(X'X\right)^{-1} X'y \qquad (3)$$

For this research, our model is as follows:

$$GDP = a + b_1 IR + b_2 LR + b_3 RIR + b_4 MS + b_5 CPS + e \qquad (4)$$

where

a = Constant, IR = Inflation Rate, LR = lending Rate, RIR = Real Interest Rate, MS = Money supply, CPS = Credit to private sector.

Testing of Assumptions

Stationarity of the Series:

For stationarity analysis, it is necessary to carry out unit root tests on the variables that will be included in the model. The condition for stationarity is one of the requirements prior to estimation since regression models involving non-stationarity time series may produce spurious regressions. A standard test for time series stationarity is the Augmented Dickey-Fuller (ADF) test that consists of estimating the equation:

$$\Delta y_t = \alpha + \gamma y_{t-1} + \sum_{i=1}^{p} \Delta y_{t-1} + e_t \qquad (5)$$

where *yt* is the series being tested and γ_{t-1} is the first difference operator. The null and alternative hypotheses are respectively, H_0: g = 0 and H_1: g < 0. This is a test of the hypothesis that the series has a unit root, meaning that it is non-stationary when the ADF statistical value is less than the critical value. Otavio et al. (2011) given that the series is a financial data and considering its volatility nature, we test for stationarity of the series.

Autocorelation

Durbin-Watson d Test

Gujarati (2004), the Durbin-Watson d statistic, used to detect serial correlation is defined as

$$d = \frac{\sum_{t=2}^{n} (\hat{e}_t - \hat{e}_{t-1})^2}{\sum_{t=1}^{n} \hat{e}_t^2} \qquad (6)$$

Multicollinearity

Variance Inflationary Factor

Multicollinearity generated by variable X_j is measured by variance inflationary factor given by

$$VIF_j = \frac{1}{1-R_j^2} \tag{7}$$

where R_j^2 is the coefficient of determination of the regression model that uses X_j as the response variable and all other X as the explanatory variable. If $VIF_j > 5$, X_j is highly correlated with the other explanatory variables, Kothari & Gaurav (2014).

Test for Normality of Error Terms

Normality test for the error terms were conducted using normal plot. Normal plot of the residual and also histogram of the residual was plotted.

RESULT AND DISCUSSION

Data was collected from the statistical bulletin of the central Bank of Nigeria (1980-2016). Some selected financial variables were collected. The variables include: Inflation rates (X_1), lending Rate(X_2), real interest rate (X_3), money supply (X_4), Credit to private sector (X_5), and the Gross domestic product (GDP = Y). Choice of variables to include in the model was largely influenced by availability of data and the researcher discretion. Analysis was done with the aid of Minitab software. Initially, the series was plotted without testing for stationarity. As seen in appendix I, all the independent variables except X_5 had a negative relationship with the GDP. The Durbin-Watson statistic value 0.623155 shows that no autocorrelation exists between the independent variables. The variance inflation factor (VIF) for the independent variables showed that X_4 and X_5 are correlated.

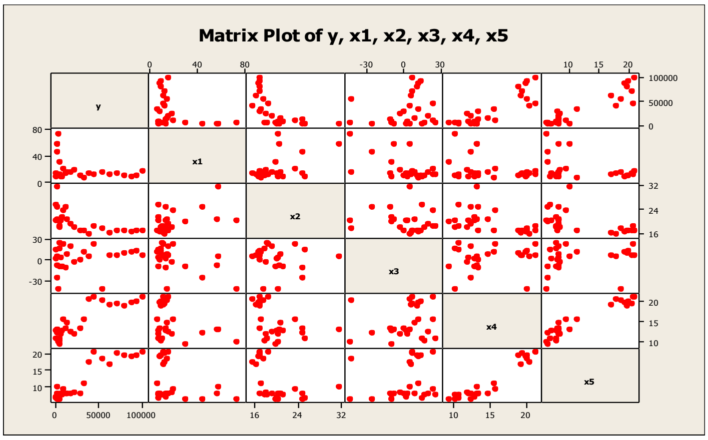

Figure 1. Matrix plot of the dependent and independent variables of the original series.

The matrix plot of the dependent variable and the independent variables in Figure 1 also suggested the relationship between X_4 and X_5. The correlation between the variables was calculated as seen in appendix II. The result showed that X_4 and X_5 was highly correlated. X_4 was then removed from the model because the correlation coefficient is highest. Appendix III has a display of the new model without the variable X_4.The independent variables except X_5 have a negative relationship with the GDP. Variance inflation factor of the new model showed presence of no multicollinearity. The normal graph for the residual in Figure 2 shows some level of adequacy of the model but the R^2 value of 86.7% is indicative that the model might be spurious. The series was tested for stationarity using the ADF test. Y variable was stationary at second difference while X_1, X_2, X_3, X_4 and X_5 were stationary at first difference respectively.

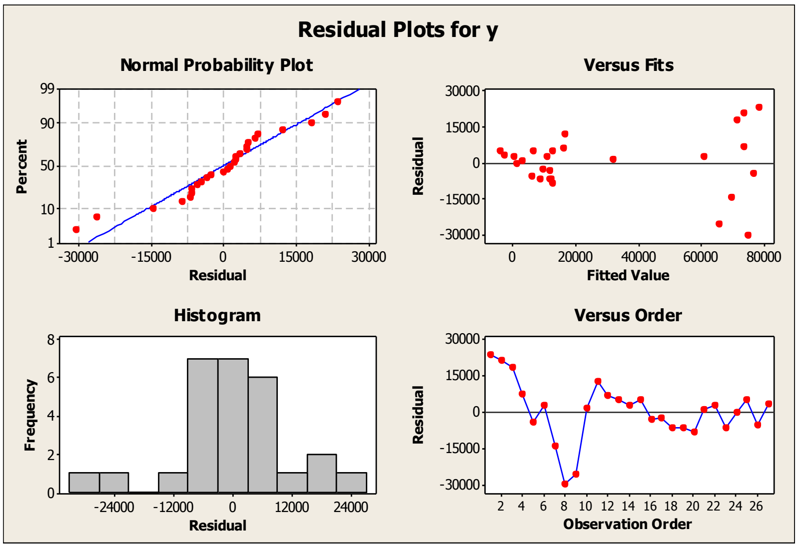

Figure 2. Residual Plots of the original series

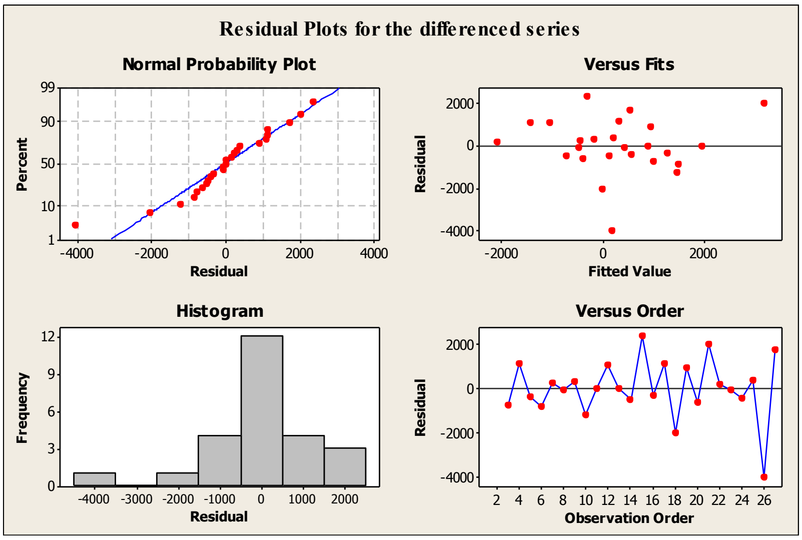

Figure 3. Residual plot of the differenced series

See appendix IV. The series was then modeled with the difference data. Interestingly, lending rate and credit to private sector had a positive relationship with the GDP while Inflation rate and Real Interest rate has a negative relationship with the GDP. A comparison between the models from stationary and nonstationary series in Tables 2 and 3 showed that the stationary series performed better.

Table 1. ADF unit root test summary

Variable	**Verified stationarity (5% level of significance)**
Y	in the second difference
X_1	in the first difference
X_2	in the first difference
X_3	in the first difference
X_4	in the first difference
X_5	in the first difference

Table 2. Regression analysis of the differenced series

Dependent Variable: YD2
Method: Least Squares
Date: 05/03/18 Time: 11:55
Sample (adjusted): 1992 2016
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	263.4906	303.8595	0.867146	0.3961
X1D1	-20.23370	25.54531	-0.792071	0.4376
X2D1	14.31716	102.5667	0.139589	0.8904
X3D1	-47.46577	13.08816	-3.626620	0.0017
X5D1	70.45066	161.8033	0.435409	0.6679
R-squared	0.421226	Mean dependent var		289.9268
Adjusted R-squared	0.305471	S.D. dependent var		1734.097
S.E. of regression	1445.169	Akaike info criterion		17.56670
Sum squared resid	41770247	Schwarz criterion		17.81047
Log likelihood	-214.5837	Hannan-Quinn criter.		17.63431
F-statistic	3.638950	Durbin-Watson stat		2.792025
Prob(F-statistic)	0.021984			

Table 3. Regression analysis of the original series

Dependent Variable: Y
Method: Least Squares
Date: 05/03/18 Time: 11:47
Sample: 1990 2016
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2390.835	20666.12	0.115689	0.9089
X1	-77.58886	198.2155	-0.391437	0.6992
X2	-1440.643	911.6963	-1.580179	0.1283
X3	-59.37974	177.0031	-0.335473	0.7404
X5	4877.840	543.3946	8.976607	0.0000
R-squared	0.867381	Mean dependent var		29783.15
Adjusted R-squared	0.843268	S.D. dependent var		33028.95
S.E. of regression	13075.95	Akaike info criterion		21.96051
Sum squared resid	3.76E+09	Schwarz criterion		22.20048
Log likelihood	-291.4669	Hannan-Quinn criter.		22.03187
F-statistic	35.97215	Durbin-Watson stat		0.618420
Prob(F-statistic)	0.000000			

CONCLUSION

Monetary policy rate set by government determines the direction of the economy. The lending rate, real interest rate, money supply etc are influenced by monetary policy. Research has shown that the GDP is affected positively by money supply. Increase or decrease in money supply in turn affects the direction of inflation, lending rate, interest rates. Within the period under study, it is observed that lending rate and credit to private sector have a positive relationship with the GDP while the other independent variables had a negative influence on the economy. This could be seen in the economic outlook. Recession, depression, increase in prices of commodities, rise of the exchange rate in favour of the dollar etc. From the analysis, increase in credit to private sector, money supply and lending rate will have a positive impact in the GDP. This means that facilities given to the private sector helped to improve the economy. In the light of the foregoing, it is therefore recommended that government should pay more attention to giving aids in form of credit facilities to the private sector, encourage the ease of doing business and support small medium enterprises (SMEs). This will encourage employment and contribute to the economic development. It is worthy to note that this work could also be carried out using cointegration method and estimates made using the Vector Error Correction (VEC). So further research could be carried out to compare the results.

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Appendix I: Regression Analysis of the Original Series.

Regression Analysis: y versus x1, x2, x3, x4, x5

The regression equation is y = 8355 - 95 x1 - 1373 x2 - 70 x3 - 1026 x4 + 5592 x5

Predictor	Coef	SE Coef	T	P	VIF
constant	8355	24735	0.34	0.739	
X1	-95.4	205.6	-0.46	0.647	1.952
X2	-1372.9	940.2	-1.46	0.159	1.744
X3	-70.5	181.9	-0.39	0.702	1.504
X4	-1026	2235	-0.46	0.651	11.836
X5	5592	1652	3.38	0.003	12.552
R-Sq	86.9%				
R-Sq(adjustment)	83.7%				
Durbin-Watson statistic = 0.623155					

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	**5**	24639492231	4927898446	27.79	0.000
Residual Error	**21**	3724209400	177343305		
total	**26**	28363701631			

Appendix II: Stepwise Regression of the Original Series

Stepwise Regression: y versus x1, x2, x3, x4, x5

Alpha-to-Enter:0.15 Alpha-to-Remove: 0.15,Response is y on 5 predictors, with N = 27

STEP	1	2
CONSTANT	-33856	3841
x5	5417	4871
T-Value	11.62	9.43
P-Value	0.000	0.000
x2		-1591
T-Value		-2.02
P-Value		0.055
S	13318	12569
R-Sq	84.37	86.63
R-Sq(adjustment)	83.74	85.52
Mallows Cp	2.0	0.4

Correlations: y, x1, x2, x3, x4, x5

	Y	X1	X2	X3	X4
X1	0.375(0.054)				
X2	-0.609(0.001)	0.488(0.010)			
X3	0.172(0.390)	-0.541(0.004)	-0.135(0.502)		
X4	0.865(0.000)	-0.341(0.082)	-0.479(0.011)	0.174(0.386)	
X5	0.919(0.000)	-0.329(0.094)	-0.524(0.005)	0.193(0.334)	0.955(0.000)
Cell Contents: Pearson correlation, P-Value in parenthesis.					

Appendix III: Regression Analysis of the Original Series without x4

Regression Analysis: y versus x1, x2, x3, x5

The regression equation is y = 2391 - 78 x1 - 1441 x2 - 59 x3 + 4878 x5

Predictor	Coef	SE Coef	T	P	VIF
constant	2391	20666	0.12	0.909	
X1	-77.6	198.2	-0.39	0.699	1.883
X2	-1440.6	911.7	-1.58	0.128	1.701
X3	-59.4	177.0	-0.34	0.740	1.477
X5	4877.8	543.4	8.98	0.000	1.408
R-Sq	86.7%				

R-Sq(adj)	84.3%
Durbin-Watson statistic = 0.618420	

Analysis of Variance

Source	**DF**	**SS**	**MS**	**F**	**P**
Regression	**4**	24602132920	6150533230	35.97	0.000
Residual Error	**22**	3761568711	170980396		
total	**26**	28363701631			

Appendix IV: Regression Analysis of the Differenced Series

Regression Analysis: yt-2 versus X1-1, X2-1, X3-1, X5-1

The regression equation is yt-2 = 263 - 20.2 X1-1 + 14 X2-1 - 47.5 X3-1 + 70 X5-1

Predictor	Coef	SE Coef	T	P	VIF
constant	263.5	303.9	0.87	0.396	
X1-1	-20.23	25.55	-0.79	0.438	1.297
X2-1	14.3	102.6	0.14	0.890	1.240
X3-1	-47.47	13.09	-3.63	0.002	1.346
X5-1	70.5	161.8	0.44	0.668	1.300
R-Sq	42.1%				
R-Sq(adj)	30.5%				
Durbin-Watson statistic = 2.79202					

Analysis of Variance

Source	**DF**	**SS**	**MS**	**F**	**P**
Regression	**4**	30399969	7599992	3.64	0.022
Residual Error	**20**	41770247	2088512		
total	**24**	72170216			