The Contribution of Commercial Banks to GDP Growth in Nigeria using Autoregressive Distributed Lag Model

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Abstract

In most econometrics literature, the Autoregressive Distributed Lag (ARDL) model is often applied in many economic analyses to study short and long run relationships. This is because ARDL model can deal with economic variables that are integrated of different order (I(0), I(1) or combination of both) and also it is robust where there is single long-run relationship between the underlying variables in a simple sample size. This study applied the ARDL model to examine the contributions of commercial Banks to GDP growth in Nigeria. To achieve this, annual data covering 1981 to 2015 for loans and advances, savings, lending rates and GDP of Financial Institutions were collected from CBN bulletin. The ADF test revealed that the variables are I(1) except for lending rate which was of I(0) order. The ARDL(1,1,1,2) model revealed that loans and advances, and lending rates are significantly positively related to GDP in Nigeria but savings was not significant in the model. The model revealed some evidence of short run relationships while the ecm(-1) was -0.6156 (P-value=0.0038<0.05) which means that the rate of the speed of adjustment to equilibrium is 61.56% annually. The estimated model is free from serial correlation, multicollinearity, heteroscedasticity while the model is stable and the residuals are normally distributed. The study recommends that savings and savings culture should be encouraged in Nigeria since economic theory states that savings and investment are related in any economic development.

Keywords: Gross Domestic Product (GDP), Lending Rates, Savings, Loans and Advances, ARDL

1.0   Introduction

Pesaran, et al. (2001) proposed an Autoregressive Distributed Lag (ARDL) or Bounds testing approach to investigate the existence of cointegration relationship among variables. There are three specific advantages associated with this approach (Udoh et al. 2015):

- It circumvents the problem of the order of integration associated with the Johansen likelihood approach.
- Unlike most of the conventional multivariate cointegration procedures which are valid for large sample size, the bounds test approach is suitable for sample size study.
- It provides unbiased estimates of the long run model and valid t-statistics even when some of the regressors are endogenous.

Autoregressive Distributed Lag (ARDL) Models have played a prominent role in numerous application in the Nigerian economy. Examples include the study of fiscal decentralization, economic growth and human resources development in Nigeria (Udoh, et al. 2015); Doguwa and Alade (2015) compared ARDL model among other models on the modeling of Nigeria's external reserves; Udom and Yaaba (2015) used ARDL model on the determination of the monetary policy instrument for Nigeria, and, Musa and Gulumbe (2014) studied the interrelationship between inflation rate and government revenues in Nigeria using ARDL model.

This study applied the ARDL model to examine the contributions of commercial Banks to GDP growth in Nigeria.

2.0   Empirical Review on the Contribution of Banking Sector to GDP Growth

According to Adekunle, Salami and Adedipe (2013) a well-developed financial system play several roles to boost efficiency of intermediation through reduction of information, transaction and monitoring costs. It will also enhance investment by identifying and funding good business opportunities, mobilizes savings, encourage trading, hedging and diversification of risk as well as facilitating exchange of goods and services. However, not all savings are used to finance investments despite high demand for credit because of the limited accessibility to credits in Nigeria (Azege, 2007). Indeed, the lack of credit has been cited by firm managers in the developing countries especially Nigeria as their major constraint (Bigstein and Soderbom, 2005). Lack of funds has made it difficult for industries to invest in modern machines, information technology and human resources development which are critical in reducing production costs, raising productivity and improving competitiveness. Also, low investments have been traced to unwillingness of banks to provide credits to manufacturers, owing partly to the mismatch between the short-term nature of banks' funds and the medium to long term nature of funds needed by industries.

Hashim (2012) posits that despite series of bank reformed aimed at strengthening the ability of banks to efficient services delivery and branch networking as well as funding the real sector to boost Nigerian economy, the dynamic challenges still lingers on the efforts. The problems such as inefficient allocation of funds to the real sector, lack of long-dated funding, decline in domestic credit by the banking sector to the private sector, mismatch of liquidity in the Nigeria economy, etcetera were attributed to the financial inefficiency in the economy.

Abubakar and Gani (2013) investigate the long run relationship between financial development indicators and economic growth in Nigeria for the period 1970-2010. The study used Johansen and Juselius (1990) approach to co integration and Vector Error Correction Modelling (VECM). It was discovered that long-run, liquid liabilities of commercial banks and trade openness exert significant positive influence on economic growth, conversely, credit to the private sector, interest rate spread and government expenditure exert significant negative influence. This implied that, credit to the private sector is marred by the identified problems and government borrowing and high interest rate are crowding out investment and growth. The study recommends that financial reforms in Nigeria should focus more on deepening the sector in terms of financial instruments so that firms can have alternatives to banks' credit which proved to be inefficient and detrimental to growth, moreover, government should inculcate fiscal discipline so as to reduce excessive borrowing from the financial sector and thereby crowding out private investment.

In the same vein, Bhusal (2012) examine the impact of policy reforms on financial development and economic growth in Nepal by employing the annual data spanning from 1965 to 2009. He employed Augmented Dickey Fuller test and exogenous break test as instrument of analysis. The findings revealed that all variables except domestic credit are nonstationary at the level, when time series properties of variables help to detect the impact of policy reforms are examined with a structural break; only economic growth experienced a shock, growing positively after the liberalization. Similarly, domestic credit provided by banks witness negative growth, and it decreased in pace after policy reforms, which implies that the role of government declined after the liberalization.

According to Pearce (1992), credits refer to the process of lending and borrowing of fund from financial able bodies such as banks, government, individuals and other financial

institutions. It can also be describe as a means of obtaining resources at a certain period of time with an obligation to repay in accordance with the terms and conditions of the credit obtained. Succinctly, credit refers to availability of resources (money) to household, firms and government with an agreement to repay at a stipulated period of time. Pandey, (2006) posits that the credit term to be granted to any customer depends on the norms and practice of the industry.

3.0   Model Specification

The ARDL model specification of the functional relationship between the GDP for Financial Institutions and Lending Rates, Loans and Advances and Weighted Average Savings is given below

$$\Delta LNGDPF = \alpha_0 + \beta_1 LNGDPF_{t-1} + \beta_2 LNLA_{t-1} + \beta_3 LNSAV_{t-1} + \beta_4 LNINT_{t-1} +$$

$$\sum_{i=1}^{p} \delta_{1i} \Delta LNGDPF_{t-i} + \sum_{i=0}^{q} \delta_{2i} \Delta LNLA_{t-i} + \sum_{i=0}^{r} \delta_{3i} \Delta LNSAV_{t-i} + \sum_{i=0}^{s} \delta_{4i} \Delta LNINT_{t-i} + \varepsilon_t \qquad (1)$$

Where: LNGDDF- Natural Logarithm transform of GDP of Financial Institutions, LNINT- Natural Logarithm transform of Lending Rates, LNLA- Natural Logarithm transform of Loans and Advances, LNSAV-Weighted Average Savings, p, q, r, s= Lag lengths for the ARDL model, Δ = First differencing operator; ε = white noise disturbance error term, α_0 = constant in the model, $\beta_1 \dots \beta_k$ are the long run coefficients, $\delta_1 \dots \delta_k$ are the short run coefficients.

The bound test approach for the long-run relationship between the macro variables is based on the Wald test (F statistic), by imposing restrictions on the long-run estimated coefficients of one period lagged level of the dependent variable and the independent variables to be equal to zero, that is, $H_0 : \beta_1 = \dots \beta_k = 0$. Then the calculated F statistic is compared to the tabulated critical value in Pesaran et al. (2001).The explanatory variables are assumed to be integrated of order zero, or I(0) for values of the lower bound, while the upper bound values assumed that they are integrated of order one, or I(1). Therefore, the decision rule is that if computed F-statistic falls below the lower bound value, I(0), the null hypothesis (no co-integration) cannot be rejected. While if the computed F-statistic exceeds the upper bound value, I(1) then it can be concluded the variables are co-integrated.

The long-run and short run parameters of equation (1) can then be estimated once a cointegration relationship had been established. The co-integration long run relationship was estimated using the following specification:

$$LNGDPF = \alpha_0 + \beta_1 LNGDPF_{t-1} + \beta_2 LNLA_{t-1} + \beta_3 LNSAV_{t-1} + \beta_4 LNINT_{t-1} + \varepsilon_t \qquad (2)$$

However, to restore equilibrium immediately may not be possible because of the speed of adjustment. This could be caused by the lags and adjustment process used to capture changes in any of the factors affecting GDP overtime. Hence, the error correction model was used to capture the speed of adjustment of GDP model. The model is expressed below thus:

$$\Delta LNGDPF = \alpha_0 + \sum_{i=1}^{p} \delta_{1i} \Delta LNGDPF_{t-i} + \sum_{i=0}^{q} \delta_{2i} \Delta LNLA_{t-i} + \sum_{i=0}^{r} \delta_{3i} \Delta LNSAV_{t-i} + \sum_{i=0}^{s} \delta_{4i} \Delta LNINT_{t-i} + \delta_5 ect_{t-1} + \varepsilon_t \qquad (3)$$

Where: ect_{t-1} = the error correction term lagged for one period; δ_5 = the coefficient for measuring speed of adjustment in equation (3).

4.0   Materials and Methods

Secondary data was employed in this study collected from Central Bank Statistical Bulletin. Annual data was collected on Loan and advances, Lending Rate, Savings and GDP of financial institutions. The data covers a period from 1981 to 2015. The data was transformed using Natural logarithm as Natural Logarithm transform of GDP of Financial Institutions (LNGDDF), Natural Logarithm transform of Lending Rates (LNINT), Natural Logarithm transform of Loans and Advances (LNLA), Natural Logarithm transform of Weighted Average Savings (LNSAV). The Natural Logarithm transform of GDP of Financial Institutions (LNGDDF) was used as the dependent variable.

5.0   Results and Discussion

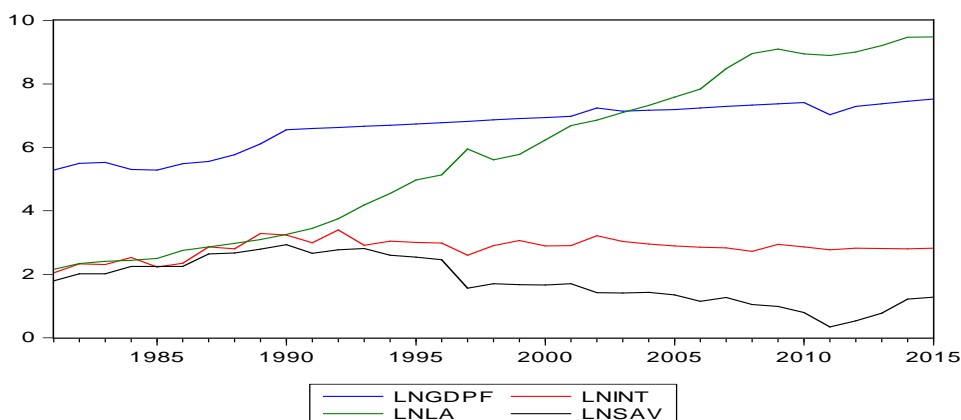The analysis are carried out using EViews 7.2 Statistical Software

Fig 1: A Plot of the Economic Macro Variables

Figure 1 above shows the plot of the natural log transformed of the variables used in this study.

There evidence of positive growth in the performance of the macro economic variables.

Table 1: Descriptive Statistics of the Economic Macro variables

	LNGDPF	LNINT	LNLA	LNSAV
Mean	6.658313	2.828667	5.751817	1.793394
Median	6.867640	2.867330	5.777030	1.702930
Maximum	7.523930	3.394510	9.479310	2.933860
Minimum	5.282750	2.047690	2.151760	0.343590
Std. Dev.	0.729900	0.297896	2.564343	0.725453
Skewness	-0.806143	-0.749199	0.051584	-0.084856
Kurtosis	2.229984	3.516531	1.527985	1.944436
Jarque-Bera	4.655571	3.663336	3.175479	1.666900
Probability	0.097511	0.160146	0.204387	0.434547
Sum	233.0409	99.00334	201.3136	62.76879
Sum Sq. Dev.	18.11361	3.017238	223.5791	17.89360
Observations	35	35	35	35

Key: LNGDDF- Natural Logarithm transform of GDP of Financial Institutions
LNINT- Natural Logarithm transform of Lending Rates
LNLA- Natural Logarithm transform of Loans and Advances
LNSAV-Weighted Average Savings

Table 1 above shows the descriptive statistics of the macro economic variables. The economic macro variables are all normally distributed (since P-values>0.05)

Table 2: ADF Test of the Economic Macro variables

	Level		1st Difference		
Variables	ADF Value	p-value	ADF Value	P-value	Order
LNGDPF	-1.5884	0.4774	-5.0987	0.0002	I(1)
LNLA	-0.0937	0.9423	-5.1918	0.0002	I(1)
LNSAV	-0.8215	0.8001	-5.4345	0.0001	I(1)

LNINT	-3.6566	0.0103	-5.2552	0.0001	I(0)

Table 2 above, The GDP, Loans and Advances, Average Savings are stationary in their first difference, that is integrated of order one I(1). While the Natural Logarithm transform of Lending Rates is stationary at level. This also shows the appropriateness of ARDL model since it can handle values at different order of integration (Udoh et al., 2015).

Table 3: Standard ARDL(1,1,1,2) Model

Dependent Variable: D(LNGDPF)
Method: Least Squares
Date: 06/13/18   Time: 13:28
Sample (adjusted): 1984 2015
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.469084	0.517229	2.840298	0.0105
D(LNGDPF(-1))	0.071123	0.175800	0.404567	0.6903
D(LNLA)	0.160886	0.107135	1.501718	0.1496
D(LNLA(-1))	0.131408	0.127163	1.033389	0.3144
D(LNSAV)	0.006272	0.119139	0.052645	0.9586
D(LNSAV(-1))	0.041953	0.130089	0.322494	0.7506
D(LNINT)	0.366587	0.136772	2.680277	0.0148
D(LNINT(-1))	-0.377071	0.206280	-1.827956	0.0833
D(LNINT(-2))	-0.217285	0.130128	-1.669785	0.1114
LNGDPF(-1)	-0.819942	0.175217	-4.679576	0.0002
LNLA(-1)	0.173731	0.057879	3.001638	0.0073
LNSAV(-1)	0.008326	0.143103	0.058179	0.9542
LNINT(-1)	1.045864	0.255051	4.100603	0.0006

R-squared	0.680777	Mean dependent var		0.062426
Adjusted R-squared	0.479163	S.D. dependent var		0.145633
S.E. of regression	0.105102	Akaike info criterion		-1.376563
Sum squared resid	0.209883	Schwarz criterion		-0.781108
Log likelihood	35.02501	Hannan-Quinn criter.		-1.179186
F-statistic	3.376628	Durbin-Watson stat		1.913919
Prob(F-statistic)	0.008852			

Table 4: Bound Testing
Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	6.408593	(4, 19)	0.0019
Chi-square	25.63437	4	0.0000

Null Hypothesis: C(10)=C(11)=C(12)=C(13)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.

C(10)	-0.819942	0.175217
C(11)	0.173731	0.057879
C(12)	0.008326	0.143103
C(13)	1.045864	0.255051

Restrictions are linear in coefficients.

Table 3 above presents the Standard ARDL (1,1,1,2), while table 4 presents the Bound testing for cointegration that is to ascertain the evidence of long run association among the macro economic variables. The Pesaran critical values: Lower bound=2.86 and Upper Bound=4.01 with F-calculated value=6.408593>4.01. It means that the macro economic variables have long run relationships

Table 5: Short Run and ecm coefficient of ARDL(1,1,1,2) Model
Dependent Variable: D(LNGDPF)
Method: Least Squares
Date: 06/13/18   Time: 13:34
Sample (adjusted): 1984 2015
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.034124	0.043973	-0.776022	0.4460
D(LNGDPF(-1))	0.173986	0.198117	0.878197	0.3893
D(LNLA)	0.255263	0.119745	2.131729	0.0444
D(LNLA(-1))	0.101409	0.118428	0.856290	0.4011
D(LNSAV)	0.047274	0.107131	0.441270	0.6633
D(LNSAV(-1))	-0.089707	0.121263	-0.739771	0.4673
D(LNINT)	0.240741	0.139547	1.725157	0.0985
D(LNINT(-1))	-0.015937	0.188414	-0.084587	0.9334
D(LNINT(-2))	-0.054164	0.128498	-0.421516	0.6775
ECM(-1)	-0.615602	0.190418	-3.232903	0.0038

R-squared	0.491612	Mean dependent var		0.062426
Adjusted R-squared	0.283635	S.D. dependent var		0.145633
S.E. of regression	0.123262	Akaike info criterion		-1.098707
Sum squared resid	0.334256	Schwarz criterion		-0.640665
Log likelihood	27.57931	Hannan-Quinn criter.		-0.946879
F-statistic	2.363778	Durbin-Watson stat		1.878239
Prob(F-statistic)	0.048206			

From table 5 above, the short run coefficients and the Error Correction coefficient (ECM) are presented. The Error Correction coefficient (ECM) is negative with estimate as -0.615602 with a p-value of 0.0038 which is very significant. This implies a reasonable high speed of equilibrium after a shock (that is 61.6%). Approximately 62% of disequilibria from the previous year's shock converge back to the long – run equilibrium in the current year. The expected sign of ECM coefficient is in line with the work of Okafor and Shuaibu, (2016).

**Table 6: Multicollinearity test**
Variance Inflation Factors
Date: 06/13/18   Time: 13:37
Sample: 1981 2015
Included observations: 32

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.001934	4.072471	NA
D(LNGDPF(-1))	0.039250	2.010504	1.700190
D(LNLA)	0.014339	2.926163	1.451016
D(LNLA(-1))	0.014025	2.867119	1.399789
D(LNSAV)	0.011477	1.455724	1.442813
D(LNSAV(-1))	0.014705	1.861925	1.842712
D(LNINT)	0.019473	2.101215	2.090311
D(LNINT(-1))	0.035500	3.831176	3.814415
D(LNINT(-2))	0.016512	1.866795	1.846716
ECM(-1)	0.036259	2.253638	2.251382

There is no presence of Multicollinearity (VIF<10)
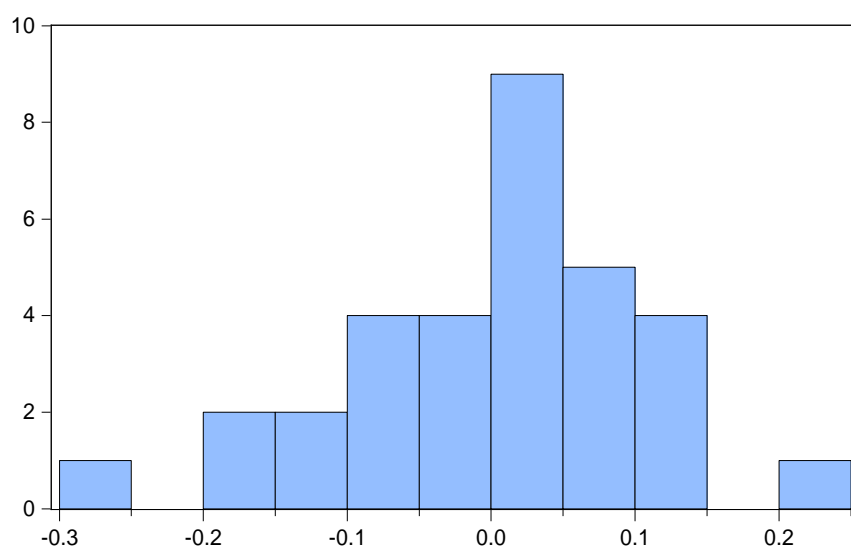
Series: Residuals
Sample 1984 2015
Observations 32

Mean	-2.52e-17
Median	0.011413
Maximum	0.200795
Minimum	-0.278544
Std. Dev.	0.103839
Skewness	-0.554315
Kurtosis	3.471678
Jarque-Bera	1.935387
Probability	0.379958

Fig 2: Normality Test of the Residuals

Table 7: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.676693	Prob. F(2,20)	0.5196
Obs*R-squared	2.028173	Prob. Chi-Square(2)	0.3627

Table 8: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.349094	Prob. F(9,22)	0.2693
Obs*R-squared	11.38014	Prob. Chi-Square(9)	0.2505
Scaled explained SS	6.647447	Prob. Chi-Square(9)	0.6738

The Diagnostic test of the estimated short run ARDL(1,1,1,2) obtained is free from the problem of multicollinearity (see Table 6), no presence of serial correlation (see Table 7) and no presence of Heteroskedasticity (Table 8) while the residual is normally distributed (see Figure 2). This means that the estimated model is robust (Okafor and Shuaibu, 2016)
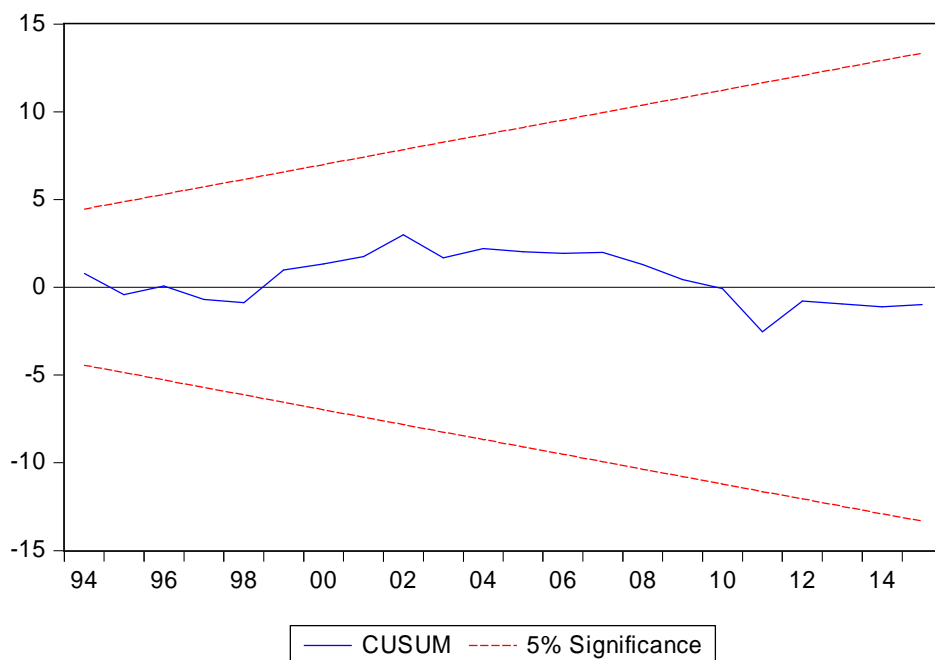

Fig. 3: CUSUM Stability Test

Figure 3 above shows the CUSUM stability test, the test shows the stability of the model. This supports the results from the diagnostic and the residual analyses of the estimated ARDL model.

Table 9: Long Run Coefficients
Dependent variable: LNGDPF

Variables	Coefficients	Standard error	t-value	p-value	Remarks
LNLA	0.211882	0.053426	3.965925	0.0008	Significant
LNSAV	0.010154	0.174564	0.058167	0.9542	Not Significant
LNINT	1.275534	0.220018	5.797397	0.0000	Significant

It results in the table 9 above present the long run relationship between GDP and, loans and advances, savings and interest rate. The Natural Logarithm transform of Loans and Advances

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and Natural Logarithm transform of Lending Rate have a long run positive significant relationship with Natural Logarithm transform of GDP of Financial Institutions while Natural transform of Savings have a long run positive non-significant relationship with Natural Logarithm transform of GDP of Financial Institutions. This confirms the poor saving culture of the Nigeria people (Nwachukwu and Odigie 2011).

6.0   Conclusion and Recommendation

This study applied the ARDL model to examine the contributions of commercial Banks to GDP growth in Nigeria. To achieve this, annual data covering 1981 to 2015 for loans and advances, savings, lending rates and GDP of Financial Institutions were collected from CBN bulletin. The ADF test revealed that the variables are I(1) except for lending rate which was of I(0) order. The ARDL(1,1,1,2) model revealed that loans and advances, and lending rates are significantly positively related to GDP in Nigeria but savings was not significant in the model, this is in line with work of (Nwachukwu and Odigie 2011).

The model revealed some evidence of short run relationships while the ecm(-1) was -0.6156 (P-value=0.0038<0.05) which means that the rate of the speed of adjustment to equilibrium is 61.56% annually. The estimated model is free from serial correlation, multicollinearity, heteroscedasticity while the model is stable and the residuals are normally distributed. The study recommends that savings and savings culture should be encouraged in Nigeria since economic theory states that savings and investment are related in any economic development.

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