The Impact of Interest Rate on Domestic Investments and Nigerian Economic Growth

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Abstract: **The paper investigated the impact of interest rate on domestic investments and economic growth of Nigeria using time series analysis and annual data from 1980-2016. Using interest rate, inflation rate, money supply and the rate of economic growth as independent variables and domestic investment as dependent variable, the study applied Auto -Regressive Distributed Lag (ARDL) method. This is based on the outcome of ADF unit root tests which revealed that the variables are integrated of I(1) and I(0). The ARDL bounds test result provided evidence of a stronghold long run relationship among the variables. This necessitated the estimation of ARDL short run and long run results. The short run results of the model revealed that MS (-2) is significant but with positive impact of interest rate on domestic, investments and economic growth of Nigeria. The long run results indicated that MS was made significant but with negative impact on Nigeria Domestic Investment. The impacts of INTR, INF, MS, MS (-1) and EGR were positive and negative in both long and short runs. The outcome of the diagnostic tests supported the acceptability of the model results and it was concluded that over the years, the cause of low investment in Nigeria is due to high and fluctuating interest rates. Thus, the formulation and implementation of financial policies that enhance investment-friendly rate of interest is necessary for promoting economic growth in Nigeria.**

Keywords: **Interest Rate, Domestic Investment, Economic Growth, Auto-Regressive Distributed Lag (ARDL), Unit root test.**

I. INTRODUCTION

The most important tasks of any economy is to allocate its capital resources across different possible investment outlays, and that in deciding upon the best investment opportunity, one needs to evaluate the costs and benefits associated with that investment (Samuelson, and D.N. ,2010).

The behaviour of interest rates to a large extent, determines the investment activities and hence economic growth of a country. Investment depends upon the rate of interest involved in getting funds from the market, while economic growth to a large extent depends on the level investment. According to Jhingan (2003), if the rate is high, investment is at low level. A low rate of interest leads to an increase in investment. There is therefore a need to promote an interest rate regime that will ensure "inexpensive" spending for investment and consequently enhancing economic growth at low financial cost.

Investment is perceived as boost for the attainment of an enduring economic development and poverty alleviation both in developed and developing economies. It magnifies entrepreneurship as well as creates employment opportunities that bring about income for people in the society. Investment in an economy is majorly fund driven, and according to Tobias and Mambo (2012), funds for investment are sourced through diverse avenues such as borrowings, retained profits, finance from shareholders, placements and credits from deposit money banks and long period capital from capital markets.

Obainuyi and Olorunfemi (2011) observed that the financial reforms which commenced in July, 1986 relied on market forces and the main objective was the elimination of financial repression in order to improve the incentive structure and ensure productive efficiency in the economy. It has been asserted that high interest rates discourage investments and hence forestall economic growth and that high interest rate increases the cost of borrowing which could ultimately leads to reduction of output and spur up unemployment rate. In other way, low interest rate is likely to stimulate production and real economic development.

However, Ekpo (2014) Investment determines the rate of accumulation of physical capital hence it is a crucial ingredient in the growth of an economy through addition to capital stock. Investment raises the income of the people, boosts aggregate demand, and consequently engenders economic growth. In the long-run, investment has the capacity to increase productivity and competitiveness of a country.

Real investment in an economy comprises of both private and public components. The private investment consists of investment by individuals and firms, whereas, public investment is an investment by any of the tiers of government. In recent decades, developing countries, including Nigeria, have made frantic efforts to improve investment as main engines of growth of modern economies across the globe (Sesay and Brima, 2017).

II. METHODOLOGY

This section is dedicated to developing and defining the methods for data collection, data types, data sources, the tools and techniques used in this study. The data for this work are annual data gathered from the Central Bank of Nigeria (CBN)

statistical bulletins and National Bureau of Statistics (NBS) (various issues) and World Economic Indicators. The data obtained spanned through 1980-2016 and include Interest Rate (INTR), Inflation Rate (INF), Money Supply (MS), and the Rate of Economic Growth (EGR). All of these are to act as guides to Nigeria's interest rate. Using Augmented Dickey-Fuller (ADF), the variables as mentioned above are subjected to stationary testing. Time series characteristics of the research variables need to be studied in order to determine the order of their integration. Time series data are mostly not stationary, meaning that the mean, variance, and covariance of such data sets are not invariant in time, (Gujarati, 2009). Non-stationary series can result in spurious and misleading regression. This study employs the Auto-Regressive Distributed Lag (ARDL) methodology suggested by Pesaran, Shin and Smith (2001) for the analysis of data.

2.1. Model specification

In this research, the model captures the impact of interest rate on domestic investments and economic growth of Nigeria. The variables are stated with interest rate, inflation rate, money supply and the rate of economic growth as independent variables and domestic investment as the dependent variable.

The model is thus:

$$DI = f(INTR, INF, MS, \text{EGR}), \quad (1)$$

where $INTR = Interest\ Rate, INF = Inflation\ Rate, MS = Money\ Supply, EGR = Rate\ of\ Economic\ Growth$

$DI = Domestic\ Investment$

The parameterized version of the Nigeria Domestic Investment model is presented as:

$$DI_t = \beta_0 + \beta_1 INTR_t + \beta_2 INF_t + \beta_3 MS_t + \beta_4 EGR_t + \mu_t \quad (2)$$

β_0 = Intercept

$\beta_1 - \beta_4$ = Coefficient of the independent variables

μ_t = White noise or error term

The a priori expectation:

It is anticipated that $\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0$.

2.2. Test for Unit Root:

The presence of trends and unit roots are detected from the slowly decaying autocorrelation function in

univariate process which indicates non-stationarity. Consider $AR_{(p)}$ model so that

$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + ... + \phi_p Y_{t-p} + \varepsilon_t$ *which can be written as*

$$\psi(L) y_t = \varepsilon_t \quad (3)$$

where $\psi(L) = 1 - \phi_1 L - \phi_2 L^2 - ... - \phi_2 L^2$ is a polynomial in lag L.

If the root of the characteristic equation $\psi(L) = 0$ are all greater than unity in absolute term, then y_t is stationary, otherwise y_t is non stationary.

2.3. Dickey-Fuller test:

The Dickey-Fuller test affirms if $\phi = 0$. In this model of the data $y_t = \beta_t + \phi y_{t-1} + e_t$ written as

$\Delta y_t = y_t - y_{t-1} = \beta_t + \gamma y_{t-1} + e_t$, a linear regression of Δy_t is performed against t and y_{t-1} and test if γ is different from 0. If $\gamma = 0$, then we have a random walk process. If not and $-1 < 1+\gamma < 1$, then we have a stationary process. Given the model

$$y_t = \beta y_{t-1} + \varepsilon_t \quad (4)$$

Subtracting y_{t-1} *from both sides, we have*

$$y_t - y_{t-1} = \beta y_{t-1} - y_{t-1} + \varepsilon_t$$

$$\Rightarrow \Delta y_t = (\theta - 1) y_{t-1} + \varepsilon_t$$

$$= \delta y_{t-1} + \varepsilon_t \quad (5)$$

Testing for $\theta = 1$ is equal to testing for $\delta = 0$

The following regression equations and the associated error terms are considered for unit root test:

$$\Delta y_t = \delta y_{t-1} + \varepsilon_t \quad (6)$$

$$\Delta y_t = \beta_0 + \delta y_{t-1} + \varepsilon_t \quad (7)$$

$$\Delta y_t = \beta_0 + \delta y_{t-1} + \beta_1 t + \varepsilon_t \quad (8)$$

2.4. Augmented Dickey-Fuller (ADF) test:

The ADF test belongs to a category of tests called 'Unit Root Test', which is the proper method for testing the stationarity of a time series. The Augmented Dickey-Fuller test checks through these models:

$$\Delta y_t = (\rho - 1) y_{t-1} + \sum_{j=1}^{n} \beta_j \Delta y_{t-j} + \varepsilon_t \quad (9)$$

$$\Delta y_t = \alpha + (\rho - 1) y_{t-1} + \sum_{j=1}^{n} \beta_j \Delta y_{t-j} + \varepsilon_t \quad (10)$$

$$\Delta y_t = \alpha + \delta_t + (\rho - 1) y_{t-1} + \sum_{j=1}^{n} \beta_j \Delta y_{t-j} + \varepsilon_t \quad (11)$$

Hypotheses Tests are specified as :

$H_0 : \rho = 1 \quad vs \quad H_1 : \rho < 1$

$H_0 : \alpha = 0 \quad vs \quad H_1 : \alpha \neq 0$

$H_0 : \gamma = 0 \quad vs \quad H_1 : \gamma \neq 0$

The test statistic is specified as :

$T_\rho = \frac{\hat{\rho}}{S.E.(\hat{\rho})}$ *ADF*(I, n, α) *is compared with the appropriate value of Dickey Fuller table*

The null hypothesis for the tests is that the data are non-stationary, and it is rejected for this test so that we want a p-value of less than 0.05.

2.5. ARDL Bounds Test for Co integration:

In order to empirically analyze the long-run relationships and short run dynamic interactions among the variables of interest, the Autoregressive Distributed Lag (ARDL test is based on the assumption that the variables are I(0) and I(1) (Pesaran etal, 2001).

2.5.1 Short Run and Long Run Estimation of the ARDL model:

The short run equation in our model is given as follows:

$$DI_{t-1} = \beta_0 + \beta_1 D(INTR)_{t-1} + \beta_2 D(INF)_{t-1} + \beta_3 D(MS)_{t-1} + \beta_4 D(EGR)_{t-1} + ECM(-1) \quad (12)$$

Where "D" represents the first difference operation of the variables, ECM (-1) is the one period lag of the model residual. The parameters β_1 to β_4 are the short run coefficients of the model while the coefficient of ECM (-1) is the long run speed of adjustment of the model. The sign of the coefficient of ECM (-1) should be negative and significant as well for holding the long run equilibrium (Dhungel, 2014).

The long run equation is stated as:

$$DI_t = \beta_0 + \beta_1 INTR_t + \beta_2 INF_t + \beta_3 MS_t + \beta_4 EGR_t + \mu_t . \quad (13)$$

where the variables INTR, INF, MS and EGR are defined in equation 1 while the parameters β_1 to β_4 are the long run coefficients and "U" is the error term.

III. RESULTS

Table 3.1: Results of ADF Unit root test of Stationarity

Variables	Maxlag (SIC)	ADF test statistic at Levels	ADF test statistic at First Difference	Critical Values	Remark
LNDI	9	-3.179487	-4.500269	-3.632900***	Stationary, order 1
LNINTR	9	-2.795556	-5.860018	-3.639407***	Stationary,order 1
LNINF	9	-2.987689	-5.830950	-3.632900***	Stationary. order 1
LNMS	9	-3.407776	-2.883879	-2.963972**	Stationary. order 0
LNEGR	9	-3.824993	-11.19125	-3.632900***	Stationary. order 1

Source: Computed by the authors using E –views 9 outputs

Note: *, **, *** imply 1%, 5%, or 10% level of significance respectively. The results of the ADF unit roots tests of the series in table 3.1 show that all the variables are stationary at first difference except money supply that is stationary at levels. The variables are thereforeI (1) and I (0). The ADF maximum lag is based on Schwarz Information Criterion (SIC). The null hypothesis of unit root is therefore not accepted since the ADF test statistics are greater than the critical values at the indicated levels of significance. Thus, domestic investment and the modelled variables are stationary and follow I (1) and I (0) processes. Having determined that ADF unit roots tests variables are integrated of order 1 and 0 and are stationary, it is verified whether the variables are co-integrated and as such, employed the ARDL bound test.

3.2: ARDL Bounds Testing Approach to Co - Integration

The result of the ARDL Bounds test to Co- integration for the model is presented in table 3.3

Table 3.3. Result of ARDL Bounds Test to Co - integration for the Model

Model	Result	
F – Statistic Value	= 7.081240	
Critical Value Bounds		
Significance	I0 Bounds	II Bounds
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Computed by the authors using E –views 9 Output

From the results in table 3.3, the null hypotheses of no long-run relationships are rejected as the F – statistic values of 7.081240 is greater than the critical upper (II) bounds values of 4.01 at 5% level of significance for the model. This confirms the existence of long run relationships among the variables. Lag length of four (4) was automatically selected based on Akaike Information Criterion (AIC). Having established the existence of long run relationships, short run and long run impact of the explanatory variables are estimated. The results of the short run and long run impact of the explanatory variables on domestic investment are presented in table 3.4 for the model.

Table 3.4: ARDL Short Run and Long Run Results for the Model (Dependent Variable: DI)

Short – Run Result				
Variable	Coefficient	Std. Error	t - Statistic	Prob.
D(INTR)	192.822053	561.588585	0.343351	0.7342
D(INF)	-113.376767	190.708912	-0.594502	0.5575
D(MS)	1.303889	6.392427	0.203974	0.8400

D(MS(-1))	-10.241874	10.957233	-0.934714	0.3589
D(MS(-2))	31.715067**	9.178475	3.455375	0.0020
D(EGR)	88.188984	941.767533	0.093642	0.9261
CointEq(-1)	-0.439956**	0.104723	-4.201138	0.0003
Long – Run Result				
Variable	Coefficient	Std. Error	t – Statistic	Prob.
INTR	438.276062	1312.914216	0.333819	0.7413
INF	-257.700415	448.051652	-0.575158	0.5703
MS	-14.359214**	3.795392	-3.783328	0.0009
EGR	200.449688	2148.179736	0.093311	0.9264
C	26520.29899	428303.132503	0.937009	0.3577
R-squared	0.828509	Mean dependent var		46836.06
Adjusted R-squared	0.773632	S.D. dependent var		34498.99
S.E. of regression	16413.97	Akaike info criterion		22.47158
Sum squared resid	6.74E+09	Schwarz criterion		22.87562
Log likelihood	-373.0169	Hannan-Quinn criter.		22.60937
F-statistic	15.09757	Durbin-Watson stat		1.951848
Prob(F-statistic)	0.000000			

Source: Computed by the authors using E – views9 output;
Note: ** denotes significant variables of the model.

Results in table 3.4 indicate that in the short run, MS (-2) was significant but positive. While, INTR, INF, MS, MS (-1) and EGR were made positive and negative and non - significant impact on domestic investment. Precisely, a unit increase in MS (-2) leads to 31.7% increases in Nigeria domestic investment whereas a unit increase in INTR, INF, MS, MS (-1) and EGR leads to 192.8%, 113.3%, 1.30, 10.2% and 88.1% decline in Nigeria domestic investment respectively. In the long run, MS was made significant but negative impact on Nigeria Domestic Investment. Specifically, a unit increase in MS and INF reduces Nigeria Domestic Investment by 14.3% and 257.7% were made negative but INF is non – significant. While, a unit increase in INTR, EGR increases Nigeria domestic investment by 438.2% and 200.4% were made positive and non significant. The coefficient of the error correction term (Coint Eq (- 1) is negatively signed and significant. The coefficient of the ECT of 0.43 reveals that the speed with which Nigeria domestic investment adjusts the regressors is about 43% in the short run. The R – square value of 0.82 shows that 82% variation in Nigeria domestic investment are jointly explained by variations in the explanatory variables of the model. The probability F – statistics value of 15.09757 shows that, the overall model is significant in explaining the impact of interest rate on domestic investments and economic growth of Nigeria.

The results of the diagnostic test of model adequacy for the model are presented in Table 3.5 and figure 3.6.

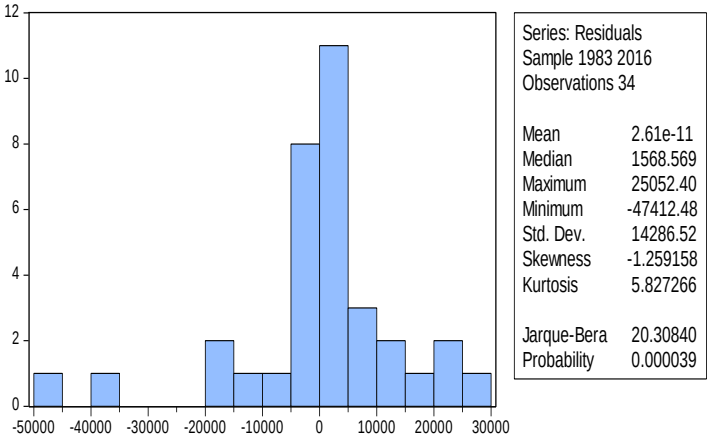
Table 3.5: Summary of Diagnostic Tests for the Model

Model			
Breusch – Godfrey Serial Correlation LM Test			
F-statistic	0.299842	Prob. F	0.7438
Obs*R-squared	0.863964	Prob. Chi-Square	0.6492
Correlogram – Q – Statistic Probability Value		0.000	
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.184942	Prob. F	0.3468
Obs*R-squared	9.347694	Prob. Chi-Square	0.3138
Jarque – Bera Test of Normality			
Jarque – Bera	20.30840	Probability	0.000039

Source: Computed by the author using E – views 9 output;.

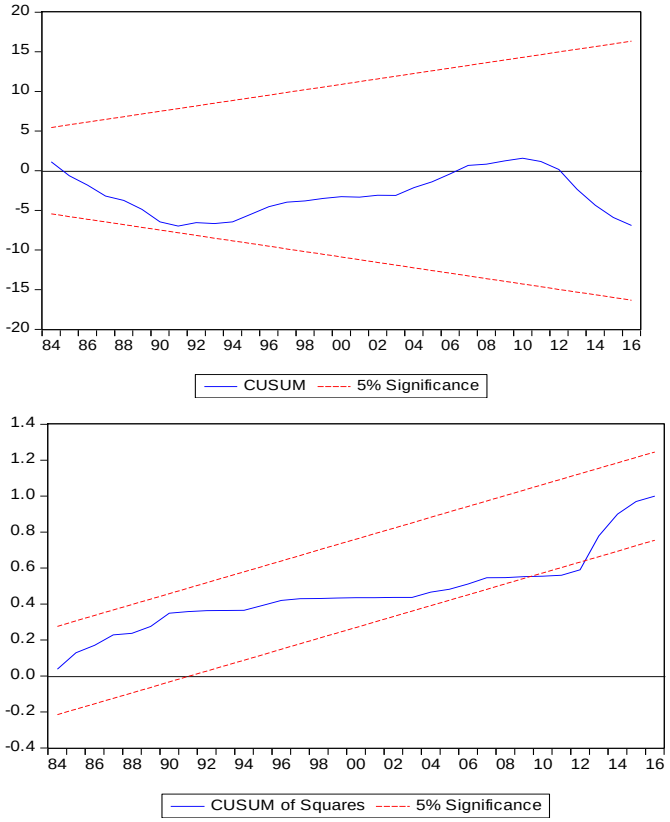
Tests critical values are computed at 5% level of significance.

The results of the diagnostic tests such as Breusch-Godfrey Serial Correlation, Correlogram – Q – Statistic test, Normality test and Heteroscedasticity test further affirm the validity of these findings. The findings are shown in table 3.5 and it does display all the diagnostic tests passed by the sample. The diagnostic tests applied to the model show evidence that no auto – correlation is not violated on heteroscedasticity. Residual skew and kurtosis based on normality testing showed that the residuals are normally distributed.



Using the Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUMSQ), the consistency of the regression coefficients is further evaluated. The CUSUM and CUSUMSQ plotting showed that the regression equation is found to be stable, provided that neither the CUSUM nor the CUSUMSQ test statistics go beyond the 5 percent significance level stipulated limits.

Figure 3.6: Result of CUSUM and CUSUM of squares Test of Stability for Model



IV. CONCLUSIONS

This study concludes that the short run results of the model revealed that MS (-2) is significant but positive impact of interest rate on Domestic Investments and Economic Growth of Nigeria whereas the long run results indicated that MS was made significant but negative impact on Nigeria Domestic Investment. The impact of INTR, INF, MS, MS (-1) and EGR were positive and negative in both long and short runs. However, the deregulation of interest rates in Nigeria may not optimally achieve its goals, if those other factors which negatively effects investment in the country, as suggested by Guseh and Oritsejafor (2007), are not tackled. This implies that the link between interest rate, domestic investment and economic growth is not automatic. Thus, the relationship between domestic investment and economic growth in Nigeria may not allow for optimal benefits from interest rate reforms in the country. The important condition for promoting economic growth, therefore, is for the government to formulate and implement financial policies that enhance investment-friendly rate of interest and take into consideration those other factors which negatively affect investment in the country. With this, it can be concluded that over the years in Nigeria, the cause of low investment in Nigeria is due to high and fluctuating interest rate.

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