INVESTMENT, OUTPUT AND REAL INTEREST RATE IN NIGERIA: AN ARDL ANALYSIS

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Abstract
This paper investigated the impact of Output and Real interest rate on Investment in Nigeria between the years 1981-2014 employing the Autoregressive and Distributed Lag (ARDL) model approach to cointegration. Stationarity of the variables were accounted for using the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) Unit Root test. Our findings reveal the existence of long run relationship among the variables. The result also reveals that in the short run, a one period lag of GDP has a positive and significant impact on Investment while a one period lag of Real interest rate has a negative but no significant impact on Investment. The result also shows that Foreign Direct investment inflow has a positive and significant effect on Investment in the short run while Exchange rate do not have any significant effect on Investment. It is therefore recommended that policies tailored towards the attraction of FDI into Nigeria should be encouraged. Policies which may include the improvement of enabling environment for business, development of critical economic infrastructure and the provision of sufficient power grid for companies. Economic policies should also be implemented in favor of output growth such as policies aimed at increasing aggregate demand which can be achieved through expansionary monetary policies which cuts interest rates in the banking system. Borrowings for investment and consumption rises which also leads to a rise in output which would in turn lead to a further increase in Investment in the country.

Keywords: Investment, Output, Real interest rate, ARDL.

Introduction
It is well known that capital formation, otherwise called Investment is an important factor in the development of economies. Countries having accumulated high level long term investment, today belong to the most developed countries (Hamuda, Sulikova and Horvath, 2013). Since the era of Adam Smith and Karl Marx, investment has been deemed to be both the engine of economic

stability and the primary cause of economic malaise (Emerenini and Ojima, 2015) as investment drives growth and create jobs and the lack of investment retards growth.
Investment can be said to be of two types; the fixed and inventory investment. While fixed investment is planned spending by firms on equipment and structures, inventory investment is additional spending on raw materials, parts, and finished goods, calculated by the change in holdings of these items in a given period of time (Mishkin, 2004). This kind of investment is what can be termed firm based investment. On a broader view, investment refers to all economic activity which involves the use of resources to produce goods and services (Anwer and Sampath, 1999). Investment in infrastructure is particularly needed for the growth and development of less developed countries. This is due to the fact that infrastructure makes it realisable for producers to use modern technology as an expansion of infrastructure could promptly sparks productive activities. Investment in education and health also leads to a healthier and productive labour which in turn leads to growth and development. It is certain investment leads to an increase in economic growth as economic theory postulates, as it is also necessary to empirically investigate if economic growth in itself propels investment.

Economic theory postulates a negative relationship existing between real interest rate and investment as an increase in real interest rate is said to bring down investment spending and its decrease raises investment spending.
Interest rate policy has been a notable apparatus of monetary policy across economies of the world in its role of financial resource accumulation and growth including Nigeria. Real interest rate is said to be the opportunity cost of borrowing money from a lender, adjusted to remove the effects of inflation. It reflects the real cost of borrowing. According to Acha and Acha (2011), interest rate is an important economic price. This is because interest rate has fundamental implications for the economy either impacting on the cost of capital or influencing the availability of credit.

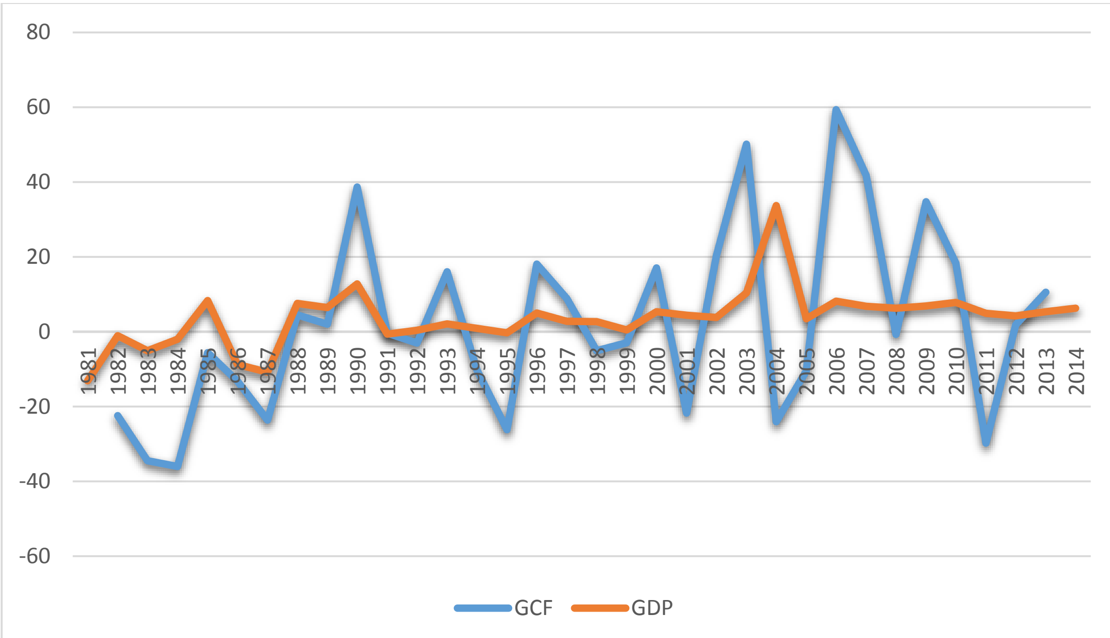
It is necessary to affirm if truly real interest rate has an influence on investment as economic theory posits, for an increase in investment is also said to not just increase output but also reduce unemployment and also affect other macroeconomic fundamentals through movements in the business cycle. With Nigeria currently battling with an economic recession, it becomes imperative to examine factors that drive investment in the economy. It is for this reason that this work seek to empirically investigate specifically the impact of output and real interest rate on investment in Nigeria.

Theoretical and Empirical Review

Economists have long recognized that investment tends to be the most volatile of the components of expenditure over the business cycle. Of course, strong correlations between investment and output mean that both variables tend to move co-move over time.
We present a brief graphical analysis of investment and output for 33 years spanning the periods 1981 to 2014 in Nigeria.

In achieving this, we make use of the gross fixed capital formation growth rate which we use as a proxy for investment and the growth rate of GDP for output.

Figure 1: Graphical analysis of Investment and Output in Nigeria.



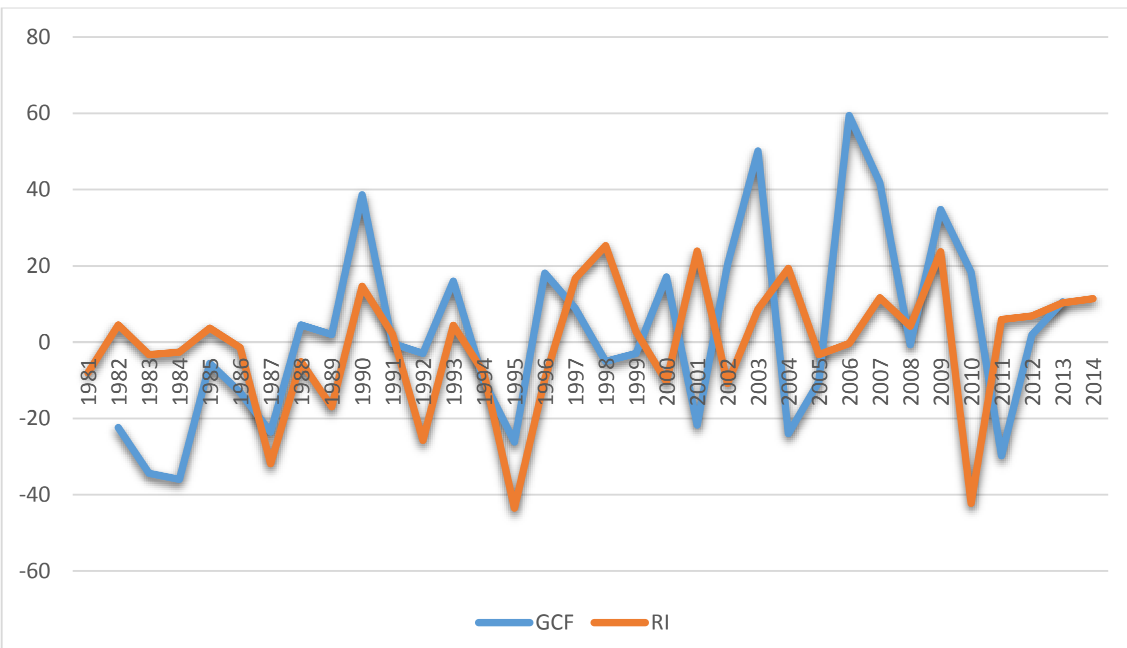
Source: Authors computation from data sourced from WDI (2015)

The above graph depicts movement of output and investment in Nigeria. We can roughly say that both variables are positively related but the magnitude of their movement changes from one time period to another. In the early 80s, the growth rate of output and investment declined continuously with the exception of 1985 where output grew by 8.3 percent in the midst of a negative growth rate of investment. Few other negative relation existed like the year 1992 where output grew by 0.43 percent with a negative investment growth rate of -3 percent. The year 2001, 2004, 2005, 2008 and 2011 also saw positive output growth in the presence of negative investment growth rate. This can occur as a result of rising consumption and government spending or net export which offsets the fall in investment.

The accelerator theory of investment seeks to explain the relationship between output and investment. It says that any temporary change in output could lead to changes in investment spending (Gordon, 2009). According to this theory, rising output leads to increased net investment because output is increasing at an increasing rate, but when output increases at a decreasing rate, net investment is said to decline. This theory was later modified to remove one of the major weakness of the simple accelerator model that capital stock is optimally adjusted without any time lag. The modified version explained that there is a time lag between the increase in output and the subsequent increase in investment.

Keynes had also propounded a theory of investment where investment decisions are taken by comparing the marginal efficiency of capital (MEC) to the real interest rate. So long as MEC is greater than the real interest rate, new investment in plant, equipment and machinery will take place. It was also the traditional Keynesian view of money transmission mechanism that characterised a fall in real interest rate leads to a rise in investment which in turn leads to a rise in aggregate demand. The credit view channel comprising of the balance sheet channel and the unanticipated price level channel of monetary policy also presents a negative relationship between investment and real interest rates. In the view of the balance sheet channel, a fall in real interest rates leads to a rise in stock prices which raises firms net worth leading to a reduction in adverse selection and moral hazards. This in turn leads to a rise in lending and thus investment. In view of the unanticipated price level channel, a fall in the real interest rate leads to a rise in inflation through the increase in money supply, there is an unanticipated rise in the price level which raises the firms' net worth. This further leads to a rise in lending and thus investment.

Figure 2: Graphical analysis of Investment and Real interest rate in Nigeria.



Source: Authors computation from data sourced from WDI (2015)

The table above shows a graphical relationship existing between Investment and real interest rates in Nigeria from 1981 to 2014. The result does not completely show a negative relationship existing between both variables as economic theory has postulated. While a positive relationship exists in some years, a negative relationship exists in other years.

Tobin (1969) also developed a theory of investment called the tobin q theory. This theory explains how monetary policy can affect the economy through its effects on the valuation of stocks. Tobin had defined q as the market value of firms divided by the replacement cost of capital. If q is high, the market price of firms is high relative to the replacement cost of capital, and the new plant and equipment capital is cheap relative to the market value of firms. Companies can then issue stock and get a high price for it relative to the cost of the facilities and equipment they are buying. Investment spending will rise, because firms can buy a lot of new investment goods with only a small issue of stock. Conversely, when q is low, firms will not purchase new investment goods because the market value of firms is low relative to the cost of capital. The crux of this theory is that there is a link between Tobin's q and investment. This link can be analysed through a fall in real interest rate which leads to an increase in stock prices. This raises q and thus investment.

Ojima and Emerenini (2015) in their study had investigated the impact of interest rate on investment in Nigeria. The error correction model was used as the statistical method for the study. The study revealed that high interest rate negatively affects investment.

Wuhan and Adnan (2015) also studied the effect interest rate on investment in Jiangsu province of China. The study adopted the VECM over the period 2003-2012. The results indicate that while there is a long run relationship among the variables, interest rate and investment has a negative relationship in the short run.

Eregha (2010)examined the variations in interest rate and investment determination in Nigeria. The study employed dynamic model of two equations using instrumental variable technique of estimation. The study revealed that variation in interest rate played a negative and highly significant role in investment decision and the demand for credit also had negative and significant influence on interest rate variation in both the short run and the long run.

Majed and Ahmad (2010) investigated the impact of interest rate on investment in Jordan between1990 and 2005 using co integration technique. The study found that real interest rate has a negative impact oninvestment. An increase in the real interest rate by one percent reduces the investment level by forty four percent.

Albu (2006) studied trends in interest rate, investment and GDP growth rate. The study used two partial models to examine the impact of investment on GDP growth and the relationship between interest rate and investment in the case of the Romanian economy. The study found that the behavior of the national economy system and interest rate-investment relationship tend to converge to those demonstrated in the normal market economy.

Chetty (2004) showed that the investment demand curve is always a backward-bending function of the interest rate in a model with non-convex adjustment costs and the potential to learn. At low interest rates, an increase in the rate of return raises the cost of learning and increases aggregate investment by enlarging the set of firms for whom the interest rate exceeds the rate of return to delay. An increase in interest rate is more likely to stimulate investment when the potential to learn is larger and in the short run rather that the long run.

Blomstorm et al (1996) studied the relationship between fixed investment and economic growth using Granger-Sims causality framework for 101 countries. Their findings show that growth has more causal effect on subsequent capital formation rather than capital formation on subsequent growth and fixed investment does not have a key role in economic growth.

Methodology

The objective of this study is to investigate the impact of output and Real interest rate on investment in Nigeria between the years 1981-2014 in a time series framework. The first procedure for any time series analysis is to ascertain the order of integration of the variables. This procedure enables researchers determine the econometric technique suitable for analysis. Data for this work were sourced from the World Bank World Development Indicators (WDI, 2015)

Model Specification

In this section, we present a functional relationship between output, real interest rate and investment. The model also incorporated exchange rate and foreign direct investment. Exchange rate is included in the model due to the fact that the manufacturing sector in Nigeria is largely dependent on imported inputs and so exchange rate depreciation or appreciation could largely affect investment through the cost of inputs. Also, we know that Nigeria is dependent on oil revenues and thus, fluctuations in crude oil prices leads to changes in revenue accruing to the government and invariably leads to changes in the level of government investment expenditure.

Foreign direct investment which is an investment made by a company or individual in one country in business interests in another country in the form of either establishing business operations or acquiring business assets in another country such as ownership or controlling interest in a foreign company is also included in the model owing to the fact that it enhances capital inflow into the economy and hence propels investment.

The model can be expressed as

$$GCF = f(GDP, RI, EXC, FDI) \quad (1)$$

Explicitly, the equation can be stated as

$$GCF_t = \pi_0 + \pi_1 GDP_t + \pi_2 RI_t + \pi_3 EXC_t + \pi_4 FDI_t + \varepsilon_t \quad (2)$$

Where GCF= Gross Fixed Capital Formation [(% of GDP)Proxy for Investment].

GDP= Gross Domestic Product (Constant LocalCurrency Unit).

RI= Real Interest rate.

EXC= Official Exchange Rate of Local Currency to US dollar.

FDI= Foreign Direct Investment [net inflow (% of GDP)].

ε= Error Term.

π_0= Constant and π_1- π_4= Coefficients of the Explanatory variables.

Presentation and Analysis of Result

Unit Root Test

In this study, we apply the Augmented-Dickey Fuller (ADF) test and the Phillips-Perron (PP) test to account for the stationarity of the variables (order of integration) in the model. The ADF test consist of estimating the equation

$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum_{i=1}^{m} \varphi i \Delta Y_{t-i} + \varepsilon_t$ (3)

Where α is the drift component, t represents deterministic trend and m is an optimal lag length ample enough to ensure that ε_t is a white noise error term.

The PP test is also similar to the ADF test, but they incorporate an automatic correction to the Dickey Fuller (DF) procedure to allow for autocorrelated residuals (Brooks, 2008). The PP unit root test also differs from the ADF test in how to deal with serial correlation and heteroscedasticity in the errors. In particular, the ADF test use a parametric autoregression to approximate the ARMA structure of the errors in the test regression, the PP tests ignore any serial correlation in the test regression. The regression of the PP test is

$\Delta Y_t = \beta^I D_t + \pi Y_{t-1} + \mu_t$ (4)

Where μ_t is said to be stationary at levelsI(0).

The tests were performed with the assumption of intercept and no trend in both the ADF and PP unit root specifications.

Table 1: ADF and PP Unit Root Results

Variables	ADF t-statistics	5% critical value	Order of integration	PP t-statistics	5% critical value	Order of Integration
GCF	-4.597213	-2.954021	I(0)	-4.379282	-2.954021	I(0)
GDP	-3.377896	-2.957110	I(1)	-3.359502	-2.957110	I(1)
RI	-5.846976	-2.954021	I(0)	-5.847065	-2.954021	I(0)
EXC	-5.387043	-2.957110	I(1)	-5.387043	-2.957110	I(1)
FDI	-3.584185	-2.954021	I(0)	-3.554277	-2.954021	I(0)

Source: Authors computation using E-views (2016).

From the result above, GCF, RI, and FDI are stationary at levels, I(0) while GDP and EXC are stationary at first difference, I(1). According to Pesaran, Shin and Smith (2001), the appropriate econometrics technique which captures the mixed combinations of I(0) and I(1) variables is the Autoregressive and Distributed Lag (ARDL) model. The model takes the form,

$\Delta GCF_t = \pi_0 + \sum_{i=1}^{n} \pi_{1i} \Delta GCF_{t-i} + \sum_{i=1}^{n} \pi_{2i} \Delta GDP_{t-i} + \sum_{i=1}^{n} \pi_{3i} \Delta RI_{t-i} + \sum_{i=1}^{n} \pi_{4i} \Delta EXC_{t-i} + \sum_{i=1}^{n} \pi_{5i} \Delta FDI_{t-i} + \delta_0 GCF_{t-1} + \delta_1 GDP_{t-1} + \delta_2 RI_{t-1} + \delta_3 EXC_{t-1} + \delta_4 FDI_{t-1} + \varepsilon_t$

(5)

Where Δ= first difference operator.

π_0=drift component
ε_t = White noise error term.
This model is said to be an unrestricted error correction model. The term with the summation sign expresses the error correction dynamics, i.e.$\pi_1 - \pi_5$, while the second part $\delta_0 - \delta_4$ expresses the long run relationship. Computing the short run relationship, the model becomes

$$\Delta GCF_t = \pi_0 + \sum_{i=1}^{n} \pi_{1i} \Delta GCF_{t-i} + \sum_{i=1}^{n} \pi_{2i} \Delta GDP_{t-i} + \sum_{i=1}^{n} \pi_{3i} \Delta RI_{t-i} + \sum_{i=1}^{n} \pi_{4i} \Delta EXC_{t-i} + \sum_{i=1}^{n} \pi_{5i} \Delta FDI_{t-i} + \varphi ECT_{t-1} + \varepsilon_t \quad (6)$$

The ECT is the error correction term, which must be negative, significant and less than one. This is what to expect if there is cointegration among the variables.

Lag Length Selection

The next step in this research is selecting the optimal lag length. ARDL bound testing approach to long run level relationship requires the determination of the optimal lag for the cointegrating equation based on the assumption that the residuals are serially uncorrelated. The lag length that minimizes the value of the Akaike Information Criterion (AIC), Schwarz (Bayes) Criterion(SC), Hannan-Quinn Criterion (HQC) and at which the model does not have autocorrelation is the optimal lag.
For this analysis, the SC would be used as our choice for the selection of the optimum lag length.

Table 2: **Optimum Lag Length Selection**

Lag Length	**AIC**	**SC**	**HQC**
3	4.684817	5.665655	4.998595
2	4.443980	5.184102	4.685241
1	4.406141**	4.909988**	4.573152**

Source: Authors computation using E-views 7(2016).
** indicates lag length selected by the criterion
The above result shows that the lag length which minimises SC is lag one and therefore, our optimal lag length is lag one. The result also showed that both AIC and HQC have also selected lag one as our optimal lag length.
We therefore proceed to test if the variables in the model co-move in the long run.

Table 3: Estimated Unrestricted ECM
Dependent Variable: D(GCF)

Variables	Coefficient	t-statistics	Prob.
C	4.153956	2.558355	0.0183**
D(GCF(-1))	0.285169	2.190501	0.0399**
D(GDP(-1))	2.21E-14	0.090500	0.9287
D(RI(-1))	-0.004452	-0.202907	0.8412
D(EXC(-1))	0.034303	1.143320	0.2658
D(FDI(-1))	0.368330	1.993682	0.0593***
GCF(-1)	-0.504741	-5.797826	0.0000*
GDP(-1)	1.74E-13	2.990356	0.0070*
RI(-1)	-0.024254	-0.726837	0.4754
EXC(-1)	-0.038763	-2.433173	0.0240**
FDI(-1)	-0.395305	-1.843860	0.0794***
R-Squared= 0.717778	**Adj. R-Squared** =0.583387	**F-stat(prob)** =5.340959(0.000610)	**Durbin-Watson stat** =1.947069

Source: Authors' computation using E-views 7(2016)
*** Significant at 10 percent ** significant at 5 percent * significant at 1 percent

An important assumption of the ARDL/Bounds Testing methodology of Pesaran, Shin and Smith (2001) of the estimated unrestricted ECM result above is that the errors must be serially independent. The Durbin-Watson statistics of 1.95 indicates that the model is free from serial correlation. As a cross check, we perform the Breusch-Godfrey (B-G) LM test to support our conclusion of the non-existence of serial correlation in the model. The Jarque-Bera Normality test, the Breusch-Pagan-Godfrey (B-P-G) test for Heteroscedasticity and the Ramsey Reset test would also be performed to ensure the model is of good fit.

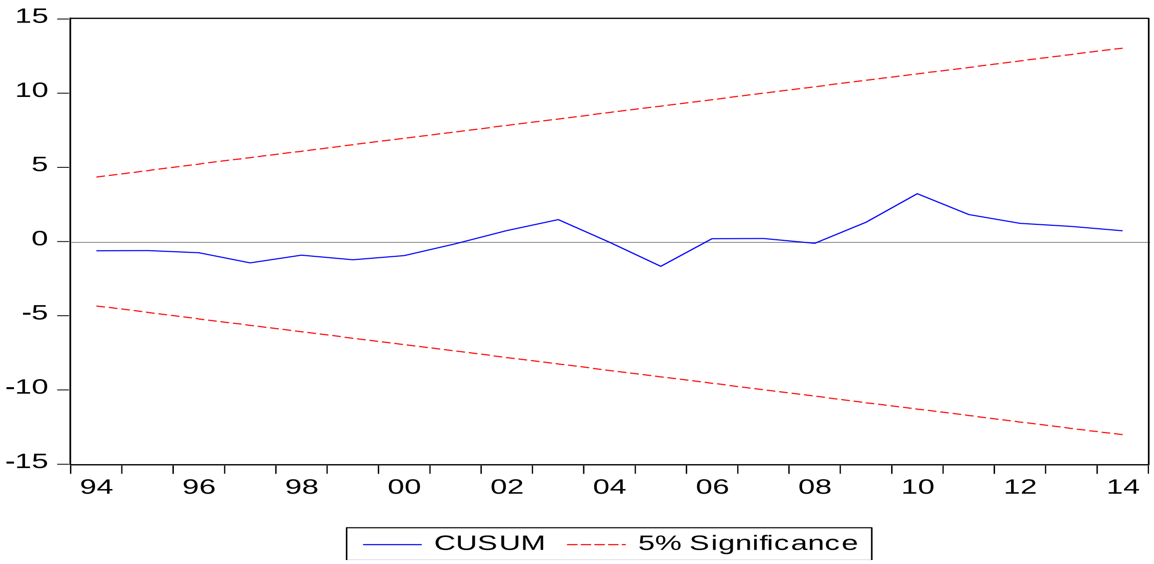
Table 4: Summary of Diagnostic Tests for the Model

Test	Probability
B-G LM	0.9025
Jarque-Bera Normality	0.278664
B-P-G	0.6375
Ramsey-Reset	0.5652

Source: Authors' computation using e-views 7 (2016)

Based on the result in table 4, the probability value of the B-G LM test indicates the rejection of the null hypothesis of serial correlation and conclude that the model is free from serial correlation. Under the null hypothesis that the residuals are normally distributed, the Jarque-Bera test for residual normality assumption is not violated. The B-P-G test result also showed that our model is free from heteroscedasticity while the result of the RR test suggests that the model is well specified.
The stability test based on the CUSUM test shows that our estimated model is dynamically stable since the fitted line falls within the 5% critical region, this means we can rely on our estimated result.

Figure 3: CUSUM Stability Test



Source: Authors computation using E-views 7, (2016)
To explore the occurrence of long-run relationships among GCF, GDP, RI, EXC, and FDI, the bound testing under Pesaran, Shin and Smith (2001) procedure is used. The bound testing procedure is based on the F-test. The F-test is essentially a test of the assumption of no cointegration among the variables against the premise of its existence, denoted as:

$H_0: \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$

i.e., there is no cointegration among the variables.

$H_1: \delta_0 \neq \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$

i.e., there is cointegration among the variables.

The Bound Test Approach to Co-integration

From the result in Table 3, we make use of the Wald test to determine if the variables co move in the long run.

Table 5: Wald Test
Equation: Untitled

Test Statistic	Value	Df	Probability
F-statistic	7.018082	(5, 21)	0.0005
Chi-square	35.09041	5	0.0000

Source: Authors computation using E-views, (2016)

Given the result in Table 4, the F-statistic value should be compared with the Pesaran critical value at 5 percent level of significance. According to Narayan (2005), the current critical values stated in Pesaran, Shin and Smith (2001) cannot be used for small sample sizes because they are predicated on the premise of the existence of large sample sizes. Narayan (2005) provided a set of critical values for sample sizes ranging from 30 to 80 observations. They are $2.496 - \mathbf{3.346}$ at 10% level of significance, $2.962 - \mathbf{3.910}$ at 5% level of significance and $4.068 - \mathbf{5.250}$at 1% level of significance.
With an F-statistic of 7.018082, which is greater than the upper bound critical value at 10 percent, 5 percent and 1 percent level of significance, we reject the null hypothesis and hence draw a conclusion that there exist a long run relationship between the time series variables in Nigeria.

For quality assurance, we perform a "Bounds t-test" of $H_0: \delta_0 = 0$, against $H_1: \delta_0 < 0$. With a t-statistics of**-5.797826** which is greater than the upper bound critical values for t-statistics at 10 percent [-2.57,**-2.91**], 5 percent [-2.86,-**3.22**], and 1 percent [-3.43,**-3.82**]significance levels in absolute terms, we can hence conclude that there is indeed a long run relationship between the variables.

Table 6: Wald Test
Equation: Untitled

Test Statistic	Value	Df	Probability
t-statistic	-5.797826	21	0.0000
F-statistic	33.61479	(1, 21)	0.0000
Chi-square	33.61479	1	0.0000

Source: Authors computation using E-views 7(2016)
From the result, we can hence estimate a short run relationship between GCF and the explanatory variables.

Table 7: ARDL Short run relationship.
Dependent Variable: D(GCF)

Variable	Coefficient	t-statistics	Probability
C	-1.153840	-2.439679	0.0221**
D(GCF(-1))	0.370282	3.037123	0.0055*
D(GDP(-1))	3.23E-13	1.811324	0.0821***
D(RI(-1))	-0.021098	-1.470369	0.1539
D(EXC(-1))	0.038122	1.455489	0.1580
D(FDI(-1))	0.418104	2.733267	0.0113**
ECT(-1)	-0.472828	-5.478375	0.0000*
R-squared= 0.657439	**Adj. R-squared=** 0.575225	**F-stat(Prob)=** 7.996627(0.000070)	**Durbin-Watson stat**=1.970447

Source: Authors computation using E-views(2016)

*** significant at 10 percent ** significant at 5 percent * significant at 1 percent

The result in table 6 shows that Investment has a positive and significant relationship with its one period lag value. The result also shows that GDP, and FDI has a significant and positive impact on Investment in Nigeria. From the result, it can be seen that a one period lag of GDP has a positive and significant impact on Investment. This denotes that the impact of GDP on Investment has a lag effect, a one period lag effect to be precise. FDI also has a positive and significant lag effect on Investment in the short run. A general conclusion to this is to say that a unit increase in GDP in year ***t*** would lead to a 3.23 percentage increase in investment in year ***t+1***while a percentage increase in FDI in year ***t*** would lead to a 0.41 percentage increase in Investment in year ***t+1***. RI is seen not to have any significant lag impact on the rate of Investment in Nigeria but its sign follows apriori expectations of a negative relationship between RI and Investment. The result also shows that exchange rate has no significant lag impact on the rate of Investment in Nigeria but it can be seen that an increase in exchange rate (exchange rate depreciation) induces Investment. The F-statistics probability value of 0.000070 indicates that all the variables put together have an impact on the rate of Investment in Nigeria. The R-squared value of 0.657439 indicates that 66 percent of the variation in Investment is accounted for by the explanatory variables, and after taken into consideration the degree of freedom, the adjusted R-squared notes that 57.5 percent of the variations in Investment is accounted for by the explanatory variables. The Durbin-Watson value of 1.97 denotes that the short run model is free from serial correlation. We also noticed the ECT which is negative and very significant. It is indeed what to expect if there is cointegration relationship among the variables as earlier stated. The ECT which denotes the speed of adjustment towards long-run equilibrium is 47.2 percent. This means that the whole system can achieve long run equilibrium at the speed of 47.2 percent.

We proceed to diagnose our short run model to ensure it is also of good fit. As before, we go further to confirm the non-existence of serial correlation in our model using the Breusch-Godfrey (B-G) LM test, Jarque-Bera Normality test to detect if the residuals of the model are normally distributed, the Breusch-Pagan-Godfrey (B-P-G) test for Heteroscedasticity and the Ramsey Reset test to ensure the model is well specified.

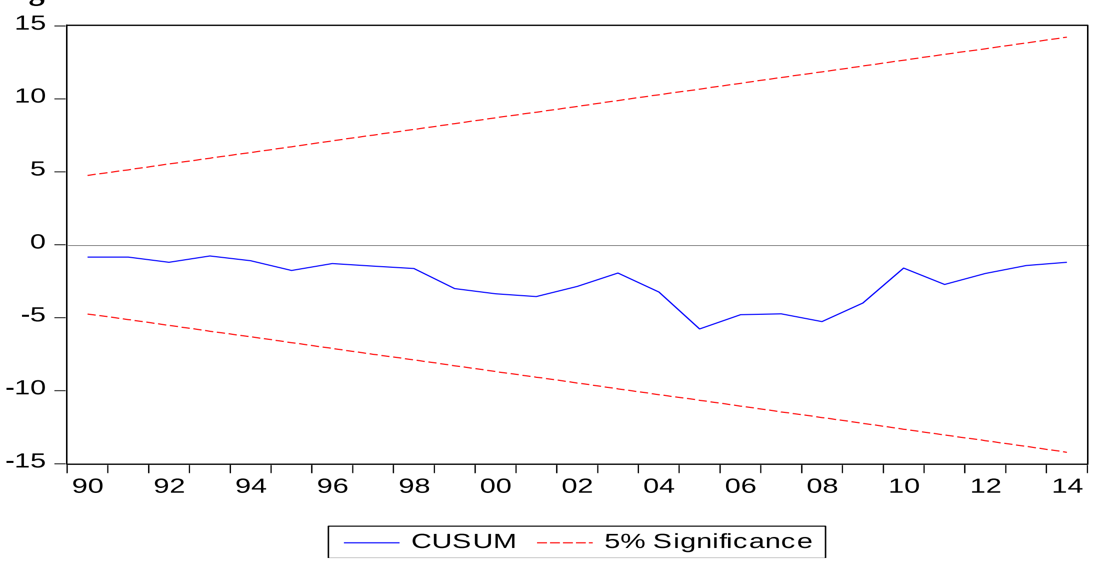
Table 8: Summary of Diagnostic Tests for the Short run Model.

Test	Probability
B-G LM	0.9156
Jarque-Bera Normality	0.742323
B-P-G	0.3265
Ramsey-Reset	0.5047

Source: Authors computation using E-views (2016)

The above result in table 7, is a proof that the model is indeed free from serial correlation; the residuals are normally distributed; the errors of the model are homoscedastic and well specified. The figure below also shows that our short run model is dynamically stable.

Figure 4: CUSUM Test



Conclusion

This paper has empirically investigated the impact of Output and Real Interest rate on Investment in Nigeria between the years 1981 to 2014. After accounting for the stationarity of the variables. The Autoregressive and Distributed Lag (ARDL) model technique to cointegration was employed. The result revealed that while a long run relationship exists, in the short run, investment depends on its previous level. The result also revealed that Output and FDI has a positive and significant lag impact on Investment in Nigeria and Real interest rate and Exchange rate do not have significant lag impact on the rate of Investment in Nigeria. It is therefore recommended that policies tailored towards the attraction of FDI into Nigeria should be encouraged. Such policies may include the improvement of enabling environment for business, development of critical economic infrastructure and the provision of sufficient power grid for companies. In addition, economic policies should be implemented in favor of output growth such as policies aimed at increasing aggregate demand which can be achieved through expansionary monetary policies which cuts interest rates in the banking system. Borrowings for investment and consumption increases which also leads to an increase in output which would in turn lead to a further increase in Investment in the country.

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APPENDIX

Null Hypothesis: GCF has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.597213	0.0008
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: GCF has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.379282	0.0015
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-3.377896	0.0194
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.359502	0.0203
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

Null Hypothesis: RI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.846976	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

Null Hypothesis: RI has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.847065	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

Null Hypothesis: D(EXC) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-5.387043	0.0001
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

Null Hypothesis: D(EXC) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.387043	0.0001
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

Null Hypothesis: FDI has a unit root

Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.584185	0.0117
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

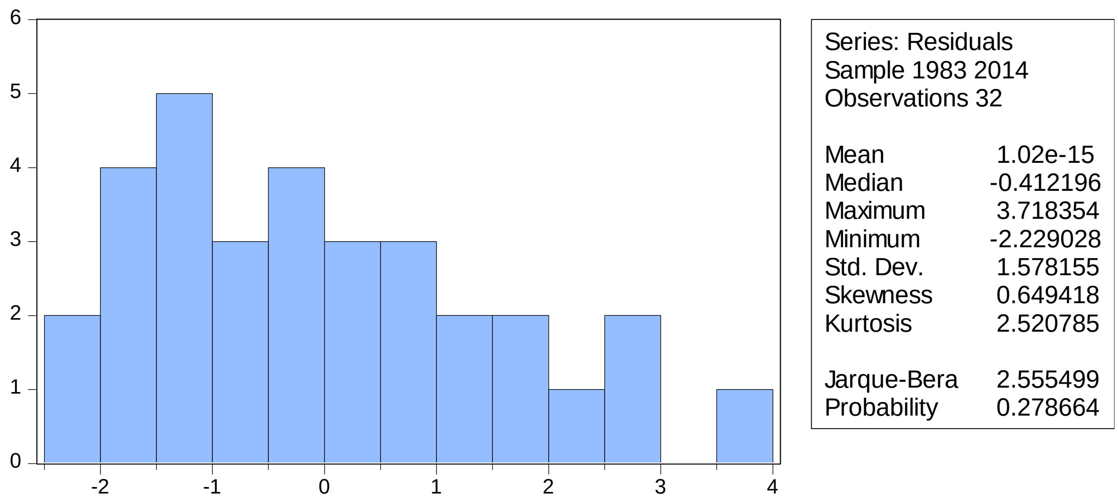
		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.554277	0.0125
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

Dependent Variable: D(GCF)
Method: Least Squares
Date: 06/26/16 Time: 19:46
Sample (adjusted): 1983 2014

Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.153956	1.623682	2.558355	0.0183
D(GCF(-1))	0.285169	0.130185	2.190501	0.0399
D(GDP(-1))	2.21E-14	2.45E-13	0.090500	0.9287
D(RI(-1))	-0.004452	0.021941	-0.202907	0.8412
D(EXC(-1))	0.034303	0.030003	1.143320	0.2658
D(FDI(-1))	0.368330	0.184749	1.993682	0.0593
GCF(-1)	-0.504741	0.087057	-5.797826	0.0000
GDP(-1)	1.74E-13	5.83E-14	2.990356	0.0070
RI(-1)	-0.024254	0.033370	-0.726837	0.4754
EXC(-1)	-0.038763	0.015931	-2.433173	0.0240
FDI(-1)	-0.395305	0.214390	-1.843860	0.0794

R-squared	0.717778	Mean dependent var	-0.528993
Adjusted R-squared	0.583387	S.D. dependent var	2.970670
S.E. of regression	1.917436	Akaike info criterion	4.406141
Sum squared resid	77.20774	Schwarz criterion	4.909988
Log likelihood	-59.49825	Hannan-Quinn criter.	4.573152
F-statistic	5.340959	Durbin-Watson stat	1.947069
Prob(F-statistic)	0.000610		



Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.009383	Prob. F(1,20)	0.9238
Obs*R-squared	0.015005	Prob. Chi-Square(1)	0.9025

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.689713	Prob. F(10,21)	0.7229
Obs*R-squared	7.911502	Prob. Chi-Square(10)	0.6375
Scaled explained SS	2.590809	Prob. Chi-Square(10)	0.9895

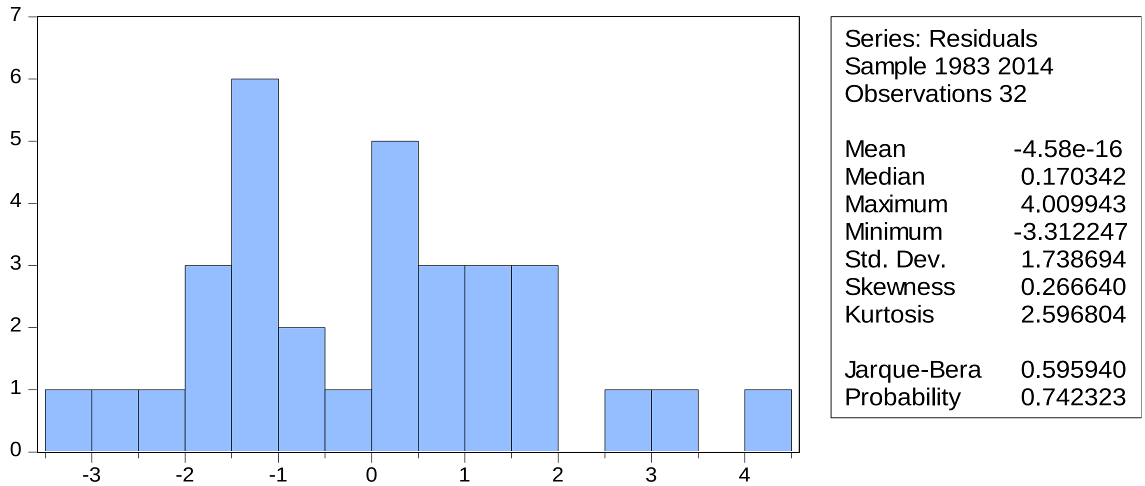
Ramsey RESET Test
Equation: UNTITLED
Specification: D(GCF) C D(GCF(-1)) D(GDP(-1)) D(RI(-1)) D(EXC(-1))
D(FDI(-1)) GCF(-1) GDP(-1) RI(-1) EXC(-1) FDI(-1)
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.584798	20	0.5652
F-statistic	0.341988	(1, 20)	0.5652
Likelihood ratio	0.542555	1	0.4614

Dependent Variable: D(GCF)
Method: Least Squares
Date: 06/26/16 Time: 19:56
Sample (adjusted): 1983 2014
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.153840	0.472948	-2.439679	0.0221
D(GCF(-1))	0.370282	0.121919	3.037123	0.0055
D(GDP(-1))	3.23E-13	1.78E-13	1.811324	0.0821
D(RI(-1))	-0.021098	0.014349	-1.470369	0.1539
D(EXC(-1))	0.038122	0.026192	1.455489	0.1580
D(FDI(-1))	0.418104	0.152968	2.733267	0.0113
ECT(-1)	-0.472828	0.086308	-5.478375	0.0000

			-
R-squared	0.657439	Mean dependent var	0.528993
Adjusted R-squared	0.575225	S.D. dependent var	2.970670
S.E. of regression	1.936128	Akaike info criterion	4.349897
Sum squared resid	93.71476	Schwarz criterion	4.670527
Log likelihood	-62.59835	Hannan-Quinn criter.	4.456177
F-statistic	7.996627	Durbin-Watson stat	1.970447
Prob(F-statistic)	0.000070		



Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.008432	Prob. F(1,24)	0.9276
Obs*R-squared	0.011239	Prob. Chi-Square(1)	0.9156

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.153838	Prob. F(6,25)	0.3616
Obs*R-squared	6.939718	Prob. Chi-Square(6)	0.3265
Scaled explained SS	3.381767	Prob. Chi-Square(6)	0.7596

Ramsey RESET Test
Equation: UNTITLED
Specification: D(GCF) C D(GCF(-1)) D(GDP(-1)) D(RI(-1)) D(EXC(-1))
D(FDI(-1)) ECT(-1)
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.677270	24	0.5047
F-statistic	0.458695	(1, 24)	0.5047
Likelihood ratio	0.605822	1	0.4364