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Effects of Interest Rate on Domestic Investment in Nigeria: Linear and Non-Linear Approaches

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Abstract

This work investigated the impact of interest rates variations on investments in Nigeria, for the periods between 1981 and 2018. The linear and non-linear Autoregressive lagged (ARDL and NARDL) techniques were employed to capture both the long-run and short-run dynamics of the variables as well as the asymmetric effects of interest rate on investment in the model. On the whole, investment behaviour was found to be insensitive to interest rate in Nigeria looking at it both from the linear and non-linear ARDL techniques employed in the model. Judging from the asymmetry test, some slight level of asymmetry was found to hold between positive and negative interest rate values. This holds at a 12% level of significances using the stepwise regression result. So, whether or not we aggregate or decompose interest rate into its positive and negative changes, it was found not to impact investment greatly it rather affected their relationship which happens to be in line with economic theory. Specifically, the empirical results of the ARDL indicated that a fall in the prime lending rate by one unitcaused an increase in investments by 0.230 units however this inverse relationship was not statistically significant. Whereas, the NARDL and general to specific least square regressionresults for both positive and negative increase in a year lag value of prime rate by one unit were found to result to a decline in current investment level by 0.0025 and 0.1066 units, as well as 0.3052 and 0.2391. Note alsothat both the increased and decreased interest rate changes have non-significant inverse relationship with investment. Consequently, we recommended among others; a loosening of interest rate by the monetary authority but, under strict scrutiny. This is needed in order to maintain the appropriate threshold and to create an effective and efficient interest rate transmission channel, to engender productive sectors as well as creating a conducive business environment for investment to strive, which will in turn promote domestic investment and economic growth in Nigeria.

Key Words: Investment, Interest Rate, Economic Growth, Financial Market

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1.0 Introduction

One of the major monetary policy tools used by financial authorities around the Globe, is interest rate this is due to the role it's plays in mobilizing financial resources with an intention to stimulate economic growth and development, through investment. Interest

rate is the cost of capital, and can be seen as an important economic price for investment, savings, as well as expenditure consumption. It is the opportunity cost of borrowing money and also the returns to the providers of financial resources. Most importantly, interest rate has been seen to possess fundamental implications for the economy due to the cost of capital or its ability to influence the availability of credit, via savings role that it plays (Acha&Acha 2011). Hence, understanding the response of the economy to changes or the variations in interest rates is central to the many issues in economic policy as it serves as a signal for the flow of funds from savers to borrowers both from within the country and outside the country who utilizes them for investment purpose (Richard, 2012).

Investment on the other hand is the change in capital stock or an addition to the stock of goods in existence for a given period of time. Investment can be financial or real in nature depending on whether it is seen as existing assets or addition to capital (Jhingan, 2003). In determining the level of investments, three fundamental factors must be considered; cost of capital asset, expected rate of returns, and the market rate of interest which is summed up in Keynes concept of "*marginal efficiency of capital"* (Jhingan, 2003).

Investment appears to be both a factor that triggers economic activity and a basic cause of economic problem since the classical economist era (Ojima &Emerenini, 2015). It is the most unstable component of all the aggregate demand components and hence has a significant impact on the economic growth of a country. Countries rely on investment to achieving some basic macroeconomic objectives (Muhammad, 2004).Hence, an understanding of the nature, determinants and the driving force of investment is deemed critical and crucial in designing policies to enhance and boost economic growth. The importance of interest rate in this study hinges mostly on its equilibrating influence on the availability of loanable funds from the financial sector for investment. Consequently, the main crux of this study is to examine empirically the impact interest rates variations may have on investment within the context of the Nigerian economy. No doubt, there have been studies bothering around interest rates, economic growth and bank lending, marginal efficiency of capital, and the role of interest rate on Foreign Direct Investment (FDI), which are internationally dominated as well as in local literature, also, most of such studies are cross-country based studies; but not much study centres on interests rate and investments using the Non-linear Auto regressive Lag (NARDL) technique which has the capacity to examine the asymmetric effects of the positive and negative changes in explanatory variables on the dependent variable. This is unlike the conventional ARDL wherein the possible impact of explanatory variables remains same. The innovation in this study therefore lies on the methodology which include the use of Non-linear Auto regressive Lag (NARDL) technique alongside the conventional Linear ARDL, the extension of scope as well as the fact that it is a country specific study, Nigeria economy being the case study.

The rest of the paper is structured as follows: Section two provides the review of related literature, while the methodology adopted for the study is presented in section three. Section four dwells on the findings and discussion, and finally the conclusion and implications are presented in section five.

2.0 Literature Review and theoretical Framework

2.1 Theoretical Review

From extant literature several theories have been advanced in an attempt to aid the effective explanation of the determining factors or driving forces as well as the

rationales for investments and its implication for macroeconomic objectives. They include among others the classical investment theory, the Accelerator investment theory (the fixed and flexible versions), the Keynesian theory of investment, Neo-Classical investment theory, the profit theory of investment, Tobin-q theory, and Mckinnon and Shaw (1973) Financial Repression/Complementary Hypothesis.

2.2 Empirical Review

The behaviour of interest rate culminating from monetary policy adjustments and how it plays out on changes in investment spending both on the aggregate and firm level perspective has stimulated some huge chunk of empirical studies both in the developed, developing and emerging countries with ample evidences in the literature. Mohammad and Md. Rabiul (2003); Ndikumana (2008); Olubanjo, Atobatele and Akinwumi (2010); Hira and Vesarach (2014); Ammer, Tabova and Wroblewski (2018); Aysun, and Kabukcuoglu (2018); Zhang, Li and Lai (2019); Meza, Pratap and Urrutia (2020); Belke, Baudisch and Gocke (2020).

The crux of these studies is that interest rate variation has implication for investment spending changing and possibly for a long-run economic growth. Specifically, based on theory, an inverse relationship exists between them.

Correspondingly, Albu (2006) found that interest rate - investment – economic growth relationships tend to converge to those demonstrated in a market economy using two partial models to investigate the impact of investment on national income growth rate and also to test for relationship between interest rate and investment in the case of Romanian economy, and. In that same light, Taolam (2014) revealed evidence that changes in firms' financial position stemming from either their performance or interest rate variation may translate to changes in their investments and employment plans. Precisely, the study stressed that higher interest rates encourage postponement of investment spending and reduced inventories, whereas lower rates encourage an expansion of activity. According to Monetary Policy Committee (MPC) report (1999), both the private and public sector depend on bank financing and are sensitive to the direct effects of interest rates. Higher interest rate worsens the financial positions of firms and lower rates improve their financial position. Hence, Ingersoll and Ross (1992) derived an appropriate rule for deciding when to invest, and resolved on the fact that the option to wait can be valued as an option of interest rates. Hira and Vesarach (2014) study revealed a negative relationship between interest rates and foreign direct investments in Thailand, Indonesia, and Malaysia. Belke *et.al* (2020) who examined the hysteretic impact of changes in the interest rate on macroeconomic investment under certainty and under uncertainty. They found a strong inverse reaction in investment activity following changes on interest precisely as soon as changes of the interest rate exceed a zone of inaction, what they referred to as the 'play' area. This hysteretic effect of interest rate changes on investment was found in most countries. However, their shape and magnitude differ widely across countries. Ammer et.al (2018) whose study aimed at examining how interest rates affect cross-border portfolio investments used US data from 31 countries who are foreign investors to US revealed that lower interest rate in foreign investors countries will lead to increase in investment in United State and that this effect is generally driven by investment in (higher yielding) corporate bonds. Consequently, they concluded that low interest rates can lead to shifts in the volume and composition of overseas investments.

From the firm-level perspective, Ndikumana (2008) research on investment using annual data on both aggregated industry-level and disaggregated data on 27 sub-sectors of the manufacturing sector in South Africa for a period of 1970-2001. The study found that governments' role is potentially powerful in stimulating private investment. This is so because, a tight or expansionary fiscal policy can either reduce or expand domestic aggregate demand and in the whole, investment. The study also reveals the direct effect of a fall in interest rates to be minimal. From the same angle, Aysun, and Kabukcuoglu (2018) in their study on Interest rates, R&D investment and the distortionary effects of R&D incentives. Using the firm-level financial and sector- level R & D incentives data and a methodology that hinges on within firm allocation of investment. Found among others that firms decrease (increase) their share of R & D spending (investment on R &D) during a credit tightening (easing). This therefore reveals an inverse relationship between interest rate and investment on R & D.

Using Nigeria Data, Eregha (2010) found that investment has an indirect relationship with interest rate variations and other variables in the model. Also, Ojima and Emerenini (2015) who employed multiple regression approach in their research found that high interest rate negatively affects investment for Nigeria. On the reverse side, evidence by Olubanjo, Atobatele and Akinwumi (2010) as carried out in Nigeria using two stages least square method found that a decrease in the real lending rate would not result to automatic increase in domestic investment. Deviating from the norm also Oosterbaan, Der Windt, and Steveninck (2000) revealed that the real interest rate has a threshold of -5 to +15% within which growth is maximized. This therefore explains to the fact that there is a level of interest rate fall that may trigger positive increase in investment spending. Stemming from the above argument, suffice to say that interest rate variation effect on investments in different countries depends on their macroeconomic environment.

Apart from interest rate variation, domestic investment spending can be influenced by other factors like foreign direct investment, level of openness of the said economy, as well as external debt and financial burdens amongst others. On the effect of foreign direct investment on domestic investment, it depends on whether it substitutes or complements domestic investment, because foreign direct investment can be an opportunity or competition for domestic businesses depending on the nature of FDI (De Mello, 1999 as cited in Hira and Vesarach 2014). Masron and Zulkornain (2012) asserts that Multinational Corporations from developed countries can help improve competition within or amongst entrepreneurs of host country, and hence a positive relationship between FDIs and DIs (domestic investments). On the other side, FDI can have some unintended impediments as well. It can affect negatively by crowding out domestic investment. Using Vector Auto regression (VAR) Technique on an annual data from 1986 to 2012. Mohamed, Jit Singh, and Chung-Yee (2013) study on FDI and domestic investment found no relation between FDI and economic growth in Malaysia. Linkages between FDI, DI and interest rates are important to be considered for maximum benefit of Domestic investments. Another important factor to consider is the degree of trade liberalization that is usually included in investment analysis. It might have positive (Balasubramanyum, Salisu, and Saps ford, 1996) as well as negative (Serven 2003) effects on investment. In the same vein, Mohammad and Md. Rabiul (2003) investigated investment behaviour in a panel data of 97 developing countries for the period between 1973 and 2002 using the GMM

dynamic panel estimator. Their result suggests that investment is significantly affected by trade openness including other variables in the model. The external debt level is a variable that can represent a source of external credit in investment financing. However, financial burdens might have bad effect on investment by making macroeconomic policies vulnerable for investment decisions and good by increasing credit availability in the economy (Mohammad & Md. Rabiul, 2003).

From the above, most literature that was reviewed in the area of interest rate and investments were found to have one limitation or the other which this study is set out to improve upon or if possible correct. The methodology which authors employed in examining the impact of interest rate variation on investment happens to be the most recurring of the flaws. Some studies took no cognizance of time series properties. Even though it has been established that such act can lead to biasedness of the result. According to Engle and Granger (1987) any regression run in that manner will produce a spurious result. Again, others who took care of time series properties did not take into consideration the possibility of lag or delayed response and rather analysed a static model. Again, most study treated the issue of interest rate variation as a symmetric case by lumping both the positive and negative growth effect of interest rate which most times yield inconsistent generalization thereby undermining the possibility of asymmetry. Against the backdrops, this study employed the conventional ARDL and the Non-Linear Autoregressive distributive lag (NARDL) techniques. The NARDL approach decomposes the interest rate growth variable into positive and negative components following the stepwise approach in order to examine whether there is asymmetric effect or not. That is, to examine whether there is significant difference in the way and manner the positive and negative components of interest rate affect investment.

2.3 Theoretical Framework

The classical and Keynesian investment theories drive this study. The classical investment theory posits that investment depends on the interest rate and that from the circular flow of income; interest rate guarantees the equality of investment and savings respectively. The notion is predicated on the belief that whatever income that the factors of production earn are either spent on capital goods (invested) and/or are saved. This therefore revealed that an inverse relationship runs between interest rate and investment. The Keynesian theory of investment posits that decisions on investment depends on the differentials of internal rates of return produced from the investment in a specific asset, but, not just on the interest rate. This is known as the Marginal Efficiency of Investment (MEI) and the predominant market rate of interest. This theory was popularized by John M. Keynes and Irving Fisher. They maintained that investments are made until the present value of expected future revenue at the margin, is equal to the opportunity cost of capital. This implies that firms will invest until their net present value (NPV) is equal to zero, i.e. NPV =0

$$NPV = C0 + / Ct\ e\ (g-i)\ t\ dt \quad (2.1)$$

Where; g = growth rate, i = the opportunity cost of capital.

According to this theory, there is said to be a direct relationship between investment and the rates of return from such investment and an inverse relationship between interest rate and investment. This is because; most lucrative projects are undertaken first and as such, any addition to investment will consist of projects with progressively lesser rates of return. Based on the above, an investment

would be embarked upon as long as the marginal efficiency of each additional investment exceeds the interest rate of capital.

That is, IRR >i or MEI >i.

Where; IRR = internal rate of return; i = represents interest rate.

Note that MEI/ IRR is computed by equating present value of revenue to initial cost outlays. According to Keynes *marginal efficiency theory* of investment; a new investment is made when the rate of returns expected from an additional unit of capital asset is over its cost, hence establishing an inverse relationship between investment and rate of interest

Note that investment would be non-profitable when the cost of borrowing the required funds exceed the returns on the investment in other words, if the interest rate on borrowing appears higher. Hence, it implies that higher rate of returns in the face of low interest rate will have a positive impact on investment.

3.0 Methodology

This study employed both the linear and nonlinear ARDL techniques. The nonlinear ARDL known as NARDL approach has been recently developed by Shin,Yu& Greenwood-Nimmo (2014). It is an extension of the ARDL approach by Pesaran, Shin & Smith (2001). The Non-linear ARDL employs the positive and negative partial sum decompositions in detecting the asymmetric effects in the long-run and short-run periods. Linear models are based on the assumption that a linear relationship runs between variables. However, this may not necessarily be the case at all times, the relationship may be nonlinear in some cases. The nonlinear approach will enable us to ascertain whether positive and negative changes in interest rate have symmetric or asymmetric effects on domestic investment in Nigeria. The choice of NARDL is predicated on its advantages over the conventional co-integration and ARDL approaches. For instance, unlike the traditional co-integration and ECM model, the NARDL allows the use of small samples (Romilly,Song& Liu, 2001); NARDL can be applied irrespective of whether the regressors are stationary at levels or at order one (i.e., I(0) or I(1)). However, it does not allow for the use of regressors that are stationary at order two (i.e. I(2)). Unlike the convention ARDL it can be used not just to ascertain the short and long-run impact but to examine the possibilities of short-run and long-run asymmetries as well as hidden co-integration. For example, a negative growth (shock) in interest rate may have a larger absolute impact in the short-run while a positive shock in interest rate may have a larger effect on investment in the long-run (or vice –versa). This can be detected easily with the help of NARDL.

The econometric analysis spanned from 1981 to 2018 due to availability of data. Annual data employed in this study were obtained from the 2019 volume of the Central Bank of Nigeria statistical bulletin, and year 2018 World Development Indicator of World Bank.

3.1 Model Specification

In line with the theoretical framework, and from extant literature, the functional relationship between interest rate and investment in Nigeria is as follows;

$$INV = f(INTRT, FDI, OPN) \quad 3.1$$

The Linear ARDL approach Model as advanced by Pesaran et al. (2001) is specified as follows:

$$\Delta INV_t = c_0 + \partial_1 INV_{t-1} + \partial_2 INTRT_{t-1} + \partial_3 FDI_{t-1} + \partial_4 OPN_{t-1} + \sum_{i=1}^{p} \theta\, \Delta INV_{t-1} + \sum_{i=1}^{p} \beta\, \Delta INTRT_{t-1} + \sum_{i=1}^{p} \gamma\, \Delta FDI_{t-1}$$

$+\sum_{i=1}^{p} \rho\, \Delta OPN_{t-1} + \varepsilon_t$ 3.2

Where; ∂_i are the long-run multipliers, $c_0\ is\ the\ intercept, \varepsilon_t$ is the white noise or error term. $(\theta, \beta, \gamma\ and\ \rho)$ are the short-run coefficients.

Having estimated the above generalized ARDL model, the next step is to carry out the co-integration test suppose the result shows that there is a long-run relationship, short-run model or an ARDL by Error Correction model with long-run estimates will be specified as follows;

$\Delta INV_t = c_0 + \sum_{i=1}^{p} \theta\, \Delta INV_{t-1} + \sum_{i=1}^{p} \beta\, \Delta INTRT_{t-1} + \sum_{i=1}^{p} \gamma\, \Delta FDI_{t-1} + \sum_{i=1}^{p} \rho\, \Delta OPN_{t-1} + \vartheta ECM_{t-1} + \varepsilon_t$3.3

In order to analyze the asymmetric effects of positive and negatives changes or growth of interest rate of Nigeria on the domestic investment of the country, we specified a functional nonlinear ARDL model as follows:

$INV = \alpha_{0+}\, \alpha_1 INTRT_POS_t + \alpha_2 INTRT_NEG_t + \alpha_3 FDI_t + \alpha_4 OPN_t + U_t$3.4

Using the variables in this study, specifically, Investment (INV) proxied by gross capital formation; Prime rate (INTRT); Aggregate income (GDP); Foreign direct investment (FDI); Openness (OPN), which was computed as the ratio of total trade to GDP.

Following Shin et al. (2014) and incorporating the study's variables, an asymmetric model of equation 3.1 and 3.4 are depicted as follows;

$\Delta INV_t = \rho(INV_{t-1}) + \beta_1^p(INTRT_POS_{t-1}{}^{+}) + \beta_2^N(INTRT_NEG_{t-1}) + \beta_3(FDI_{t-1}) + \beta_4(OPN_{t-1}) + \sum_{J=1}^{\rho-1} \mu\, \Delta INV_{t-1} + \sum_{J=1}^{\rho-1} (\varphi\, \Delta INTRT_POS_{t-1}{}^{+}) + \sum_{J=1}^{\rho-1} \varphi\, \Delta INTRT_NEG_{t-1}) + \sum_{J=1}^{\rho-1} \pi\, \Delta FDI_{t-1} + \sum_{J=1}^{\rho-1} \omega\, \Delta OPN_{t-1} + U_t$3.5

As seen in the equations 3.5above, maximum growth in interest rate is denoted as INTRT_POS while minimum growth in interest rate is denoted as INTRT_NEG. They are added to equation 3.4 and 3.5 as additional variables. The partial sums of squares of INTRT_POS and INTRT_NEG changes in interest rate are defined as follows;

$INTRT_{POS} = \sum_{j=1}^{t} INTRT_j^{+} = \sum_{j=1}^{t} \max(INTRT, O)$3.6

$INTRT_{NEG} = \sum_{j=1}^{t} INTRT_j^{-} = \sum_{j=1}^{t} \text{mIN}(INTRT, O)$3.7

Note that is the coefficients of INTRT_POS and INTRT_NEG are significantly negative and positive respectively, it will imply that they their impacts is not symmetric as assumed under the linear ARDL model.

Where: INV is domestic investment proxied by gross fixed capital formation, INTRT represent interest rate captured by the prime rate, INTRT_POS positive changes of interest rate, INTRT_NEG negative changes of interest rate, FDI foreign direct investment, and OPN is trade liberalization measured as the ratio of total trade to Gross domestic Product.

Stemming from economic theories, the a priori expectations for the investment equation as specified in equation 3.5is summarized as follows:

$\rho > 0$; $\beta_1 < 0$; $\beta_2, \beta_3, \beta_4 > 0$

To capture timing of investment or the effect of delay on investment, the investment variable is lagged by one year.

4.0 Analysis of Data and Discussion of Findings

The results of the study are presented and discussed as follows: To confirm the stationarity status of the series the Augmented Dickey Fuller statistics were adopted. The result showed that all the variables were stationary at first difference. Table 4.1 has a detail of the result.

Table 4.1: Augmented Dickey Fuller Result at Levels and First Difference.

VARIABLES	ADF STATISTICS AT FIRST DIFFERENCE	5% ADF CRITICAL VALUES	REMARKS
DINV	-5.3824	-3.5442	STATIONARY AT FIRST DIFFERENCE
DINTRT	-9.6296	-3.5403	STATIONARY AT FIRST DIFFERENCE
DFDI	-8.4360	-3.5403	STATIONARY AT FIRST DIFFERENCE
DOPN	-4.7637	-3.5403	STATIONARY AT FIRST DIFFERENCE

Source: Authors' computation 2021 *D=First order difference*

Table 4.2: ARDL Bounds Testing to check for existence of Long-Run Relationship

F-STATISTIC	5% CRITICAL BOUNDS	5% CRITICAL BOUNDS
INV	UPPER BOUND I(1)	LOWER BOUND I(0)
6.776*	3.15	4.08

Source: Authors' computation 2021

From Table 4.2 above, the F-Statistic ratio was obtained following the OLS estimation procedure and when compared with the Bound Testing critical Values as suggested by Pesaran et.al (2001), the F-Statistic appears to be greater than the critical values of both the upper and lower bounds at 5% level of significance. This therefore, suggest the existence of a long-run relationship in the investment model.

Table 4.3 Estimates of the Linear ARDL Model: Dependent Variable: DINV

Regressors	**ARDL**		**Long-run ARDL (1,0,0,0)**		**Short-Run ARDL**	
	Coef.	**t-statis.**	**Coef.**	**t-statis.**	**Coef.**	**t-statis.**
Constant	-9.613**	-2.2839	-10.004	-2.659		
DINV(-1)	0.039	0.2174			-0.9608*	-5.3395
INTRT	0.230	1.0409	0.239	1.1160		
FDI	1.130	1.6261	1.176	1.5082		
OPN	8.762***	1.6806	9.119***	1.7507		
ECM(-1)					-0.9608*	-6.184(0.00)
Diagnostic Tests $R^{2\,=}$ 0.22 R^2 0.52 F = 2.24(0.087) DW:1.8853 $x^2SC =$ (0.4531) $x^2HET =$ (0.1145) CUSM = S $CUSM^{2\,=}$ S						

Source: Authors' computation 2021

*Note: *, **, *** represents 1%, 5% and 10% significance; items in parentheses are the probability values of CUSUM and CUSUM of square tests and their stability is denoted by "S" and where unstable its denoted by "UNS";* x^2SC *and* x^2HET *denote the LM tests for serial correlation and Heteroscedasticity tests.*

Results from table 4.3 presents the coefficient of determination to be 0.22 and 0.52 percent for the ARDL and the short-run ARDL respectively. This implies that 52 percent of the variations in investment can be explained by all the explanatory variables in the short run.The F-statistic shows that the model is statistically significant at the 10% level of significance judging from its probability values that reads 0.087. The Durbin- Watson Statistic of 1.86 which is approximately 2 reveals the absence of autocorrelation in the model. Both the serial correlation and Heteroskedasticity Tests accept the Null hypotheses judging by their probability values of 0.4531 and 0.1145 which happened to be greater than 0.005. the tests show the absence of autocorrelation and heteroskedasticity problems in the model. The CUSUM test is significant at 5% level of significance as it ranges between the acceptable region. Since there appear to be a sound goodness of fit as analysed above, we can thus rely on the estimated parameters of the variables. Hence, the result of the estimation is interpreted as follows:

From the long-run result, aggregate value of interest was found to have a positive and insignificant relationship with investment spending in Nigeria for the period under investigation. Thereby implying that a decline in interest rate will cause an increase in investment spending by 0.230 units. This

corroborates (Olubanjo et. al, 2010; Oosterbaan et. al, 2018; and Ammer et al, 2018). Note that here interest rate is assumed to be symmetric in nature. But, judging with the t-statistics, interest appear to be insensitive to impacting domestic investment followed by the fact that its probability value is greater than 5%. Also, FDI and Openness were both seen to have a direct relationship with investment. While FDI happens to be statistically insignificant, OPN was significant at a 5% level of significance in driving investment. From the short-run analysis, the first year lagged differenced investment variable which also is the dependent variable was found to be indirectly related to investment and also statistically significant at 1% level of significance. The Error correction mechanism in the first lag denoted by (ECM-1) is correctly signed with a coefficient of -0.96 and appeared to be highly significant at 1% level. This indicates that, about 96% of the previous year's shock or disequilibrium in domestic investment can be corrected in the year at a faster rate as stated.

Table 4.4 Estimates of the Nonlinear ARDL using Stepwise Backward and General to specific Least squares approaches; **Dependent Variable is DINV**

	Regressors	**NARDL by Stepwise Regression**		**NARDL** by General to Specific Approach	
		Coef.	t-stat.	Coef.	t-stat.
Long - Run Estimates	Constant	18.0652*	2.9673	25.8211	3.0391
	Inv(-1)	-0.4644*	-4.8695	-0.5195	-4.5332
	Intrt_pos(-1)	-0.0025	-0.0181	-0.3053	-1.1339
	Intrt_neg(-1)	0.1066	0.7163	-0.2139	-0.8665
	FDI(-1)	-0.0710	-0.1338	0.6386	0.7877
	OPN (-1)	-36.1211*	-3.4603	-41.8651	-3.3513
Short-Run Estimates	DINV(-1)			0.1293	0.9081
	DINV(-2)	-0.3446**	-2.6251	-0.2510	-1.6875
	DINTRT_POS(-1)			0.2750	1.0785
	DINTRT_NEG(-1)			0.3292	1.1916
	DFDI			0.6312	0.9127
	DOPN			-21.1468	-1.2586
Diagnostic Tests $R^{2\,=}$ 0.55 x^2SC = (0.4017) F = 5.93*(0.007) x^2HET = (0.2373) DW:1.55 CUSM = $SW_{LR\,=}$ 8.99(0.0002) $CUSM^{2\,=}$ $SW_{LR(ASY).=}$ 2.597(0.11)				**Diagnostic Tests** $R^{2\,=}$ 0.62 x^2SC = (0.5504) F = 3.46(0.005) x^2HET = (0.1076) DW:1.84 CUSM = $SW_{LR\,=}$ 7.133(0.0015) $CUSM^{2\,=}$ $SW_{LR\,(ASY).=}$0.5487(0.4663) $W_{SR(ASY)\,=}$ 0.7094(0.4852)	

Source: Authors' computation 2021

*Note: *, **, *** represent 1%, 5% and 10% significance; items in parentheses are the probability values of the CUSUM and CUSUM of square tests and their stability is*

denoted by "S" and where unstable its denoted by "UNS"; x^2SC and x^2HET denote the LM tests for serial correlation and HeteroscedasticityWhite tests. W_{LR}, $W_{LR\ (ASY)}$ and $W_{SR(ASY)}$denote the Wald long-run tests of cointegration, Wald long-run test of asymmetry and Wald short-run test of asymmetry respectively. To check for the presence of asymmetry between the positive and negative changes in interest rate with respect to investment.

From table 4.4, the coefficients of determination for both approaches are 0.55 and 0.62 respectively. These imply that 55 percent of the variations in investment model can be explained by all the explanatory variables in the Stepwise regression. While in the case of the simple general to specific approach, 62 percent of the variations in the investment model is being explained by the independent variables put together. The F-statistics from the two estimation techniques show that the model is statistically significant at the 1% level of significance judging from its probability values that reads 0.000. This implies that the overall model is significant in explaining the variations in domestic investment. The Durbin-Watson Statistic of 1.55 and 1.84 respectively which is approximately 2 reveals the absence of autocorrelation in the model using the two techniques. Due to the soundness of goodness of fit as presented above, the estimated parameters of the variables can be relied on for inferences and policy implication. Hence, the result of the estimation is interpreted as follows:

From the non-linear ARDL (Stepwise regression and general to specific regression) results of the investment model, the one-year lag period investment in the long-run was found to be inversely related and statistically significant to the current year's investment at 1% level of investment. The results shows that an increase in the one year lagged period investment in the long-run by one unit will bring about a decline in the current period's investment by 0.464 and 0.5194 units. This gives credence to the prevalence of the business vicious cycle in the Nigerian economy. Using the NARDL approach, while positive increase in a year lag value of prime rate denoted as (INTRT_POS(-1)) by one unit leads to a decline in current investment by -0.0025 unit, a negative growth in a year lag value of prime rate denoted as (INTRT_NEG(-1)) by one unit were found to result to an increase in current investment level by 0.1066 units. With this method both positive and negative increase in interest rate met the a priori sign. Also, with the general to specific regression approach, an increase in the growth of the positive values of a year lag value of prime rate caused a decline in current investment to a tone of -0.3052,but the negative growth in interest rate by one unit also caused investment level to fall by -0.2391 units. The positive increase in prime rate met the a-priori expectation which is also in line with theory unlike the negative increase. However, judging from their t-statistics they were both found to be statistically insignificant in driving investment in Nigeria. This therefore suggest to mean that interest rate is insensitive to or not strong enough to drive investment growth in Nigeria. And this could be attributed to some structural and institutional defects. In the long-run also, a year period lag Foreign direct investment (FDI) revealed a mixed result for the stepwise, and the general to specific approaches. The inverse relationship between increased positive interest rate and investment confirms the works of (Taolam, 2014; Hira and Vesarach 2014). While the fact that interest rate drop was found to cause a decline in investment tends to supports the following studies (Ndikumana, 2008; Aysun and Kabukcuogh, 2018; Ojima and

Emerenin, 2015). This result could be attributed to huge drop in the prime rate beyond the rate that is appropriate to trigger investment growth.

From the NARDL result an inverse relationship was found to run between FDI and domestic investment with a magnitude of -0.0709 units whereas, using the simple General to specific approach a positive relationship was found to exist between FDI and domestic investment with a coefficient value of 0.6386 units. In both analyses, FDI appeared to be statistically insignificant in driving domestic investment judging from the t-statistics that are less than 2. This therefore implies that the massive inflows of FDI is not capable of boosting domestic investment in general rather FDI are seen to be run independently such that businesses owned by foreigners has nothing to do with domestic investors. This ought to be the reserve as FDI is supposed to complement and boost domestic investment. Openness (OPN) in both analyses happened to be both inversely related and statistically significant at 1% level of significance in driving investment. A unit rise in the level of trade openness, will result to a reduction in the level of domestic investment by 36.1210 and 41.8651 respectively. The inverse nature of the relationship between OPN and domestic investment can be attributed to the loss of competitiveness in the global market which tends to crowd out or hedge off domestic investments or companies from the market as the economy opens further. This suggests to mean that rapid openness tend to represses or retard domestic investment.

The short-run components of the resultsare not farfetched from that of the long-run. In the short-run. The differenced two periods' lagged value of domestic investment was found to inversely related and statistically significant to domestic investment by 5% level of significance. Again, both positive and negative shocks of the prime rate were both statistically insignificant to domestic investment. However, OPN in short-run happens to decline investment but not at a significant rate.The results of diagnostic, robustness and reliability tests are satisfactory. Judging by the probability values of the LM tests for serial correlation and Heteroscedasticity White tests which stood at 0.4017 and 0.2373 for the NARDL and 0.5504 and 0.1076 for general to specific regression which happened to be greater than 5%. With this will accepted the null hypotheses of no autocorrelation and no heteroskedasticity in the model. A long-run equilibrium was found to exist in the model judging by the probability values of the Wald long-run test of co-integration that happens to be significant by 0.0002 and 0.0015 respectively. This also confirms the bounds test of co-integration as reported above and when we compared the F-values of the Wald test 8.99 and 7.13 to the lower and upper bound values from Pesearan et.al (2001) table of co-integration these values outweighed the lower and upper bounds alike. This suggests that there exists a long run relationship in the model.

To examine whether an asymmetric relationship exist between the positive and negative changes in interest and how they impact domestic investment we carried out a Wald test of long-run and short run asymmetry test. From the result we accepted the null hypothesis which states that the relationship between INTRT_POS and INTRT_NEG is symmetrical in nature judging by the probability values of 0.11 and 0.46 respectively from both NARDL and the general to specific approach in the long run case and 0.48 from general to specific approach in the short run scenario. The asymmetry only holds at a higher level of significance of about 12% for the stepwise approach. This is to say that the difference might be there but not too significant. The plots of stability graphs implies that all

estimated coefficients are stable judging by the CUSUM and CUSUM of square graphs that appeared within the acceptable region and are significant at 5% level of significance. The variables in the model were also found to be normally distributed this stems from the plots that did not reveal any form of skewness to the right or left and also by the probability values of the Jarque-Bera test.

Summary Conclusions& Recommendations

This study investigates the impact of interest rates variations on investments in Nigeria, using time series and annual data from 1981 - 2018. The classical and Keynesian theories of investments formed the theoretical basis for analysing the impact of interest rate on investment. The linear and non-linear Autoregressive lagged (ARDL and NARDL) techniques were employed to capture both the long-run and short-run dynamics of the variables as well as the asymmetric effects of interest rate on investment in the model.

The study found interest rate to be insignificant in driving domestic investment in Nigeria both from the linear and non-linear ARDL techniques employed in the model. Judging from the asymmetry test, some slight level of asymmetry was found to hold between positive and negative interest rate values. This holds at a 12% level of significances using the stepwise regression result. So, whether or not we aggregate or decompose interest rate into its positive and negative changes, it does not impact investment greatly it rather affects their relationship which happens to be in line with economic theory. Specifically, the empirical results of the ARDL indicated that a fall in the prime lending rate by one unit caused an increase in investments by 0.230 units however this inverse relationship was not statistically significant. Whereas, the NARDL and general to specific least square regression results for both positive and negative increase in a year lag value of prime rate by one unit were found to result to a decline in current investment level by 0.0025 and 0.1066 units, as well as 0.3052 and 0.2391.Consequently, we recommend a loosening of the rate by the monetary authority but this must be done under strict scrutiny so as to maintain the appropriate threshold. Because any drop beyond the threshold will trigger a decline in investment as was revealed by the coefficient value of the decreased interest rate value (INTRT_NEG). And to make investment significant, it should be segmented according to business scale. To this end, interest rate fall should be channelled to sectors that are productive or have the potential to be productive. Like entrepreneurial, agriculture, service etc. For instance, the interest rate to medium and small-scale business and other productive sectors should be of topmost priority as this may encourage new investments and a boosting of existing ones.

Also, the result reveals that previous investment affects current investment, and this goes further to conform the business vicious cycle syndrome. Conclusively, having examined the impact of interest rate variations on investments in Nigeria, it was deduced that the response of investment to shocks in foreign direct investment was negatively insignificant.On the whole, the government should aspire to put in more efforts on building a stable economy so as to have a conducive atmosphere where investments can thrive.

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