CHAPTER THIRTEEN

ASYMMETRIC EFFECT OF REAL EXCHANGE RATE ON DOMESTIC INVESTMENT IN NIGERIA

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Abstract
The study investigated the asymmetric effect of the real exchange rate on domestic investment in Nigeria. The study used a nonlinear autoregressive distributed lag model to determine the asymmetric influence of real exchange rates on domestic investment in the short and long run. Quarterly time series data spanning from 2007Q1 to 2020Q2 were used for the analysis. After differentiating exchange rate appreciation from depreciation, the study found that in the short run, the coefficient of appreciation of the real exchange rate at the current level did not significantly affect domestic investment in Nigeria. Still, the appreciation of the exchange rate led to an increase in domestic investment in the subsequent first, second, and third quarters. Also, at lag 1 and 2, the coefficients of exchange rate depreciation have statistically significant negative effects on domestic investment. Findings showed that exchange rate depreciations had a statistically significant positive effect on domestic investment in the long run. It is recommended that export-based companies should be encouraged to take advantage of the cheaper and more competitive prices of their products and produce for export. Also, the government should provide the necessary infrastructure and improve the ease of doing business in Nigeria to increase domestic investment.
Keywords: asymmetry, exchange rate, domestic investment, NARDL, Nigeria

Introduction

The creation of an investment in any country depends on many factors: exchange rate, interest rate, income, and savings. The effect of fluctuations in the exchange rate on different macroeconomic variables has been established in the literature on trade (Handoyo *et al*., 2023; Widiyono *et al*., 2021; Longue *et al*., 2019); domestic output/production (Sharaf & Shahen, 2023; Soumia, 2022; Bahmani-Oskooee & Arize 2018,) and domestic investment (Osude 2022; Oniore, Gyang & Nnadi 2016). A country may opt for devaluation of its currency to enable it to gain competitiveness in global trade, for its exports to be cheaper, and to export more of its goods and services; with increased exports, the country is expected to increase domestic investment. On the other hand, currency appreciation is expected to lead to a fall in the cost of imported raw materials, inputs, and machinery for countries that are import-dependent; this is expected to boost domestic investment. Discussions on the effect of exchange rate on domestic investment are still ongoing in literature.

The theory of optimal inertia by Dixit and Pindyck (1994) demonstrated that investors are generally hesitant to invest under uncertainty. Extending this framework, Darby *et al*. (1999) established that if a firm's opportunity cost of waiting is lower than its present value, they will not invest. Bertola (1998) and Iyke and Ho (2017) also revealed that price uncertainty reduces the investment process by risk-neutral firms. In contrast, Abel (1985) contends that high price uncertainty may promote the current level of investment by the competitive risk-neutral firm in their attempt to prevent uncertainty in the future. These different effects of uncertainty are also observed in exchange rates, and there is documented literature on its effect on domestic investment.

Bakare (2011) empirically analyzed the floating exchange rate on private domestic investment in Nigeria using the error correction model (ECM) technique and found that the floating exchange rate negatively affected private domestic investment in Nigeria. In the same vein, Oniore, Gyang, and Nnadi (2016) used the ECM technique within the Ordinary Least Square estimation and found that the depreciation of the Naira did not stimulate private domestic investment activities in Nigeria. Ac-Ogbonna and Osude (2022), using the ECM model, found a negative effect of exchange rate volatility on domestic investment in Nigeria. Udeh and Edeh (2020) applied another method- the linear Auto-Regressive Distributed Lagged (ARDL) model and also found a negative relationship between exchange rate fluctuation and domestic investment in Nigeria.

A common feature of the empirical studies conducted on exchange rates on domestic investment in Nigeria assumed that the response of domestic investment to the interest rate is symmetric. However, evidence from studies such as Alhakimi and Shama (2022) found that both positive and negative shocks in exchange rates had negative impacts on investment in

Egypt. Furthermore, Baah (2020) estimated a linear ARDL model and found fluctuations in the real effective exchange rate to be detrimental to domestic investment in Ghana in the long run. Still, the nonlinear model showed that exchange rate appreciation led to a decrease in domestic investment, while exchange rate depreciation had a significant positive effect on domestic investment. On the other hand, Iyke and Ho (2017), using the linear ARDL model, found that while the current level of exchange rate uncertainty enhanced investment in Ghana, previous levels of uncertainty dampened investment, but in the long run, exchange rate uncertainty had a positive impact on domestic investment. Further analysis from Bahmani-Oskooee and Saha (2022), differentiating exchange rates into appreciations and depreciations, analyzed the link between real exchange rates and domestic investment in Asia and found that currency depreciation had an adverse long-run effect on domestic investment. Bahmani-Oskooee and Hajile (2013) found that the real exchange rate volatility had a significant effect on domestic investment in the short run in 27 out of 36 countries. While in 14 countries, exchange rate uncertainty increased the domestic investment, in 13 countries, it decreased the investment. However, the short-run effects lasted into the long run in only 12 countries.

If, from most of these studies, domestic investment responds to the exchange rate asymmetrically, it becomes imperative not to settle for results from analysis of domestic investment's response to the exchange rate linearly as described by some researchers (Oniore *et al.* 2016; Ac-Ogbonna & Osude, 2022; Udeh & Edeh, 2020), but to assess the asymmetric effect of exchange rate on domestic investment in Nigeria. The use of the nonlinear ARDL model on the effect of exchange rates on trade and economic growth is also documented.

On commodity export, Handoyo *et al*. (2023) in ASEAN-5, using the linear ARDL approach, found that exchange rate volatility had a significant influence on 13 commodity exports in the short term, but the Nonlinear ARDL approach revealed that volatility influenced 19 commodity exports. In the long run, findings from the linear ARDL and nonlinear ARDL also indicated the nonlinear model demonstrated that volatility asserted an asymmetric influence on nearly all commodity exports. On economic growth, Soumia (2022), using the ARDL model results, showed that the exchange rate does not affect economic growth in the long run. However, after separating the real effective exchange rate into positive and negative changes in the NARDL model, the results showed that the overvaluation of the Algerian Dinar negatively affected economic growth, but the depreciation of the Dinar promoted economic growth.

Empirical evidence on the effect of the real exchange rate on domestic investment in Nigeria is minimal, with few studies. The previous studies did not consider the asymmetry in the changes in real exchange rates in Nigeria. This study, therefore, evaluated the asymmetric effect of the real exchange rate on domestic investment in Nigeria. The rest of this paper is divided into Section 2, which introduces the data and methodology; Section 3, which focuses on results and discussion; and Section 4, which draws conclusions and makes policy recommendations.

Data and Methodology

Data

The data used for this analysis are domestic investment proxied by gross fixed capital formation (GCF), the national output proxied by gross domestic product (GDP), interest rate (INR) savings (SAV), and exchange rate (REXR) in Nigeria and are measured in billion Naira except interest rate which is measured in percentages and exchange rate which measures the value of the Naira against weighted average of several foreign currencies divided by the price deflator. The data used for the analysis are quarterly time series data from 2007Q1 to 2020Q2 sourced from the Central Bank of Nigeria Quarterly Statistical Bulletin 2014 and 2020**.**

Model Specification

Evidence from empirical research suggests that domestic investment proxied by gross fixed capital formation (GCF) of a country is closely related to the national output proxied by gross domestic product (GDP), interest rate (INR) savings (SAV) and exchange rate (REXR) as found in studies by Bahmani-Oskooee and Saha (2022); Iyke and Ho (2017) and Bahmani-Oskooee and Hajile (2013). Thus, the dependent variable GCF is related in a functional relationship with its determinants:

$$GCF = f(GDP, INR, SAV, REXR) \tag{1}$$

Where, GCF= Gross fixed capital formation a proxy for domestic investment, GDP= Gross domestic product, INR= Interest rate, SAV= Savings, and REXR = Real exchange rate

Now, by taking the semi-log of the variables in equation (1) with the exception of INR and REXR which are reported in rates and have the tendency of having negative signs, we present a typical Nonlinear Autoregressive Distributed Lag (NARDL) stochastic form for the study as follows:

$GCF_t = \beta_0 + \beta_1 \ell GDP_t + \beta_2 INR_t + \beta_3 \ell SAV_t + \beta_4 REXR\_POS_t + \beta_5 REXR\_NEG_t + \mu$ (2)

Where μ is the error term that explains the effect of omitted variables and $REXR\_POS_t$ refer to positive changes in real exchange rate while $REXR\_NEG_t$ refers to negative changes in real exchange rate.

The relationship between domestic investment and the explanatory variables in a dynamic framework of the NARDL model, the specification was modified following Shin *et al*. (2014) in agreement with Bahmani-Oskooee and Hajile (2013) that, nonlinearity is intractably inherent in both human and economic conditions and this requires the use of asymmetric models.

The general NARDL $(p, q_1, ..., q_k)$ model is specified as:

$$y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \psi_i y_{t-i} + \sum_{j=1}^{k} \sum_{l_j=0}^{q_i} \beta_{j,l_j} x_{j,t-l_j} + \varepsilon_t \qquad (3)$$

Where ε_t represents innovations, α_0 is a constant term, and α_1, ψ_i and β_{j,l_j} are respectively the coefficients of linear trend, lags of y_t, and lags of the k regressors $x_{j,t}$ for $j = 1, ..., k$. Thus, following the generic form, equation (4) can be stated in asymmetric manner as:

$$\begin{aligned}\ell GCF_t = {} & \lambda_0 + \lambda_1 t + \sum_{i=1}^{p} \psi_1 \ell GCF_{t-i} + \sum_{j=0}^{q} \psi_2 \ell GDP_{j-q} + \sum_{j=0}^{q} \psi_3 INR_{j-q} + \sum_{j=0}^{q} \psi_4 \ell SAV_{j-q} \\ & + \sum_{j=0}^{q} \psi_5 REXR\_POS_{j-q} + \sum_{j=0}^{q} \psi_6 \ell REXR\_NEG_{j-q} + \xi_t \end{aligned} \qquad (4)$$

Where $\psi_1 - \psi_9$, and $\lambda_0 - \lambda_1$ are coefficients and constants respectively.

However, the model must capture the intertemporal dynamics since the study is interested in estimating the relationship between y_t on both its lags as well as the contemporaneous and lagged values of the k regressors $x_{j,t}$. This can be stated in the generic form as:

$$y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \psi_i y_{t-i} + \sum_{j=1}^{k} \beta_j(1) x_{j,t} + \sum_{j=1}^{k} \beta_j(L) \Delta x_{j,t} + \xi_t \tag{5}$$

where the first difference notation is $\Delta = (1-L)$. But given that equation (5) does not explicitly solve for y_t, it can then be referred to as a regression for intertemporal dynamics. Thus, the practical regression setting of equation (5) that uses theoretical coefficients is specified as:

$$\begin{aligned}\ell GCF_t &= \lambda_0 + \lambda_1 t + \sum_{i=1}^{p} \beta_{0,i} \ell GCF_{t-i} + \beta_1 \ell GDP_t + \beta_2 INR_t + \beta_3 \ell SAV_t + \beta_4 REXR\_POS_t \\ &\beta_5 REXR\_NEG_t + \sum_{j=1}^{k} \varphi_{1,j} \Delta \ell GDP_{t-j} + \sum_{j=1}^{k} \varphi_{2,j} \Delta INR_{t-j} + \sum_{j=1}^{k} \varphi_{4,j} \Delta \ell SAV_{t-j} \\ &+ \sum_{j=1}^{k} \varphi_{4,j} \Delta REXR\_POS_{t-j} + \sum_{j=1}^{k} \varphi_{6,j} \Delta REXR\_NEG_{t-j} + \xi_t\end{aligned} \tag{6}$$

The conditional Error Correction Form and the Bounds Test can be specified as:

$$\Delta y_t = \alpha_0 + \alpha_1 t - \psi(1) EC_{t-1} + \left(\psi^*(L) \Delta y_{t-1} + \sum_{j=1}^{k} \beta_j(L) \Delta x_{j,t-1} \right) \tag{7}$$

From equation (7), it can be seen that the error correction term, typically denoted as EC_t, is also the cointegrating relationship when y_t and $x_{1,t},\ldots,x_{k,t}$ are cointegrated. Given that, there may be no trend from cross examination, the study assumes no trend and restricts the constant inside the co-integrating equation, thus, specifies and estimates restricted constant with no trend. The model with restricted constant and no trend specification can be specified as:

$$\Delta y_t = \alpha_0 + b_0 y_{t-1} + \sum_{j=1}^{k} b_j x_{j,t-1} + \sum_{i=1}^{p-1} c_{0,i} \Delta y_{t-i} + \sum_{j=1}^{k} \sum_{l_j=1}^{q_j-1} c_{j,l_j} \Delta x_{j,t-l_j} + \sum_{j=1}^{k} d_j \Delta x_{j,t} + \varepsilon_t \tag{8}$$

Whereas: $EC_t = y_t - \sum_{j=1}^{k} \frac{b_j}{b_0} x_{j,t} - \frac{a_0}{b_0}$ (9)

With $H_0 : b_0 = b_j = \alpha_0 = 0, \forall_j$

Where y is a vector and the variables in x_t are allowed to be purely I(0) or I(1); α is a Constant

b, c and d are coefficients $j = 1,\ldots,k$; p, q are optimal lag orders and ε_t is a vector of the error terms. Thus, the asymmetric error correction model can be specified as:

$$\Delta \ell GCF_t = \sum_{i=1}^{p} \beta_1 \Delta \ell GCF_{t-i} + \sum_{i=1}^{q} \beta_2 \Delta \ell GDP_{t-i} + \sum_{i=1}^{q} \beta_3 \Delta INR_{t-i} + \sum_{i=1}^{q} \beta_4 \Delta \ell SAV_{t-i}$$
$$+ \sum_{i=1}^{q} \beta_5 \Delta REXR\_POS_{t-i} + \sum_{i=1}^{q} \beta_6 \Delta REXR\_NEG_{t-i} + \lambda EC_{t-1} + \varepsilon_t \tag{10}$$

Where λEC_{t-i} is a component of speed of adjustment towards the equilibrium path of the model and ε_t is the error term.

Estimation Procedure

Before the estimation of the model of this study, the unit root tests for stationarity were conducted using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP). Since NARDL uses lag values, the optimal lag length for the model was estimated, and the bounds test was carried out to check if a long-run relationship exists among the variables. The study, having determined the cointegration relationship, the short-run Error Correction Model and the long-run nonlinear Auto Regressive Distributed Lag model were estimated. Finally, the post-estimation tests aimed at assessing the model's goodness of fit were carried out using the normality test, heteroscedasticity, and serial correlation test.

Results and Discussions

Descriptive Statistics

Table 1 shows the historical behavior of the variables under study.

Table 1: Descriptive Statistics

	GCF	GDP	INR	SAV	REXR
Mean	3302788.	15298253	25.31887	9204233.	90.04251
Median	2950955.	15797966	24.90000	8656125.	87.82969
Maximum	10785010	19041438	31.55000	17301033	161.2770
Minimum	369265.6	11165285	17.58000	2195885.	64.96818
Std. Dev.	2278374.	2290343.	4.208770	4295899.	21.69078
Skewness	1.048353	-0.211473	-0.047736	0.165853	1.981218
Kurtosis	4.328814	1.901474	1.977470	1.956799	6.936313
Jarque-Bera	13.60758	3.059962	2.329089	2.646236	68.88998
Probability	0.001110	0.216540	0.312065	0.266304	0.000000

Source: Computation by Researcher Using EViews 10

The information displayed in Table 1 describes the independent variables: real exchange rate (REXR), savings (SAV), interest rate (INR), and gross domestic product (GDP), and the dependent variable, domestic investment proxied by gross fixed capital formation (GCF). The variables are measured in Billions of Naira except EXR and INR, which are measured in rates. The data presented shows that the variables under investigation are normally distributed given their probability and Jarque-Bera values, except REXR and GCF, whose probability values of 0.0000 and 0.0011, respectively, are less than 0.05 critical values. Nevertheless, the non-normality of these two variables may not result in any problems that will affect the quality of the result. Additionally, it can be seen that variables are positively skewed except for GDP and INR, indicating overall unfavorable Gross Domestic Product and Interest Rates in the period under review. Also, the Kurtosis of GDP, INR, and SAV, whose values are less than 3, the statistically set threshold, are platykurtic, while GCF and EXR are leptokurtic given that their values are greater than 3.

Table 1 also showed that Gross Fixed Capital Formation (GCF) averaged 3,302,788BN with a standard deviation of 2,278,374BN, which denoted that the deviation did not move far away from the average. The lowest GCF in Nigeria was recorded in 2007Q4, while the highest GCF in Nigeria was recorded in 2017Q4. Information on Gross Domestic Product (GDP) indicated that it averaged 15,298,253 Billion Naira with a standard deviation of 2,290,343, showing that GDP fluctuated very widely. The highest GDP in Nigeria recorded was 19,041,438 billion Naira in 2018Q4, while the lowest GDP recorded was in 2008Q1 with a value of 11,165,285 billion Naira.

Table 1 shows an interest rate averaging 25.31 with a standard deviation of 4.21. This means that the deviation wandered very far away from the average. The lowest interest rate was 17.58 in 2008Q1, while the highest was 31.55 in 2017Q4. Information on savings in Nigeria during the study period showed that savings averaged 9,204,233 billion Naira with a standard deviation of 4,295,899 billion Naira, which was not too far away from the average. The maximum amount of savings was 17,301,033 billion Naira documented in 2019Q4, while the lowest savings was 2,195,885 billion Naira documented in 2007Q1

Finally, the information on the real exchange rate indicated that the mean value was 90.04 in the period under investigation with a standard deviation of 21.69, which wandered far from the average. The maximum real exchange rate was 161.28, detailed in 2007Q3, while the minimum real exchange rate was 64.968, documented in 2016Q1

Pre-estimation Tests
Table 2: Unit Root

Variables	ADF at level	ADF at 1st Difference	Order of Integration	PP Statistic at Level	PP Statistic at 1st Difference	Order of Integration
GCF	1.23	-6.60***	I(1)	0.89	-10.20***	I(1)
GDP	-2.67*	----------	I(0)	-2.05	-13.87***	I(1)
INR	-0.90	-5.03***	I(1)	-0.96	-5,05***	I(1)
SAV	0.15	-6.59***	I(1)	0.21	-6.56***	I(1)
REXR	-2.99**	---------	I(0)	-2.99**	---------	I(0)

Note: *, **, *** implies significance level at 10%, 5% and 1% respectively. (-----) indicate that stationarity was achieved at levels

The (ADF) and (PP) unit root tests were tested against the null hypothesis that the variable under investigation had unit root and was termed stationary when the probability value of its corresponding t- statistics was less than 0.1. Thus, information from Table 2 showed that for the ADF test, all variables were stationary at first difference except GDP and REXR which were stationary at levels. For the PP test, all the variables were stationary at first difference except REXR which was stationary at levels. Given the mixed order of integration of the variables using either of the unit root test approaches, it indicated the suitability of the use of NARDL approach and validated the bounds test approach for cointegration.

Bounds Test
Table 3 presents the bounds test to check if the variables are cointegrated and not diverge with the passage of time.

Table 3: Bounds Test Results

Level of Significance	F- Statistic Value	Lower Bound I(0)	Upper Bound I(1)
10%		2.08	3
5%	5.55	2.39	3.38
2.5%		2.7	3.73
1%		3.06	4.15

Source: Computation by Researcher Using EViews 10

The outcome in Table 3 indicated that, at 5% level of significance, the F-statistic value of 5.55 exceeded the upper bound, with this, it was concluded that there was a long run relationship among the variables and that the null hypothesis of no long run rejected.

Short run Results

The short run results presented in Table 4.

Table 4: Short run NARDL Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGCF(-1))	-0.012171	0.111895	-0.108771	0.9142
D(LGCF(-2))	0.296503	0.116596	2.542997	0.0168
D(LGDP)	-3.292786	0.818860	-4.021183	0.0004
D(LGDP(-1))	-3.393890	0.827603	-4.100865	0.0003
D(LGDP(-2))	-3.081512	0.841162	-3.663399	0.0010
D(LGDP(-3))	-3.835203	0.831957	-4.609858	0.0001
D(REXR_POS)	-0.003928	0.004275	-0.918888	0.3660
D(REXR_POS(-1))	-0.013717	0.004942	-2.775661	0.0097
D(REXR_POS(-2))	-0.009646	0.004392	-2.196321	0.0365
D(REXR_NEG)	-0.011882	0.010753	-1.105017	0.2786
D(REXR_NEG(-1))	0.015670	0.003483	4.499264	0.0001
D(REXR_NEG(-2))	0.012114	0.003105	3.900969	0.0005
D(REXR_NEG(-3))	0.010949	0.002679	4.086535	0.0003
ECM(-1)*	-0.512317	0.074609	-6.866660	0.0000
R-squared	0.678735	Durbin-Watson Statistics		2.155966

Source: Computation by Researcher Using EViews 10

The short-run results from Table 4 showed an asymmetric effect, as suggested by Shin *et al*. (2013), that the nonlinear ARDL model appeared when the exchange rate was broken down into appreciations (ΔNEG) and depreciations (ΔPOS) had a different magnitude (sign) and lags. In the short run, the coefficient of appreciation of the real exchange rate was -0.012 at zero lag, but this did not significantly affect domestic investment in Nigeria. At lag 1, 2, and 3, a 1% exchange rate appreciation led to an increase in domestic investment in the first, second, and third quarters by 0.016%, 0.021%, and 0.011%, respectively, ceteris paribus, and these coefficients were statistically significant. Furthermore, at zero lag, the coefficient of exchange rate depreciations was -0.004, but the effect was statistically insignificant. At lag 1 and 2, the coefficients of exchange rate depreciation had statistically significant effects on domestic investment; a 1% depreciation in exchange rate had a 0.013% and 0.009% fall in domestic investment in the first and second quarters, respectively, ceteris paribus.

In the short-run result, the lagged value of domestic investment had a statistically significant positive effect on itself. Still, even though statistically significant, gross domestic product had a negative effect on domestic investment at lag 0, 1, 2, and 3. This meant that income had no significant effect on domestic investment in Nigeria. The effects of other variables like interest rate (INR) and savings (SAV) were not reported in the short run, which meant they did not have any noticeable effect on domestic investment in the short run. Furthermore, the ECM (-1) results are -0. 51, reported in Table 4, was statistically significant at 1% level. This showed that the variables in the model adjusted towards their long-run equilibrium value of 51% in a quarter in any event of temporal deviation from the equilibrium path. Also, the R-square value of 0.678735 indicated that 67% of the variables in the model had explanatory power over changes in domestic investment in Nigeria in the short run. The Durbin-Watson statistic of 2.155966, approximated to 2, showed that the model was free from autocorrelation.

Long Run Results

The long run results are presented in Tables 5 and 6.

Table 5: Long run ARDL and NARDL Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-2.409539	5.285786	-0.455853	0.6512
LSAV	2.595945	1.669830	1.554617	0.1288
INR	-0.048186	0.115527	-0.417096	0.6791
REXR	0.015377	0.016004	0.960809	0.3431
C	13.36892	68.35264	0.195588	0.8460
Long run NARDL Results				
LGDP	0.292877	3.459718	0.084654	0.9331
LSAV	1.298149	1.091808	1.188990	0.2444
REXR_POS	0.020732	0.007660	2.706503	0.0115
REXR_NEG	0.010086	0.014600	0.690798	0.4954
INR	-0.111571	0.073196	-1.524276	0.1387
C	-7.155188	43.19046	-0.165666	0.8696

Source: Computation by Researcher Using EViews 10

Results from the long-run ARDL coefficient estimates in Table 5 showed that the real exchange rate had a positive effect on domestic investment. Still, the effect was not significant in the linear model. If we were to rely on the linear ARDL result, we would have concluded that the real exchange rate had no long-run effect on domestic investment in Nigeria. However, the nonlinear ARDL model proved us wrong. In the long run, the results of the nonlinear ARDL model in Table 6 showed that real exchange rate appreciation and depreciation positively affected domestic investment in Nigeria. However, the positive effect of exchange rate appreciation on investment in Nigeria was not statistically significant. Exchange rate depreciations had a statistically significant positive effect on domestic investment in the long run; this concurred with Bahmani-Oskooee and Arize (2018), who stated that using nonlinear models produced much more significant outcomes than linear models. Thus, a 1% depreciation in the exchange rate led to a 0.020% increase in domestic investment in Nigeria, ceteris paribus. This finding conformed with that of Baah (2020), Iyke and Ho (2017), and Bahmani-Oskooee and Hajile

(2013) but at variance with the findings of Oniore *et al.* (2016); Ac-Ogbonna & Osude, (2022) and Udeh and Edeh, (2020).

Dynamic Multipliers

The cumulative dynamic multipliers depict a graphical representation of a unit change in domestic investment due to the positive and negative changes in real exchange rate in Nigeria. The responses that occurred due to shocks in real exchange rate appreciation and depreciations are shown to Figure 1. Domestic investment's respond to positive and negative shocks in real exchange rate at a specific forecast horizon is displayed by the positive change (thick black line in the upper region) and negative change (thick broken line in the lower region) curves. The disparity between the positive and negative effects of multipliers to shocks in real exchange rate is displayed by the asymmetry line (broken thick red line). The thin dotted red lines represent the upper and lower confidence bonds at 95% confidence level. They provide a measure that shows that, the asymmetry is statistically significant.

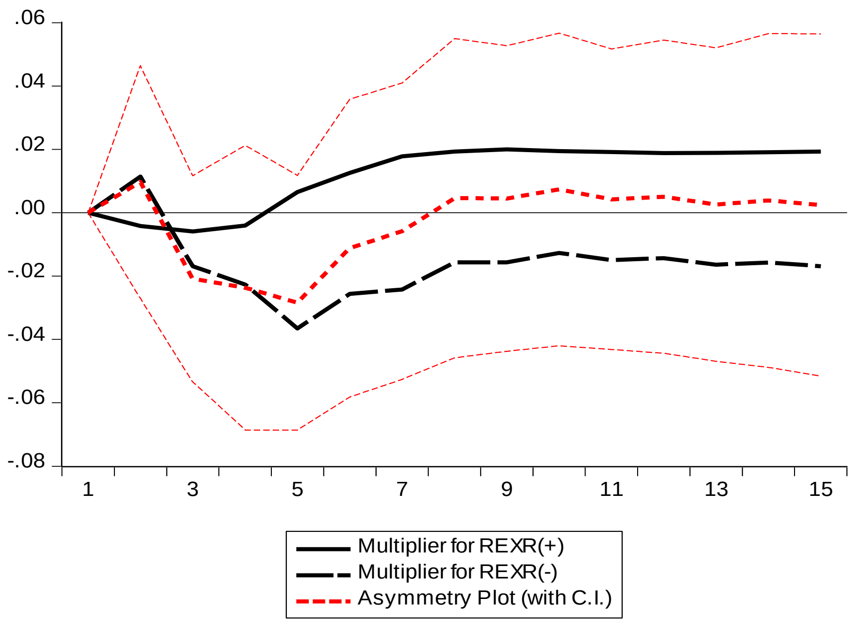

Figure 1 Result of the Dynamic Multipliers

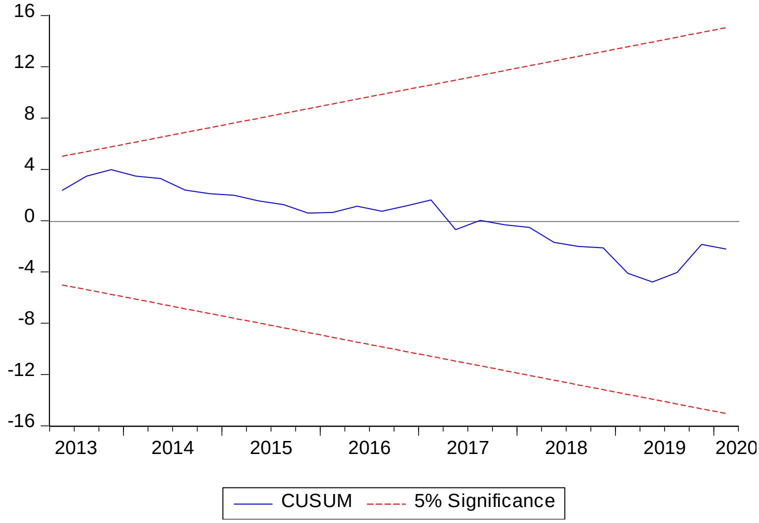

Figure 2 CUSUM Test

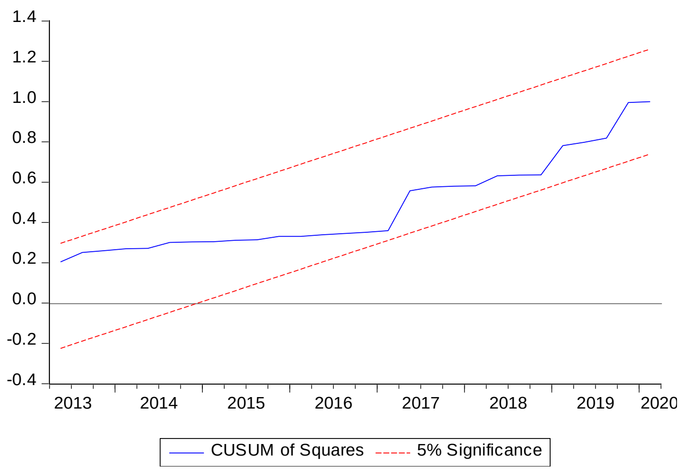

Figure 3 CUSUM of Squares Test

As shown in Figures 2 and 3, the results of both Cusum and Cusum of squares test revealed that the model coefficients of short run and long run were stable given that the plots were within the critical bounds at 5% significance level.

Post Estimation Tests

Normality Test

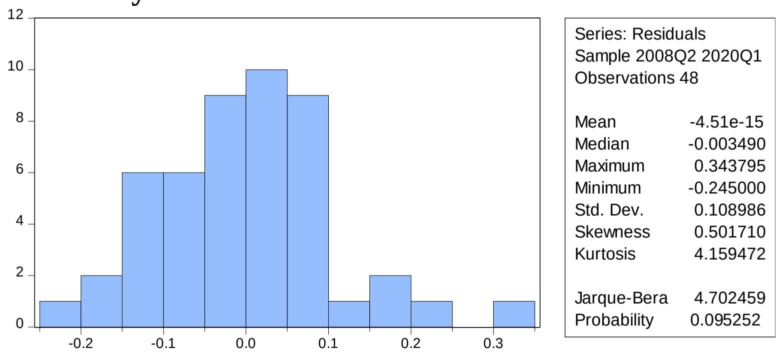

Figure 4: Normality test graph

The residual normality graph as shown in Figure 4 validated the fact that the residuals were normally distributed given the probability value of 0.095252 which was higher than the 0.05 critical value. The Kurtosis of 4.159472, was higher than the Kurtosis threshold value of 3 and it showed that the distribution of the residuals was leptokurtic, implying that the series contained some outliers.

Table 7: Heteroscedasticity and Serial Correlation Tests

Test Type	**Heteroskedasticity**		**Serial Correlation LM**	
	Value	**Prob.**	**Value**	**Prob.**
F-statistic	0.9434	0.5169	1.6997	0.1979
Obs*R-squared	11.7228	0.4682	4.4539	0.1079
Scaled Exp. SS	18.65898	0.0971	----	----

The dashes (----) in Table 7 show that the statistic is not applicable for that particular test.

The heteroscedasticity test presented in Table 7 indicated that the residuals possessed constant variance which was consistent with the stochastic process and as such was regarded as being homoscedastic. This conclusion was predicated on the probability values of the F-statistic (0.5169), observed R-squared (0.4682) and Scaled explained sum of square (0.0971) which were greater than the 0.05 level of significance.

Finally, the serial correlation test result specified that no case of autocorrelation was observed in the residuals, this was based on the probability values of the F-statistic which was 0.1979 and that of the observed R-squared was 0.1079. These post estimation results confirmed that the model performed well and appropriately fitted the data.

Conclusion and Recommendations

The actual exchange rate plays a substantial role in influencing the direction of trade and also performs a greater role in influencing other prices and returns on investment. This study revisited the effect of the real exchange rate on domestic investment in Nigeria by using a nonlinear ARDL model, thus differentiating exchange rate appreciation from depreciation. Based on the result of the study, we conclude that exchange rate depreciations had a statistically significant positive effect on domestic investment in the long run. In the short run, the coefficient of appreciation of the exchange rate led to an increase in domestic investment in the first, second, and third quarters. At lag 1 and 2, the coefficients of exchange rate depreciation had a statistically significant negative effect on domestic investment in the short run. It is recommended that export-based companies should be encouraged to take advantage of the cheaper and more competitive prices of their products and produce for export. Also, the government should provide the necessary infrastructure and improve the ease of doing business in Nigeria so as to increase domestic investment.

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