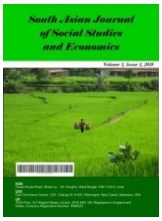

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Effects of Exchange Rate on Foreign Direct Investment Inflow in Nigeria

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Aims: This study examined the place of exchange rate in determining foreign direct investment inflow into the Nigerian economy using time series data from 1980 to 2017.
Study Design: Historical research design method was adopted for the study, it uses secondary sources and a variety of primary documentary evidence.
Place and Duration of Study: Department of economics, faculty of social sciences, Nnamdi Azikiwe University, between September 2010 and May 2018.
Methodology: The method adopted for this study was the Autoregressive Distributed Lag (ARDL) estimation approach and error correction mechanism within the framework of dynamic OLS (DOLS) estimation. The analysis began with a verification of the unit root properties of the variables. The Augmented Dickey Fuller (ADF) and Philips-Perron (PP) unit root procedures were employed and both tests indicate that the variables were integrated of either order I(0) or order I(1). This warranted the use of Bounds testing approach in determining the cointegration among the variables in the various equations in the selected countries. Analysis using the Bounds testing approach to cointegration confirmed the existence of long run relation among the variables of the models. In determining the impact of exchange rate on foreign direct investment inflow in Nigeria, we estimated an ARDL model.
Results: The results indicate that exchange rate affects FDI in both the long and short run. The result also reveals that the impact of exchange rate on FDI in the short run continuous up to three periods after the initial disturbance.

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Conclusion: This study concluded that exchange rate appreciation will lead to increases in foreign direct investment inflow. The study therefore recommended, amongst others, that government should apply exchange rate regime that is competitive at the international market so as to attract more FDI inflow to the Nigeria economy.

Keywords: Exchange rate; FDI; ARDL.

1. INTRODUCTION

Foreign direct investment (FDI) is simply the flow of capital from one country to another, in order to gain a lasting interest in an enterprise in the foreign country. It is an investment in the form of a controlling ownership in a business enterprise in one country by an entity based in another country [1]. There is an uncompromising economic and financial struggle between developed and developing countries to attract foreign companies to invest in their markets [2]. FDI has played a major role in economic development and has challenged the traditional approach of host countries with regard to trade liberalization [3,2]. Cambazoglu and Günes [4] suggest that FDI brings new technology and increases tacit knowledge and productivity of workers.

The form of a controlling ownership in a business enterprise in one country by an entity based in another country [1]. There is an uncompromising economic and financial struggle between developed and developing countries to attract foreign companies to invest in their markets [2]. FDI has played a major role in economic development and has challenged the traditional approach of host countries with regard to trade liberalization [3,2]. Cambazoglu and Günes [4] suggest that FDI brings new technology and increases tacit knowledge and productivity of workers.

One of the important determinants of FDI is the behavior of both exchange rate level and its volatility; hence Depreciation of a host country's currency reduces its production cost, which is called a relative wage channel. However, when the home country's currency appreciates, there will be a corresponding increase in the real wealth of multinational firms [4]. As a result, the level of exchange rate is a very important variable for foreign firms. So, there is need for a study on the effects of the exchange rate level on FDI inflows in Nigeria.

Nigeria is one of the economies with great demand for goods and services and has attracted FDI over the years [1]. Fig. 1 indicate that foreign direct investment (FDI) from 1980-1985 (fixed exchange rate regime) stood at N3620.1 million, N3757.9 million, N5382.8 million, N5949.5 million, N6418.3 million and N6804.0 million in each of the respective years. Also between 1986 (flexible exchange rate regime) and 1988 there was a sharp upward swing as inflows increases from N9313.6 million in 1986 to N9993.6 million in 1987 and N11339.2 million in 1988 and in 1989 it declined by 96% to N10899.6 million and further by 95% in 1990 to N10436.1 million and continued fluctuating over the years despite various incentives and policies adopted in order to attract a sustainable inflows.

Fig. 1 showed the trend of FDI from 1980 to 2017 from CBN Statistical Bulletins of various years. It shows that FDI has been relatively decreased from 1980 to1988 and then moved up in 1989 after fluctuated till 2004 and has not been increased 2009 peak up and then was decrease between 2011-2017. Foreign direct investment is influenced by exchange rate but this influence is not pure that we can decide on because the influence may be high or low, other variables may also influence foreign direct investment [5]. A popular claim is that exchange rate none volatility is one of the most important factors in FDI decision, high influence of exchange rate disincentive for FDI inflows [6].

1.1 Statement of the Problem

Nigeria's overall economic performance has been rather unimpressive. Despite the availability of huge oil resources, its growth rate has been quite feeble. World Bank data (1999) shows that between 1964 and 1997, per capita GNP rose from US $120 to US$280, i.e. it barely doubled in 33 years. Between 1961 and 1997 the average annual growth rate of GDP was only 3.7% given that average population growth during the period was close to 3% per annum; average per capita income growth was less than 1% per year. GDP growth was negative for many years, especially in the first half of the 1980s when the collapse of crude oil prices triggered an acute economic crisis in Nigeria.

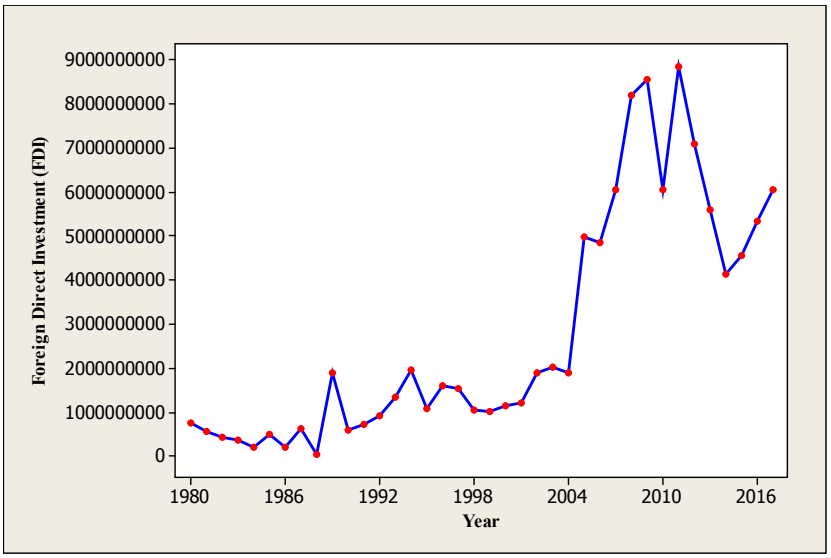

Fig. 1. Nigeria's FDI profile between 1980 to 2017

The poor economic performance in Nigeria contrast sharply with the fantastic economic performance of East Asian countries and China. In recent years GDP growth has averaged close to 10 % in China. For instance, foreign direct investment (FDI) from 1980-1985 (fixed exchange rate regime) stood at N3620.1 million, N3757.9 million, N5382.8 million, N5949.5 million, N6418.3 million and N6804.0 million in each of the respective years. We notice also that between 1986 flexible exchange rate regime) and 1988 there was a sharp upward swing as inflows increases from N9313.6 million in 1986 to N9993.6 million in 1987 and N11339.2 million in 1988 and in 1989 it declined by 96% to N10899.6 million and further by 95% in 1990 to N10436.1 million and continued fluctuating over the years despite various incentives and policies adopted in order to attract a sustainable inflows.

The Nigeria exchange rate system has witnessed so much fluctuation both in the official and bureau-de change market after the deregulation of the foreign market [7,8,9,10]. Udeh [11] also observed that the exchange rate policy in Nigeria has been moving in a circular form. The reasons for the observed behaviours are not easily discernible. Although, numerous studies have been carried out on foreign direct investment and its relationship with exchange rate volatility established; yet, there are scanty literature on foreign direct investment inflow in Nigeria. More so, the few studies that exist have focused on the official rate when considering volatility. Majorly, the focus of these studies remained on exploring factors influencing exchange rate fluctuation. Nevertheless, these studies are contextual and were conducted within specific socio-cultural environment. Hence, it is argued that the outcomes of these studies cannot be generalized. The present study tried to fill this gap by tackling effects of exchange rate on foreign direct investment inflow in Nigeria; first, the present study examined the possibility of long run relationship between exchange rate and foreign direct investment, and then evaluate the impact of exchange rate on FDI in Nigeria for the period 1980 to 2017.

1.2 Purpose and Significance of the Study

The broad objective of this study is to examine the relationship between exchange rate and FDI in Nigeria. The study considers the long run relationship exists between foreign direct investment and exchange rate in Nigeria. It further ascertains the short run impact of exchange rate on foreign direct investment inflow in Nigeria. This study is significant as the findings will add to existing theoretical and empirical literature and FDI inflow in Nigeria which will be very useful for multinational enterprises operating in Nigeria

1.3 Research Questions

This study intends to provide answers to the following questions

1. Is there a long run relationship between foreign direct investment and exchange rate in Nigeria?

2. What short run effect does exchange rate have on foreign direct investment inflow in Nigeria?

1.4 Research Questions

This study is to investigate the impact of exchange rate on foreign direct investment in Nigeria. It is on this premise that the following hypotheses were formulated:

1. H_0: There is no long run relationship between foreign direct investment and exchange rate in Nigeria.
   H_1: There is a long run relationship between foreign direct investment and exchange rate in Nigeria.
2. H_0: Exchange rate does not significantly impact on foreign direct investment in Nigeria.
   H_1: Exchange rate impacts significantly on foreign direct investment in Nigeria.

1.5 Theoretical and Empirical Framework

The internationalization theory of Dunning [12] also known as eclectic paradigm and the spillover hypothesis has been adpted in this study to explain the determinants of FDI. The eclectic paradigm of Dunning (1993) suggested that the main factors that drive FDI inflows have been the need to secure market access, the opportunities presented by large scale privatization process, and the degree of political and economic stability. The eclectic paradigm of Dunning is determined by the realization of ownership of specific advantage, location advantages and internationalization incentives According to Adaoru (2005) the locational determinants of FDI can therefore be summarized as market size and growth, raw materials, and labour supply, political and legal environment, host government economic policies, geographical proximity and host country infrastructure.

Muhammad, Azu and Oko [13] studied the influence of real exchange rate and volatility on FDI inflow in Nigeria and found that the effects of exchange rate and exchange rate volatility are more of a short-run phenomenon and increased FDI arising from devaluation. Eregha [14] found that exchange-rate movements in west African monetary zone countries are more of unanticipated than anticipated innovations in affecting FDI inflow. Payaslioglu and Polat [15] evaluated the impact of exchange rate uncertainty on FDI and delivered strong evidence that both real exchange rate level and its volatility, inflation, transportation and communication index and lagged value of monthly FDI inflows do not have significant effect on montly FDI inflows. Gandu & Yusha'u [16] analysised the impact of foreign direct investment on economic growth in Nigeria, the results indicate a long-run relationship between FDI, economic growth, exchange rate, interest rate and inflation rate. Cambazoglu, and Günes [4] studied the relationship between foreign exchange rate and foreign direct investment in Turkey, they found that from a long-term static analysis of estimated Autoregressive Distributed Lag Model there is a cointegration relationship between the exchange rate level and FDI inflows. Okenyis and Madueme [17] studied the impact of dollar exchange rate volatility on foreign direct investment in Nigeria and suggested the need to avoid over-valuation of the exchange rate and to maintain stable and flexible exchange rate in order to attract FDI inflow to Nigeria.

The literature on foreign direct investment inflow to Nigeria is vast. However, those on the impact of exchange rate variation on FDI are scarce. There is an obvious dearth in literature on the effects of exchange rate on foreign direct investment in Nigeria. Apart from Elijah (2006) and Ekpo [18] which included exchange rate as a determinant of FDI in Nigeria, recent studies have concentrated on other matters of interest and most especially on the impact of FDI on economic growth. This research work therefore departs from the views of other researchers and studies the effects of exchange rate on FDI inflow using a dynamic model as a departure from earlier studies that adopted static model. The choice of dynamic model is based on the fact that the relationships between economic variables are not instantaneous and the effects of one on another may not clear almost immediately, but lingers for some period of time. Earlier studies have ignored this fact; however, this current study intends to fill part of this empirical gap using the autoregressive distributed lag (ARDL) model. Hence, there is a need to provide new evidences on the relationship between exchange and FDI in Nigeria using new dataset; this is necessary given that changes might have occurred in the variables which were included in the previous analysis, thereby made their results not to be in consonance with the present situation of the economy.

2. METHODOLOGY

2.1 Empirical Model Specification

Drawing from the theoretical framework and in line with previous studies such as Ekpo [18]; Aduga (2001); Elijah (2006), we postulate a simple FDI function of the form:

$$FDI_t = \Phi + X\beta + \mu_t \quad (1)$$

Where FDI_t is the foreign direct investment at time t; X is the matrix of explanatory variables comprising of exchange rate (EXRT); interest rate (INT); inflation (INF); gross domestic product (GDP); trade openness (OPN) an dβ is the matrix of coefficients and μ_t is the error term at time t. Expanding Equation 1 and expressing the variables in semi-logarithmic form leads to a base line models of equation 2.

$$\mathrm{LFDI}_t = \beta_0 + \beta_1 \mathrm{EXRT}_t + \beta_2 \mathrm{INT}_t + \beta_3 \mathrm{INF}_t + \beta_4 \mathrm{LGDP}_t + \beta_5 \mathrm{OPN}_t + \mu_t \quad (2)$$

Where L is the natural logarithm; β_0 is intercept term; β_1 to β_5 are the slope coefficients. Equation 2 assumes that FDI at a time depends on current exchange rate, current interest rate, current inflation rate, current GDP and current level of trade openness. This assumption may not hold in ideal economy which appears more complex and dynamic. This paper, therefore argues that the impact of exchange rate (EXRT); interest rate (INT); inflation (INF); gross domestic product (GDP) and trade openness (OPN) on foreign direct investment (FDI) may persist beyond the current period. Taking cognizance of this fact, we render the model dynamic and obtain the estimable equation in semi-log linear form:

$$LFDI_t = \Theta_0 + \Theta_1 LEXRT_{t-1} + \Theta_2 INT_{t-1} + \Theta_3 INF_{t-1} + \Theta_4 LGDP_{t-1} + \Theta_5 OPN_{t-1} + \varepsilon t_3 \quad (3)$$

Where, $EXRT_{t-j}$, INT_{t-j}, INF_{t-j}, $LGDP_{t-j}$ and OPN_{t-j} (for j = 1, 2,.., k) are lagged series of $EXRT_t$, INT_t, INF_t, GDP_t and OPNt respectively.

2.2 Estimation Techniques and Procedures

An unrestricted Auto Regressive Distributed Lag (ARDL) estimation technique is adopted in this study. This technique is used for both cointegration test parameter estimation (short-run and long-run estimates). But first, the order of integration of the employed variables is estimated using the Augmented Dickey Fuller (ADF) and Philips – Perron (PP) unit root test approach. Second, if the variables are found to be integrated of the same order say I(d) or different order I(d) and I(k), we then proceed to apply the ARDL approach to cointegration. In the event that the variables of the models are co-integrated, an Error Correction Model (ECM) including the error correction term is estimated in order to investigate dynamic behavior of the model. The error correction model provides the short-run equilibrium among variables of the models and the speed with which the error terms adjust to return to equilibrium. However before testing for long run relationship among the variables, we estimate an unrestricted auto-regressive distributed lag (ARDL) where the variables are allowed to enter the model at various lag length. The Akaike info criterion (AIC) is used in selecting the model with appropriate lag. These procedures and techniques are discussed briefly below:

2.2.1 Co-Integration test

The Autoregressive Distributed Lag (ARDL) approach (which utilizes the bounds testing approach to cointegration) proposed by Pesaran and Shin (1999) and Pesaran et al. (2001) is used in this study. This technique has a number of features that many researchers feel give it some advantages over the approach suggested by Engel-Granger (1987) and the maximum likelihood based approach proposed by Johansen and Juselius (1990) and Johansen (1991). Firstly, it can be used with a mixture of I(0) and I(1) data, that is, it can be used whether the variables are mutually cointegrated or not. Secondly, it involves just a single-equation set-up, making it simple to implement and interpret. Thirdly, different variables can be assigned different lag-lengths as they enter the model. And, the model can be tested by using the OLS (ordinary least square) once the order of ARDL has been recognized (Pesaran & Shin 1999; Pesaran et al. 2001).

In addition, the technique addresses the problem of endogeneity. Pesaran and Shin (1999) posit that modeling with ARDL with the appropriate lags will correct for both serial correlation and endogeneity problem. However, endogeneity is not a serious problem if there is no serial correlation in the estimated ARDL model. All the variables in the ARDL model are assumed to be endogenous and the long and short run parameters are estimates simultaneously. The ARDL model in its broadest form based on Equation 3 is specified as follows:

$$\Delta LFDI_t = \theta_0 + \sum_{p=1}^{n} \theta_1 \Delta LFDI_t - 1 + \sum_{p=1}^{n} \theta_2 \Delta EXRT_t - 1 + \sum_{p=1}^{n} \theta_3 \Delta INT_{t-1} + \sum_{p=1}^{n} \theta_4 \Delta INF_{t-1} + \sum_{p=1}^{n} \theta_5 \Delta LGDP_{t-1} + \sum_{p=1}^{n} \theta_6 \Delta OPN_{t-1} + \Phi_1 LFDI_{t-1} + \Phi_2 EXRT_{t-1} + \Phi_3 INT_{t-1} + \Phi_4 INF_{t-1} + \Phi_5 LGDP_{t-1} + \Phi_6 OPN_{t-1} + \varepsilon_t \quad (5)$$

The short-run effect can be measured by the coefficient of first difference variables (θ_j for j = 1, 2,...6) while the long-run effect can be inferred by the estimates of Φj (for j = 1, 2,...6). Suppose the null hypothesis of no cointegration is rejected, a short run error correction model of equation 6 is proposed:

$$\Delta LFDI_t = \theta_0 + \sum_{p=1}^{n} \theta_1 \Delta LFDI_{t-1} + \sum_{p=1}^{n} \theta_2 \Delta EXRT_{t-1} + \sum_{p=1}^{n} \theta_3 \Delta INT_{t-1} + \sum_{p=1}^{n} \theta_4 \Delta INF_{t-1} + \sum_{p=1}^{n} \theta_5 \Delta LGDP_{t-1} + \sum_{p=1}^{n} \theta_6 \Delta OPN_{t-1} + VEC_t + \varepsilon_t \quad (6)$$

Where V is the coefficient of the error term which measures how the short run disequilibrium in the model adjusts within a period. Time series data are used for all exogenous and endogenous variables of the model ranging from 1980-2017. Data used is obtained from the CBN Statistical Bulletins of various years.

3. RESULTS AND DISCUSSION

Ensure uniformity of measurement, the values of the variables are computed based on the nature state of the variables. In the result above, we show the values for the mean, median, the total number of observation (N) of each series, the maximum, the minimum, the standard deviation, the skewness of each of the variables etc. The skewness results show that all the variables, except trade openness have positive signs indicating skewed to the right. The probability values of the Jarque-Bera test for most of the variables are low. This implies the rejection of normal distribution for these variables. In addition, the mean and standard deviation of these values indicate that while some variables have large variability, others some evidence of small variability. The descriptive statistics of the variables employed is presented in Table 1.

Sequel to the empirical investigation, we conducted unit root tests in order to determine the stationarity status of the variables in the models. This ensures that we mitigate the problem of spurious regression and thus ensure that meaningful and reliable estimates are obtained. The stationarity test is conducted using the Augmented-Dickey Fuller (ADF) and Philip-Perron (PP) unit root test techniques. Table 2 presents the results of this exercise.

Table 1. Descriptive statistics

	FDI	EXRT	INT	INF	GDP	OPN
Mean	2.780009	82.10831	16.96079	19.27895	513287.7	56.12038
Median	1.571009	57.37225	17.38000	12.95000	390787.6	62.12160
Maximum	8.842009	305.0000	29.80000	72.80000	1348936.	81.81280
Minimum	37867100	0.546400	7.500000	5.400000	31546.80	23.60890
Std. Dev.	2.684509	83.91331	5.028849	16.43923	305712.4	14.77871
Skewness	0.913614	0.890274	0.269489	1.723167	1.052930	-0.823736
Kurtosis	2.465682	3.289279	3.151043	5.135190	3.293369	2.942696
Jarque-Bera	5.738407	5.152215	0.496076	26.02408	7.157791	4.302624
Probability	0.056744	0.076070	0.780330	0.000002	0.027907	0.116331
Sum	1.060111	3120.116	644.5100	732.6000	19504934	2132.574
Sum Sq. Dev.	2.661020	260533.4	935.7049	9999.183	3.460012	8081.184
Observations	38	38	38	38	38	38

3.1 Unit Root Test Results

The unit root tests are done for each variable using the Augmented Dickey Fuller (ADF) and the Phillips-Peron (PP) approaches under the null hypothesis of presence of unit root, the results are shown on Table 2.

On Table 2, we show the time series properties of our variables for the period 1980 – 2017 in Nigeria. The test is conducted using both ADF and PP unit root approaches. The unit test is based on the assumption that the series has constant term only. Under the null hypothesis that a series has a unit root, we reject the null of if the probability value is less than 0.05 (5%) or 0.10 (10%), otherwise we accept the null. The result indicates that while FDI, GDP and trade openness are difference stationary, that is, they are I(1) processes, the other variables (exchange rate, interest rate and inflation rate) are level stationary, that is I(0) processes. Thus, we can safely conclude that there is no unit root among the variables of the models utilized for the research.

Given this conclusion, we proceed to investigate the possibility of long run relationship among the variables of the study. It is necessary to explore this, since it is one of the objectives of the study. Again cointegrated variables are policy variables (especially in the long run) and they have strong implications for policy formulation. This test is conducted in the section that follows.

3.2 Cointegration Test

Cointegration test enables us to determine whether the variables in the model share long run relationship. We follow the ARDL bound testing method, which can be applied for testing long-run relationships irrespective of whether the variables are stationary at the same or different orders i.e. I (0) or I (1) (Peseran, 1997). The result is presented on the Table 3.

Table 2. Results of unit root test

Variables	Level		First difference		I(d)
	ADF	PP	ADF	PP	
LFDI	-0.822355	-1.722955	-13.90721***	-13.90721***	
	(0.8006)	(0.4117)	(0.0000)	(0.0000)	I(1)
EXRT	-4.912138***	-4.327153***			
	(0.0003)	(0.0015)			I(0)
INT	-3.087540**	-3.032575**			
	(0.0362)	(0.0410)		-31.53887***	I(0)
INF	-3.008629**	-3.002954**		(0.0001)	
	(0.0433)	(0.0438)		-9.105761***	I(0)
LGDP	-0.265620	-1.315914	-4.966243***	(0.0000)	
	(0.9201)	(0.2016)	(0.0003)		I(1)
LOPN	-2.352228	-2.352228	-8.715941***		
	(0.1619)	(0.0.1619)	(0.0000)		I(1)
Critical value @ level			**Critical values @ difference**		
1%	-3.621023		-3.626784		
5%	-2.943427		-2.945842		
10%	-2.610263		-2.611531		

**** and ** denote statistical significance at 1% and 5% level respectively*

Table 3. ARDL bound test approach to cointegration analysis

Null Hypothesis: No long-run relationships exist		
Test Statistic	**Value**	**K**
F-statistic	5.149596***	5
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

**** indicates statistically significant at 1% significance level*

The F-test is used for testing the existence of a long-run relationship. The F-test has a non-standard distribution which depends on whether the variables included are I (0) or I (1), the number of regressors, and whether the model contains intercept and/or trend. The above co-integration test shows that there is long-run cointegration between FDI and its fundamentals (exchange rate, interest rate, inflation rate, GDP and trade openness) in Nigeria for the period 1980 – 2017. We therefore reject the null hypotheses of no long run relationship among the variables and accept the alternative.

3.3 Evaluation of Estimate/test of Research Hypotheses

Having established the existence of long run relationship among the variables using the ARDL bound test, we then present the short and long run estimates using the ARDL framework. The long run estimate is meant to capture the long run impact of exchange rate and other modeled fundamentals on FDI in Nigeria, while the error correction model (short run estimate) accounts for short run dynamics of the relationship between the endogenous and exogenous variables. The results are shown on Tables 4 and 5.

On Table 4, we present the long-run estimate of our model. The result shows that exchange rate has a negative and significant impact on foreign direct investment inflow in Nigeria in the long run. The result indicates that 1% fall in exchange rate (i.e. when exchange rate deprecates by 1%), foreign direct investment (FDI) will rise by 3.8%. conversely, 1% rise in exchange rate (i.e. if it appreciates by 1%), FDI will fall by about3.8%. This outcome is in tandem with our theoretical expectation. Exchange rate depreciation/ devaluation is an incentive for firms to produce more because depreciation or devaluation makes domestic goods attractive and profit maximizing firms would like to invest and produce more to need the increasing demand for domestically produced.

Interest rate and inflation rate have negative and positive impact on foreign direct investment in Nigeria in the long run respectively. Though these impacts appear insignificant, the results indicate that while 1% rise in interest rate will cause FDI to fall by 0.24%, a rise in inflation by the same magnitude (1%) will cause FDI to also rise by 0.01%. The signs of the coefficients turned out as expected.

The long-run result further reveals that gross domestic product and trade openness exert positive and statistically significant impact on foreign direct investment in the long-run. The coefficients of both variables tuned out as postulated by theory. The size of the estimates indicate that 1% rise in either GDP or trade openness will cause foreign direct investment (FDI) will rise by 7.3% or 0.41% respectively.

The F-value suggests that all the partial coefficients are not simultaneously equal to zero and hence statistically significant at 1% critical value. At 97 percent, the adjusted R^{-2} obtained is satisfactorily high, implying that the variables explain about 97 percent of the variation in FDI in Nigeria over the period. The Durbin-Watson test for serial correlation shows that the error terms are not serially correlated since it is approximately equal to two.

The short-run dynamic regression result is presented on Table 5. The result shows that the impact of exchange rate on FDI in the short run is mixed. In the current period and second period, exchange rate impacts FDI positively. However, in the first period and third period, the impact assumes negative. Though, the impact of exchange rate on FDI in the current period is not significant, the impact appears artistically significant in the first, second and third period. The result suggests that if the rate of exchange

Table 4. Summary of long run estimates

Variable	Coefficient	Std. Error	t-stat.	P-value
EXRT	-3.799**	1.276	-2.98	0.0243
INT	-0.240	0.256	-0.939	0.3789
INF	-0.011	0.033	-0.321	0.7577
LGDP	7.264**	2.682	2.709	0.0302
OPN	0.407***	0.098	4.142	0.0004
Cons	-62.865	34.918	-1.800	0.1148

Adj. R-squared = 0.97F-stat = 42. 41 (0.000), DW = 2.29

*Note: *** and ** denote significant at 1% and 5% significant level respectively*

Table 5. Summary of short run estimates

Variable	Coefficient	Std. Error	t-Statistics	Prob.
D(LFDI(-1))	-0.530**	0.156592	-3.385817	0.0117
D(LFDI(-2))	-0.117	0.086432	-1.358182	0.2166
D(EXRT)	0.725	1.609327	0.450698	0.6658
D(EXRT(-1))	-5.789**	2.035371	-2.844479	0.0249
D(EXRT(-2))	12.172***	2.133339	5.705616	0.0007
D(EXRT(-3))	-8.126***	1.608931	-5.050432	0.0015
D(INT)	-0.115*	0.053121	-2.172950	0.0663
D(INT(-1))	-0.078**	0.024568	-3.183614	0.0154
D(INT(-2))	0.034	0.034211	0.993789	0.3534
D(INT(-3))	-0.042	0.028251	-1.499540	0.1774
D(INF)	-0.003	0.009792	-0.306036	0.7685
D(INF)	0.033**	0.008705	3.766546	0.0070
D(LGDP)	0.681	1.373219	0.496275	0.6349
D(LGDP(-1))	-14.16*	6.242401	-2.268244	0.0576
D(LGDP(-2))	16.91*	7.320511	2.310247	0.0542
D(LGDP(-3))	-1.100**	0.372245	-2.955765	0.0212
D(OPN)	0.031**	0.009546	3.237208	0.0143
D(OPN(-1))	-0.035***	0.008137	-4.277612	0.0037
D(OPN(-2))	0.016	0.008561	1.811792	0.1129
D(OPN(-3))	-0.020**	0.008416	-2.395552	0.0478
CointEq(-1)	-1.325***	0.218004	-6.078214	0.0004

*Note: ***, ** and * denote significant at 1%, 5% and 10% significant level respectively*

appreciates by 1% (rise in value) in the current and second period, FDI will increase by 0.72% and 12.17% respectively. On the other hand, if exchange rate depreciates by 1% (fall in value) in the first and third period, it will lead to a rise in the foreign direct investment by about 5.79% and 8.13% respectively. An inference that one could draw from this result is that, short-run appreciation of the EXCHR will further attract more foreign investors into Nigeria in the current and second period. This result is contradictory with the long-run analysis and rather contrary to the sign expected as prescribed by theory.

The impact of other variables such as lagged FDI, interest rate, inflation, GDP and openness on current FDI is mixed and depends on time period. The results show that the coefficient of the error-correction term for the estimated foreign direct investment equation is both statistically significant and negative. Thus, it will rightly act to correct any deviations from long-run equilibrium. Specifically, if actual equilibrium value is too high, the error correction term will reduce it, while if it is too low, the error correction term will raise it. The coefficient of –1.32 denotes that about 13.2% of any deviation will be corrected in the current period. Thus, it will take more than two years for any disequilibrium to be corrected.

3.4 Econometric criteria: 2nd order test

The ARDL estimates are further evaluated in order to substantiate some of the assumptions of CNLRM on which our model is built. The model is evaluated using different econometric criteria namely, stationarity test, LM serial correlation test and Heteroskedasticity test.

3.4.1 Test for serial correlation

The Durbin-Watson test for serial correlation shows that the error terms are not serially correlated. The values of the R-Square and Durbin-Watson also indicates that the result is not spurious, since the value of Durbin-Watson is grater that the R-Square. More formally, we apply the Breusch-Godfrey Serial Correlation LM Test to validate the DW test. The result is shown in Table 6.

Table 6: Breusch-godfrey serial correlation LM test

F-statistic	0.689822	Prob. F(2,5)	0.5438
Obs*R-squared	7.352746	Prob. Chi-Square(2)	0.0253

The Breusch-Godfrey Serial Correlation LM Test indicates that there is no serial correlation in our estimated FDI model, since the probability of the F-statistic for the test is 0.5438 and it is greater than the 5 percent significance level. This implies the acceptance of the null hypothesis of no serial correlation in the estimated model. This result corroborates the Durbin-Watson serial correlation test.

3.4.2 Test for heteroscedasticity

The result of the heteroskedasticity test using the Glejser approach. The result suggests that there is no heteroskedasticity in the estimated model. This follows from the fact that the probability value of the F-statistic for the test is 0.9128, being greater than 0.05, leading to the conclusion that the residuals are homoscedastic.

3.5 Test of Research Hypotheses

The two research hypotheses stated in chapter one of the study are formally tested here using appropriate test statistic. Hypothesis one is tested using the F-statistic in the cointegration result reported on table of significant, while hypothesis two is tested using the t-test.

3.5.1 Hypothesis one

H_0: There is no long run relationship between foreign direct investment and exchange rate in Nigeria.

H_1: There is a long run relationship between foreign direct investment and exchange rate in Nigeria.

On Table 3, the f-statistics is greater than the 5% upper bound critical values suggesting that the null hypothesis of no long run relationship between foreign direct investment and exchange rate in Nigeria cannot accepted, hence we accept the alternative and then conclude that there is a long run relationship between foreign direct investment and exchange rate in Nigeria.

3.5.2 Hypothesis two

H_0: Exchange rate does not significantly impact on foreign direct investment in Nigeria.

H_1: Exchange rate impacts significantly on foreign direct investment in Nigeria.

3.5.2.1 Decision rule

Reject H_0, if the t-calculated > the t-critical, otherwise don't.

The critical t-value $[t_{\alpha/2}\ (n-k)]$ at 0.05 level of significant is obtained from the table.

Where n is the number of observation and K is the number of parameters.

This hypothesis is tested using the long- and short-run estimates in Tables 4 and 5 respectively.

Given the null hypothesis; H_0: B's = 0: the parameter estimates are not statistically significant at 5% level (H_0: Exchange rate does not significantly impact on foreign direct investment in Nigeria in the short- and long-run).

We reject the null hypothesis if the probability value is < 0.05 (or alternatively, if the calculated t-value is greater than the critical t-value).

Looking at Tables 4 and 5, the null hypothesis is rejected and alternative hypothesis accepted. Hence we conclude that exchange rate impacts significantly on foreign direct investment in Nigeriain the short- and long-run.

In pursuance of the study objectives, the following findings were made. First, subjecting the FDI function and its fundamentals to cointegration test reveals clear evidence of long run relationship among them. This result implies that over the period, FDI inflows have been moving closely with exchange rate, interest rate, inflation, GDP and trade openness. This finding is in line with those of Ekpo [18] and Elijah (2006).

On the impact of exchange rate on FDI in Nigeria, the result shows that exchange rate has a negative and significant impact on the foreign direct investment in Nigeria in the long run. The result indicates that 1% fall in exchange rate (i.e. when exchange rate deprecates by 1%), foreign direct investment (FDI) will rise by 3.8%. conversely, 1% rise in exchange rate (i.e. if it appreciates by 1%), FDI will fall by 3.8%. This outcome is in tandem with our theoretical expectation. Exchange rate depreciation/ devaluation is an incentive for firms to produce

Table 7. Heteroskedasticity test: Glejser

F-statistic	0.488986	Prob. F(26,7)	0.9128
Obs*R-squared	21.92714	Prob. Chi-Square(26)	0.6927
Scaled explained SS	6.052761	Prob. Chi-Square(26)	1.0000

more because depreciation or devaluation makes domestic goods attractive and profit maximizing firms would like to invest and produce more to need the increasing demand for domestically produced.

4. CONCLUSION

This study examined the effects of exchange rate on FDI inflow in Nigeria and the findings of the study showed that there is a long run relationship between exchange rate and FDI in Nigeria over the period 1980 to 2017. This result implies that exchange rate can be used as a policy instrument in controlling FDI inflows into Nigeria. On the impact of exchange rate on FDI inflow, the results indicate that exchange rate exert considerable impact on FDI in both the long run and short run. Hence, the conclusion that exchange rate is closely tied to FDI inflows in Nigeria. From the foregoing, it is clear that current study on the effects of exchange rate on FDI inflow is scanty for the Nigerian economy. This research work therefore contributes to knowledge by examining this topic bearing in mind the volatile nature of Nigeria's exchange rate and the need for exchange rate for the purpose of profit repatriation and purchased impact of input by the vehicles of foreign direct investment inflow-the multinational co-operation. Since this study is an aggregate study, the researchers suggest that further studies can look into the sectorial responses of FDI inflow to exchange rate in Nigeria.

5. RECOMMENDATIONS

The recommendations from the study are drawn from the findings and the conclusion. In respect to three major determinants of the foreign direct inflows are taken into consideration given their responses. It follows that sound macroeconomic policy should be put in place in order to achieve the followings: price control, because this policy will actually mitigate the negative effect of inflation in attracting foreign direct investment into Nigeria;

COMPETING INTERESTS

Author has declared that no competing interests exist.

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