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Impact of Exchange Rate on Foreign Direct Investment in Nigeria: A Novel Dynamic ARDL Simulation Analysis

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Abstract

This study assessed the impact of exchange rates on foreign direct investment in Nigeria for the period 1981–2023, using dynamic ARDL simulation analysis. The lack of evidence, particularly in the Nigerian context, justifies the study. The study found that the real exchange rate has a significant negative impact on foreign direct investment in both the short and long run. It shows that exchange rate devaluation or depreciation encourages FDI inflow in Nigeria, while revaluation or appreciation discourages it. The simulation graphs indicate that a 5% negative change in the real exchange rate will increase foreign direct investment to about 10.2% in the long run and vice versa. It indicates that a 5% devaluation or depreciation of the real exchange rate in Nigeria will boost foreign direct investment inflows by more than 10% in the long run and vice versa. The Granger causality results revealed a unidirectional causal relationship between the real exchange rate and foreign direct investment, with the latter leading to the former. Based on the findings, the study advocates for caution in devaluing or depreciating the naira to attract more foreign direct investment inflows in Nigeria. The simulation results should serve as a guide for policymakers to avoid the damaging consequences of over-devaluation or depreciation of the naira.

Keywords: Exchange Rate, Foreign Direct Investment, Devaluation, Revaluation.

1. INTRODUCTION

Foreign direct investment (FDI) is defined as a process where residents of one country (the source country) acquire ownership of assets in another country (the host country) to control the production, distribution, and other activities of a firm in that country (Oludayo 2020). World Bank (2022) described foreign direct investment as an investment made to acquire a lasting management interest (normally 10% or more of the stock) in a business enterprise operating in a country other than that of the investor. The lasting interest implies the existence of a long-term relationship between the foreign investor and the enterprise with a significant degree of influence on the management of the enterprise. Investors are granted management and voting rights if the level of ownership is greater than or equal to 10% of ordinary shares. Share ownership amounting to less than the stated amount is termed portfolio investment and not FDI.

Foreign direct investment creates new jobs and more opportunities as foreign investors build new companies in host economies. Consequently, it will increase the income and the purchasing power of the locals and boost the economic development of the host economy (Stefan 2021). Over the years, all over the world, down to the Sub-Saharan Africans (SSA), including Nigeria, have been major beneficiaries of technological spillovers, job creation, improved managerial skills, and other benefits from FDI (Zerrin 2018). Foreign direct investment is a key element in international economic integration because it creates stable and lasting links between economies. It is an important channel for the transfer of technology between countries, promotes international trade through access to foreign markets, and is an important vehicle for economic development. However, despite the benefits, foreign direct investment is hampered by the political and legal environment of the host country, inflationary pressure, domestic savings, infrastructure, and mostly exchange rate fluctuation (Okoro & Charles, 2019). Inadequate infrastructures, including unreliable power supply, poor road networks, and insufficient logistics, significantly affect business operations. The Nigerian economy has been subject to volatility due to fluctuations in global oil prices, exchange rate instability, and inflation (Zerrin 2021). Investment in infrastructure development and economic stability is critical to creating a more conducive environment for foreign direct investment (Ijeyi & Clement 2017).

Foreign direct investment has grown at a phenomenal rate since the early 1980s, and its world market has become more competitive, making developing nations more attractive investment destinations (Murtala 2017). The inflows of foreign direct investment around the world rose to $916 billion, with more than half received in developing countries (World Investment Report, 2022). In Nigeria, foreign direct investment (FDI) is one of the crucial factors that supports economic growth and development (Musah, Gakpetor, Kyei, and Akomeah, 2018). Nigeria's foreign direct investment net inflows were $205 million in 1970, accounting for 1.63% of GDP; by 1980, they had dropped to $-738.87 million (-1.15% of GDP). It rose to $587.88 million in 1990, $1.14 billion in 2000, and $6.03 billion in 2010, accounting for 1.09%, 1.65%, and 1.64% of GDP, respectively. Due to the COVID-19 pandemic, it fell to $2.39 billion in 2020 and $-186.79 in 2022, representing 0.75% and -0.04% of GDP for the periods. 2023 witnessed an increase to $1.87 billion, accounting for 0.51% of Nigerian GDP (World Bank 2025).

Exchange rate is one of several factors that influence foreign direct investment (FDI) flow to a particular country. According to Abiodunl (2016), exchange rate refers to the rate at which one currency is converted to another currency, which affects trade and movement of money among countries. It measures the macroeconomic performance of an economy in terms of the international level. Exchange rate fluctuation therefore results in uncertainty in international transactions, both in goods and financial assets (Toseef, Muhammed & Aneela 2017). It is an important price factor that influences foreign direct investment and the international flow of goods, services, and capital among nations, which puts pressure on inflation, balance of payments, and the economy at large (Uzoma, Damian, and Orekoya 2019). Exchange rate stability is one of the indicators that investors take into account when making investment decisions abroad, as it affects the prices and quantities of the inputs and outputs and leads to competitiveness in the global market (Kumarasamy, 2010).

The exchange rate in Nigeria has become a topical issue because of the numerous impacts it has on various economic indices, including economic growth, foreign investments, security valuation, import profitability, export profitability, investment analysis, international trade, and risk management (Rasaq 2020). The Nigerian exchange rate has been volatile, fluctuating widely over time in practically all segments of the forex markets, including official, bureau de change, and parallel markets (Yakub, Sani, Obiezue, and Aliyu, 2019). In the formal market, the exchange rate fell from N11.08 per US dollar in 1987 to N22.00 in 1994, when the federal government fixed it at N21.89 per US dollar between 1994 and 1998. It further fell to N97.95 per US dollar in 1999, N125.00 per US dollar between 2000 and 2006, and N117.97 per US dollar in 2007. Meanwhile, the naira fell to N149.58 and N150 per US dollar in 2009 and 2010 due to the global financial crisis and a decline in the worldwide oil price (Akinwolere 2021). It further depreciated to N157.50 in 2012, N158.55 in 2014, N253.49 in 2016, N306.08 in 2018, N358.81 in 2020, N425.98 in 2022, and N645.19 in 2023 (CBN 2023).

The general price level of goods and services has been unstable owing to the fluctuation of the exchange rate in Nigeria. Exchange rate fluctuations have created uncertainty and risk premium among individual investors, businesses, and governments, which have a destabilizing implication on macroeconomic performance (Chiadikobi, Oladipo, & Umozurike, 2022). When the exchange rate appreciates, it causes high costs of production, which leads to a fall in foreign direct investment, an increased poverty rate, inequality, underdevelopment, and a deficit balance of payments. On the other hand, depreciation in exchange rate provides competitive advantage in international trade, a fall in domestic prices, an increase in demand for exports, an inflow of foreign direct investment, and a positive balance of positions (Uzoma, Damian, and Orekoya 2019). As an import-based economy, the standard of living of many Nigerians has continued to decrease due to the high exchange rate that results in high inflation (Adora 2017). The adverse effect of inflationary pressure from exchange rate instability has been a serious concern for economists, monetary policy authorities, and policy analysts owing to the fact that exchange rates and inflation rates are the major instruments for measuring macroeconomic performance (Onuoha 2018).

Various administrations in Nigeria have implemented numerous public policies to attract more foreign direct investment. Such policies include the abrogation of the indigenization policy in 1978; the introduction of the Structural Adjustment Program (SAP) in 1986 to liberalize the economy; and the promulgation of the Nigerian Investment Promotion Commission and the Foreign Monitoring and Miscellaneous Provision in 1995 (Ajibolaa, Isiakab, Ogunleyec, and Adeyemid, 2018). Despite the aforementioned attempts to stimulate foreign direct investment in Nigeria, it continues to contribute minimally to the country's GDP. Existing studies revealed split conclusions regarding the influence of exchange rates on FDI in Nigeria. What then would be the impact of exchange rate on foreign direct investment inflow in Nigeria? It is also pertinent to note that none of the Nigeria-specific studies utilized dynamic ARDL simulation in their analysis. The dynamic ARDL simulation technique has many advantages over the traditional linear ARDL and other methods used in the previous studies. To fill the identified study gaps, this study assessed the impact of exchange rate instability on the foreign direct investment inflow in Nigeria using the novel dynamic ARDL simulation model.

2. REVIEW OF RELATED LITERATURE

2.1 Conceptual Framework

2.1.1 Foreign direct investment

Foreign direct investment refers to the ownership or control of entire or some fractional part of firms by foreigners in a domestic economy through the acquisition or creation of new assets, purchase of existing assets, or joint ownership with the government or citizens of the host countries (Oludayo 2020). World Bank (2022) defined foreign direct investment as the net inflows of investment to acquire a lasting management (10% or more of voting stock) in an enterprise operating in an economy other than that of the investor.

It is an important channel for the transfer of technology between countries, promotes international trade through access to foreign markets, and is an important vehicle for economic development. It is a strategy used by the majority of developing nations to increase their foreign exchange reserves through investments, economic ventures, and subsidies from developed nations.

2.1.2 Exchange rate

Abiodun et al. (2016) defined exchange rate as the rate at which one currency is converted to another currency, which affects trade and movement of money among countries. Chen (2024) defined exchange rate as the value of a nation’s currency when it is traded for another. The real exchange rate is the relative price of one country’s goods with another country. The exchange rate is one of the economic factors that influence the macroeconomic performance of an economy and measure the performance of the productive sector in terms of the international level. The exchange rate is determined by the interaction of the forces of demand and supply. However, changes

in exchange rates affect the manufacturing sector's productivity and change a country's balance of payments and income distribution. The Nigerian manufacturing sector is highly dependent on the import of inputs and capital goods, which are purchased in foreign exchange; therefore, fluctuations cause instability in the purchasing power, which affects investment in the import of manufacturing inputs. The exchange rate is one of the most important policy instruments that determine trade flows, capital flows, foreign direct investment, inflation, international reserves, and steady economic growth and development (Ogadi, Amakor & Anyanwu 2023). Its roles in an economy cannot be overemphasized, as it directly and indirectly affects domestic price level, profitability of traded goods and services, allocation of resources, and investment decisions.

Fixed Exchange Rate System: A fixed exchange rate, also known as a pegged exchange rate, refers to the exchange rate that is set firmly by the monetary authority with respect to a foreign currency. It is the type of exchange rate that is determined and fixed by central banks and monetary authorities. To maintain the stability in the currency rate, there is purchasing of foreign exchange by the central bank or government when the rate of foreign currency increases and the selling of foreign currency when the rates fall. An advantage of a fixed exchange rate system is that it ensures stability in foreign exchange that encourages foreign trade; there is stability in the value of currency, which protects it from market fluctuations. Moreover, it promotes foreign investment for the country and helps in maintaining stable inflation rates in an economy.

Flexible Exchange System: Flexible, also known as a floating exchange rate, refers to the exchange rate system that is dependent on the market forces of supply and demand. It is the monetary system that allows exchange rates to be determined by the forces of demand and supply. There is no intervention of the central banks or government in the floating exchange system. When the exchange rate is free to float, then it can change in response to external shocks like oil prices and correction of balance of payment deficit.

2.2 Theoretical Literature

2.2.1 Mundell-Fleming Model

The Mundell–Fleming model (MFM) is a macroeconomic theory that was developed by Canadian economist Robert Mundell (1963) and British economist Marcus J. Fleming (1962). The Mundell-Fleming model describes the workings of a small open economy in international trade in goods and financial assets and provides a framework to analyze the effect of exchange rate fluctuation on economic activities in a small open economy. The Mundell-Fleming model postulates that the effect of the exchange rate depends on the particular exchange rate regime (fixed or floating) that the country operates under. In a system of flexible exchange rates, central banks allow the exchange rate to be determined by market forces. An increase in money supply will then shift the liquidity of money (LM) curve to the right. The local interest rate will fall relative to the global interest rate. This leads to increased capital outflow, which will lead to an increase in the real exchange rate, ultimately leading to an increase in exports, a decrease in imports, and an overall increase in income.

Under the fixed exchange rate system, the central bank operates in the foreign exchange market to maintain a specific exchange rate. In a situation of fixed exchange rates, fiscal growth will raise the exchange rate initially, keeping income unchanged, but arbitrageurs seeking to benefit from the increasing exchange rate by selling foreign currency to the central bank at a specified price level will increase the money supply. The increase in the money supply will reverse the trend by raising aggregate income and restore the exchange rate to the fixed rate. Consequently, it returns the money supply to its original position. Increased aggregate income leads to capital outflow if the money supply expansion had a downward pressure on the interest rate. It shows that increasing money supply in a fixed exchange regime keeps capital flow constant. In the current situation, devaluation results in capital inflow, and revaluation brings about capital outflow (Mankiw, 2000).

2.2.2 Real Options Theory

Real options theory is an investment decision associated with Stewart C. Myer (1977) and Lenos and Blonigen (1997). It is a modern theory on how to make decisions regarding investments when there is uncertainty in exchange rate variations. Real options theory establishes a connection between the valuation of available financial options and the real economy. Real options theory posits that enterprises have choices about when to invest; in other words, investment decisions are options rather than obligations. A business may have the choice to invest abroad, with exchange rate instability possibly impacting the projected return on the option. The exchange rate uncertainty can increase or decrease the value of holding onto the option. Hence, the strength of this theory is that it highlights the effect that exchange rate movements may have on the timing of foreign direct investment, because a firm's decisions are to invest, wait, or not invest.

2.2.3 Risk Aversion Theory

Karni Cushman propounded this theory in 1985. It explains the tendency of individuals to prefer investments and outcomes with low uncertainty to those investments with high uncertainty. Under this approach, exchange rate risk arises due to timing differences between investment and profits. Firms invest overseas when the projected profits are equivalent to the cost and compensation for the level of risk posed by exchange rate fluctuations. The idea of this theory is that investors require compensation for the additional risks that exchange rate fluctuations bring into the investment returns. The strength of this theory is that it highlights the effect that exchange rate movements have on foreign direct investment because a firm's decisions are to invest or not to invest.

2.2 Empirical Literature

Udoinyang and Udoinyang (2024) investigated the influence of exchange rate fluctuation on FDI in Nigeria from 1986 to 2021. Using ARDL and the GARCH (1, 1), they found a substantial negative relationship between real exchange rate volatility and foreign direct investment.

Adewale, Olopade, and Ogbaro (2024) investigated the relationship between exchange rate and foreign direct investment in Nigeria for using Fully Modified Ordinary Least Squares (FMOLS). The study found a substantial positive association between the exchange rate and foreign direct investment (FDI).

Okrinya and Atamenwan (2023) found a positive significant relationship between exchange rate and FDI in Nigeria for the period 1981-2021, using the conventional ARDL model. Adegoriola and Emmanuel (2022) studied the nexus between exchange rate fluctuation and foreign direct investment in Nigeria from 1986 to 2020. The estimation was carried out using the standard ARDL approach. They discovered a negative and substantial link between the exchange rate and foreign direct investment.

Oladeji and Musa (2022) examined the relationship between foreign direct investment and the foreign exchange rate in Nigeria from 1996 to 2018. The study employed regression analysis, Granger causality test, correlation matrix, and descriptive statistics to estimate the model. The results indicate that there is no causal relationship between foreign direct investment and exchange rate, and there is a sizable long-term link between the exchange rate and foreign direct investment. The study therefore recommended that suitable policies be developed to stabilize the currency rate to promote the inflows of foreign capital while maintaining prudent regulations.

Samuel and Ferdinand (2020) studied exchange rate and foreign direct investment in Ghana from 1986 to 2017, using a generalized autoregressive conditional heteroscedasticity model. The results show that exchange rate volatility has a negative and significant impact on foreign direct investment, and there exists a long-run relationship between the variables. Zerim (2020) studied the impact of exchange rate volatility on foreign direct investment inflows in South Asia. The study employed panel data from South Asian countries over the period 1980-2017. The study used the Driscoll and Kraay (1998) fixed-effect model for the analysis. The results showed that exchange rate volatility has a significant negative impact on FDI inflows in South Asian countries.

Adokwe, Agu & Maduka (2019) studied exchange rate volatility and foreign direct investment in Nigeria, using monthly time series data that spanned from 1986 to 2016. The study employed the generalized autoregressive conditional heteroscedasticity (GARCH) and the two-stage least squares method for estimation. The findings showed that exchange rate volatility has a negative but significant effect on Nigeria's foreign direct investment. The study recommends the harmonization of Nigeria's foreign exchange system and the administration of single-interest-digit loans to increase the ease of doing business in the economy. Osinubu & Lloyd (2019) studied the effect of exchange rate on foreign direct investment (FDI) in Nigeria, using secondary data from from1970 to 2014. The study utilized the error correction model as well as the ordinary least squares (OLS) method of estimation. The results reveal a significant positive relationship between real inward foreign direct investment and exchange rate.

Tom and Thomas (2019) studied the impact of exchange rate volatility on foreign direct investment in India using monthly data that covered April 1995 to March 2018. The autoregressive distributed lag (ARDL) model was applied to estimate the model. Empirical findings revealed that in both the short and long run, exchange rate volatility has a significant negative impact on FDI flow in India. Uzoma, Damian & Orekoya (2019) studied the impact of exchange rate volatility on foreign direct investment in Nigeria from 1979 to 2017. The study employed an error correction model and Granger causality test for the analysis. The cointegration tests established the existence of long-run relationships among the variables. The Granger causality test reveals that foreign direct investment does not Granger-cause any of the explanatory variables, while unidirectional causality, running from real effective exchange rate volatility to population, gross domestic product to real effective exchange rate, and from interest rate to foreign direct investment, population, and gross domestic product, exists among the variables.

3. METHODOLOY

3.1 Analytical Framework

The theoretical framework adopted in this study is the Mundell-Fleming model. The model postulates that an appreciation of the exchange rate will decrease the net export and subsequently the national income, i.e., a higher exchange rate brings about a lower level of income in the goods market. In the money market, the world interest rate and the money market equilibrium condition determine the income, regardless of the exchange rate. The interception of the goods market equilibrium condition Y = C(Y-T) + I(r*) + G + NX(e) and the money market equilibrium condition M/P = L(r*, Y), holding interest rate constant at the world rate, determines the equilibrium exchange rate and income in a small open economy. The study period from 1981 to 2023 was dominated by a fixed exchange rate regime in Nigeria. Following the Mundell-Fleming model, increased money supply in a fixed exchange rate regime keeps the capital flow unchanged. Devaluation and revaluation are effective in the current situation. Devaluation increases net exports and aggregate income, while revaluation reduces net exports and aggregate income. Devaluation results in capital inflow, and revaluation brings about capital outflow. Trade restriction under a fixed exchange rate regime increases net exports and induces monetary expansion, which, in turn, raises the aggregate income. Trade restriction in a fixed exchange rate regime brings about capital outflow, while trade liberalization encourages capital inflow.

3.2 Model Specification

The dynamic ARDL simulation developed by Jordan and Phillips (2018) was used for the estimation. Following the explanation of the influence of exchange rate on capital inflow in Mundel-Fleming model, the study model is specified in log form as follows:

$$\ln FDI_t = \beta_0 + \beta_1 \ln REXR_t + \beta_2 \ln INTR_t + \beta_3 \ln TOPN_t + \beta_4 \ln CPS_t + \varepsilon_t \ldots (1)$$

Where,

FDI = Foreign direct investment, net inflows (% of GDP)
REXR = Real effective exchange rate index (2010 = 100)
INTR = Lending interest rate
TOPN = Trade openness (Import + Export/GDP)

CPS = Credit to private sector (% of GDP)
t = Time
β_0 = Constant
β_1-β_4 = Coefficients
ε = Error term

ln = Natural log

The expected signs of the coefficients are; $\beta_1 < 0,\ \beta_2 > 0,\ \beta_3 > 0,\ \beta_4 > 0,$
The ARDL (p, q) model of equation (2) is written thus:

$$\ln FDI_t = \beta_0 + \beta_1 FDI_{t-1} + ... + \beta_p \ln FDI_{t-p} + \alpha_0 \ln REXR_t + \alpha_1 \ln REXR_{t-1} + ... + \alpha_q \ln REXR_{t-q} + \delta_0 \ln INTR_t + \delta_1 \ln INTR_{t-1} + ... + \delta_q \ln INTR_{t-q} + \lambda_0 TOPN_t + \lambda_1 TOPN_{t-1} + ... + \lambda_q TOPN_{t-q} + \varphi_0 \ln CPS_t + \varphi_1 \ln CPS_{t-1} + ... + \varphi_q \ln CPS_{t-q} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Several lag order selection criteria are considered in selecting the lag orders p and q. The unrestricted bounds test model of the dynamic ARDL for equation (2) becomes:

$$\Delta \ln FDI_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta \ln FDI_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta \ln REXR_{t-j} + \sum_{k=0}^{q} \delta_k \Delta \ln INTR_{t-k} + \sum_{l=0}^{q} \lambda_l \Delta TOPN_{t-l} + \sum_{m=0}^{q} \varphi_m \Delta \ln CPS_{t-m} + \Omega_0 \ln FDI_{t-1} + \Omega_1 \ln REXR_{t-1} + \Omega_2 \ln INTR_{t-1} + \Omega_3 TOPN_{t-1} + \Omega_4 \ln CPS_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Where Δ = first difference.

The asymptotic non-standard F-test statistic and the upper and lower bound critical values are generated from equation (3). They are utilized in verifying the presence of cointegration in the model. When the F-test result is greater than the upper critical bound, cointegration is present; when it is less than the lower critical bound, cointegration is absent. The test is not conclusive when the F-test statistic falls within the upper and lower critical bounds. The error correction form of the model that shows the short-run dynamics is written as follows:

$$\Delta \ln FDI_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta \ln FDI_{t-1} + \sum_{j=0}^{q} \alpha_j \Delta \ln REXR_{t-j} + \sum_{k=0}^{q} \delta_k \Delta \ln INTR_{t-k} + \sum_{l=0}^{q} \lambda_l \Delta TOPN_{t-l} + \sum_{m=0}^{q} \varphi_m \Delta \ln CPS_{t-m} + \Phi_1 ECM_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

ECM is the residual obtained from equation (1). The coefficient Φ_1 captures the adjustment speed of the dependent variable in a year. It is expected to be negative and statistically significant.

3.3 Data Sources

The data for this study are annual time series data that covered 1981-2023. Foreign direct investment net inflows (% of GDP), real effective exchange rate, and lending interest rate were sourced from World Development Indicators 2025. Trade openness (import + export /GDP), and credits to the private sector as a percent of GDP were sourced from the CBN Statistical Bulletin 2023.

3.4 Estimation Procedure

3.4.1 Pre-estimation tests

In order to avoid having spurious or nonsense regressions, the variables were tested for unit root using the Augmented Dicky-Fuller (ADF) and Phillips-Perron unit root tests. Given that none of the variables is integrated at an order higher than one, the bounds test approach was used for the cointegration test. Lag selection order criteria were tested to determine the optimal lag for the analysis.

3.4.2 Post-estimation tests

The Jarque-Bera (JB) normality test was used to check if error terms are normally distributed. The Breusch-Godfrey Serial Correlation LM Test was used to test the presence of autocorrelation in the error terms. The Breusch-Pagan-Godfrey heteroscedasticity test was used to determine if the error terms are constant. To check the stability of the coefficients of the models, the cumulative sum (CUSUM) and CUSUM squares were adopted, and the Ramsey RESET test was used to check if the model is well specified.

3.4.3 Granger causality test

Regression analysis deals with the dependence of one variable on other variables; it does not necessarily imply causation, i.e., the direction of influence. The idea behind the Granger causality test is that, if event *A* happens before event *B*, then it is possible that *A* is causing *B*. However, it is not possible that *B* is causing *A*. The test in our work involves estimating the following pair of regressions:

$$\Delta \ln FDI_t = \sum_{i=1}^{n} \alpha_i \Delta \ln REXR_{t-i} + \sum_{j=1}^{n} \beta_j \Delta \ln FDI_{t-j} + u_{1t} \quad \text{..... (5)}$$

$$\Delta \ln REXR_t = \sum_{i=1}^{n} \lambda_i \alpha_i \Delta \ln REXR_{t-i} + \sum_{j=1}^{n} \delta_j \beta_j \Delta \ln FDI_{t-j} + u_{2t} \quad \text{..... (6)}$$

Where u_{1t} and u_{2t} are mutually uncorrelated error terms and 'i' and 'j' are the number of lags. The lnFDI and lnREXR were stationary after first differences. If the computed F-value exceeds the critical F-value at the chosen level of significance, we reject the null hypothesis that ΔlnFDI does not Granger-cause ΔlnREXR in equation (5) and conclude that ΔlnFDI Granger-cause ΔlnREXR. If otherwise, we accept the null hypothesis. The same decision process holds in equation (6).

4. Empirical Results and Discussion

4.1 Descriptive statistics

Table 4.1 shows that the sample size is large since the study covered 43 years. The standard deviations of all the variables are lower than their mean. It shows a cluster around the mean and low volatility of the variables.

Table 4.1: Descriptive statistics of the variables

Variable	Obs	Mean	Maximum	Minimum	Std. Dev	J-B Stat.
FDI	43	1.2212	4.2821	-0.0391	0.9458	7.4625**
REXR	43	146.3152	536.9218	49.7772	113.1176	49.1412***
INTR	43	17.2473	31.6500	8.9167	4.7858	1.8497
TOPN	43	31.6942	52.7941	9.1359	12.1000	1.6533
CPS	43	11.9121	22.7500	5.8100	5.7700	5.9838*

Source: Author's computation

Note: *, **, and *** show significance at 10%, 5% and 1% levels,

The Jarque-Bera normality tests on the variables reveal that CPS is not normally distributed at the 10% level. FDI is not normally distributed at the 5% level, whereas REXR is not normally distributed at the 1% level. INTR and TOPN are normally distributed. The mean, standard deviation, maximum, and minimum values of the variables showed sufficient differences, indicating their randomness and goodness for inference.

4.2 Lag selection-order criteria

Table 4.2: Lag order selection criteria

Lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	-81.5714				0.000066	4.5564	4.6331	4.7719
1	9.0404	181.22	25	0.000	2.1e-06*	1.1031	1.5631*	2.3960*

2	35.0427	52.005*	25	0.001	2.1e-06	1.0504*	1.8937	3.4206
3	50.8468	31.608	25	0.170	4.2e-06	1.53438	2.76099	4.9819

Source: Author's computation

Note: *lag order selected by the criterion; LR= Log-likelihood; FPE= Final prediction error; AIC = Akaike information criterion; HQIC = Hannan-Quinn information criterion; SBIC = Schwarz Bayesian information criterion

The lag order selection criteria in Table 4.2 show FPE, HQIC, and SBIC selected lag one as the optimum, whereas LR and AIC chose lag two. The study will combine lags one and two in its analysis.

4.3 Unit root test result

The Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests were conducted on the variables to determine their stationary nature. Variables found to be non-stationary were differenced to get rid of the stochastic trend, a phenomenon associated with time series data. The test was conducted with constant & trend.

Table 4.3 presents a summary of the unit root test results.

Table 4.3: ADF and Phillips-Perron unit root test results

Variable	ADF		Phillips-Perron		Order of integration
	Level	First Diff	Level	First Diff	
	Z-Statistic	Z-Statistic	Z-Statistic	Z-Statistic	
LnFDI	-2.356	-4.799***	-3.006	-8.671***	I(1)
LnREXR	-2.940	-4.216***	-2.355	-4.945***	I(1)
LnINTR	-2.226	-5.065***	-2.167	-6.273***	I(1)
LnTOPN	-1.948	-5.047***	-2.158	-7.698***	I(1)
LnCPS	-2.918	-5.529***	-2.525	-5.549***	I(1)

Source: Author's computation

Note: *** shows significance at 1% level

The results of the unit root tests in Table 4.3 show that the variables are integrated of order one, i.e., they are stationary at the first difference. Since none of the variables is integrated of order two, the Pesaran et al. (2001) ARDL bound test is used for the cointegration test.

4.4 Cointegration test

Table 4.4 shows that at a 5% level of significance, the absolute F-statistic and the t-statistic are greater than the upper bound critical values, indicating that the dependent and independent variables have long-run relationships.

Table 4.4: Bounds test result

Null Hypothesis: No long-run relationships exist

	F-test		t-test	
	F-statistic = 6.180		t-statistic = -5.037	
	Critical value		Critical value	
Sig. level	Lower I(0)	Upper I(1)	Lower I(0)	Upper I(1)
10%	2.660	3.838	-2.570	-3.660
5%	3.202	4.544	-2.860	-3.990
1%	4.428	6.250	-3.430	-4.600

Source: Author's computation.

4.5 Estimated dynamic ARDL model

Following the results of the lag order selection criteria in Table 4.2, the estimated dynamic ARDL model is stated as follows:

$$\Delta \ln FDI_t = \beta_0 + \beta_1 \ln FDI_{t-1} + \beta_2 \Delta \ln REXR_t + \beta_3 \ln REXR_{t-1} + \beta_4 \ln REXR_{t-2} + \beta_5 \Delta \ln INTR_t + \beta_6 \ln INTR_{t-1} + \beta_7 \Delta \ln TOPN_t + \beta_8 \ln TOPN_{t-1} + \beta_9 \Delta \ln CPS_t + \beta_{10} \ln CPS_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots (7)$$

4.6 Serial Autocorrelation, Normality, Heteroskedasticity, and Specification Tests

The statistically insignificant results of the diagnostic tests in Table 4.6 show that the model has normal distribution, constant error term variance (homoskedastic), and nice specification and does not have a serial autocorrelation problem.

Table 4.6: Breusch-Godfrey Serial Correlation LM test, Jarque-Bera Normality test, Breusch-Pagan-Godfrey Heteroskedasticity test, and Ramsey RESET Specification test

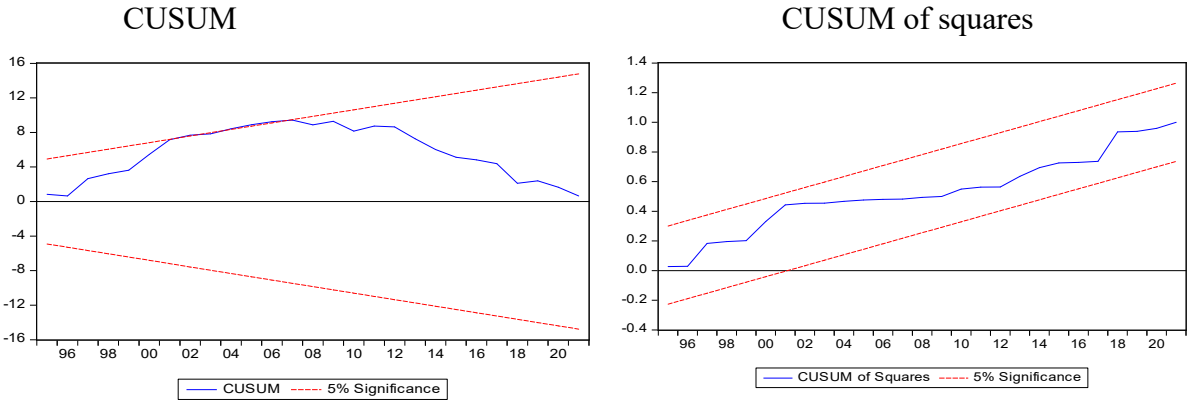
Test	Statistic	Value	Prob.
Breusch-Gogfrey Serial LM	F-statistic	1.7231	0.1990
Jarque-Bera Normality	Jarque-Bera	0.2204	0.8957
Breusch-Pagan-Godfrey Heteroskedasticity	F-statistic	0.9140	0.5409
Ramsey RESET Specification	F-statistic	0.1471	0.7044

Source: Author's computation

4.7 Stability test

Since the CUSUM and CUSUM Squares test statistic plots in Figure 1 are inside the 5% level of significance border lines, it indicates that the model is stable.

Figure 1: Cumulative Sum (CUSUM) and CUSUM of Squares Tests



Source: Author's plot

4.8 Short and long run results

The results in Table 4.8 show that real exchange rate and trade openness conform to a priori expectations in both the short run and long run. The real exchange rate exhibited a significant negative impact on foreign direct investment in both the short and long run. The finding is consistent with the works of Adegoriola and Emmanuel (2022), Udoinyang and Udoinyang (2024), Zerim (2020), Samuel and Ferdinand (2020), Maduka (2019), and Tom and Thomas (2019). The finding is also consistent with the assertion of the Mundell-Fleming

model that exchange rate depreciation or devaluation results in capital inflow and appreciation or revaluation brings about capital outflow. It shows that exchange rate depreciation or devaluation encourages FDI inflow in Nigeria, while appreciation or revaluation discourages it. It indicates that depreciation or devaluation of the naira makes the cost of assets and labour cheaper for foreign investors, making it attractive for FDI. A percentage increase in the real exchange rate will reduce foreign direct investment inflow by 1.42% and 0.81% in the short and long run, respectively.

In the short run, interest rates have an insignificant influence on foreign direct investment inflows, but they exhibit a positive negative impact in the long run. A percentage increase in interest rate will reduce foreign direct investment inflow in Nigeria by 3.1% in the long run. It indicates that Nigeria's interest rates are lower than those of other nations, discouraging foreign investment as investors seek higher returns in those countries.

Table 4.8: Short-run and long-run results
Dependent variable: dlnFDI

Variable	Coefficient	Std. Error	t-stat.	p-value
ECM_{t-1} = L1_lnFDI	-0.7109	0.1411	-5.04	0.000***
Short run				
D_lnREXR	-1.4226	0.3180	-4.47	0.000***
D_lnINTR	-0.9354	0.8074	-1.16	0.258
L1D_lnINTR	2.3970	0.7800	3.07	0.005***
D_lnTOPN	0.2282	0.3461	0.66	0.516
L1D_lnTOPN	-0.8093	0.3714	-2.18	0.039**
D_lnCPS	-0.3823	0.5632	-0.68	0.503
L1D_lnCPS	0.8005	0.5305	1.51	0.144
Long run				
L1_lnREXR	-0.8112	0.3808	-2.13	0.043**
L2_lnREXR	-0.8953	0.3499	-2.56	0.017**
L1_lnINTR	-3.1009	1.0127	-3.06	0.005***
L1_lnTOPN	0.8264	0.3917	2.11	0.045**
L1_lnCPS	-0.6885	0.2556	-2.69	0.012**
_cons	15.6977	4.4362	3.54	0.002***
F-statistic			5.68	0.0001***
R-squared	0.7470			

Source: Author's computation
Note: **shows p-value ≤ 0.05, ***shows p-value ≤ 0.01

The long-term relationship between trade openness and foreign direct investment inflow is positive and statistically significant. The result is consistent with the Mundell-Fleming hypothesis that trade restriction in a fixed exchange rate regime economy brings about capital outflow, while trade liberalization encourages capital inflow. It shows that an increase in trade liberalization in Nigeria will boost foreign direct investment inflow in the long run. A percentage increase in trade openness will increase foreign direct investment by 0.83%. Trade openness exhibited an insignificant effect on foreign direct investment in the short run. Credit to the private sector (financial development) revealed a significant negative impact on foreign direct investment in the long

run and an insignificant effect in the short run. The long-run result shows that the Nigerian stock market has not developed to an extent that it will increase the liquidity of the listed companies and reduce the cost of capital to attract foreign investments. It supports the fact that the Nigerian financial market is not relatively functioning well and discourages foreign investors. A percentage increase in credit to the private sector will result in a 0.69% reduction in foreign direct investment inflow in the long run.

The ECM_{t-1} gauges how quickly the lnFDI returns to long-run equilibrium in a year. It is negative and statistically significant at a 1% level, with an adjustment speed of 71.09%. The R-squared shows that the model has a good fit with explanatory power of 74.7%. The F-statistic is statistically significant at the 1% level, showing that the model is good for policy analysis.

4.9 Dynamic ARDL simulation graphs

Figure 2: 5% negative change in lnREXR

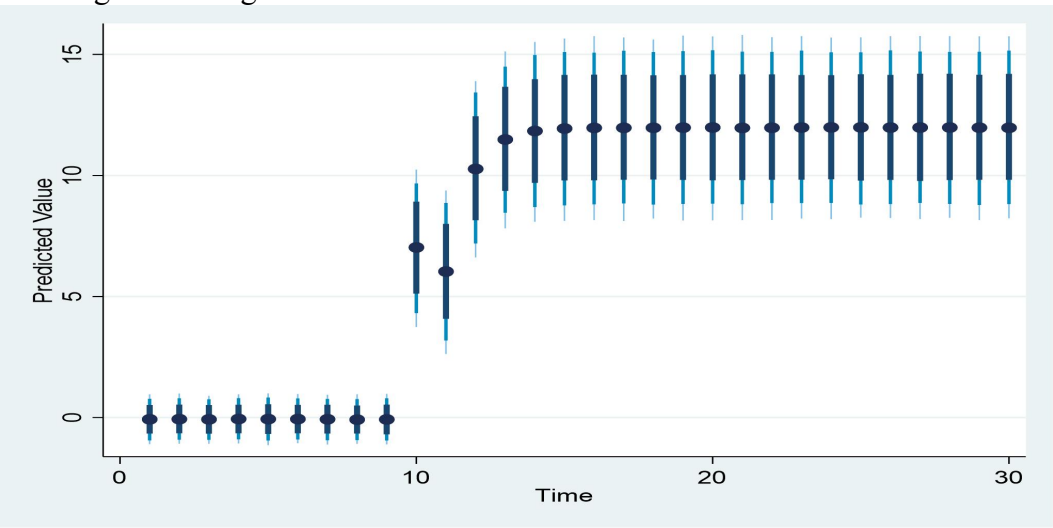
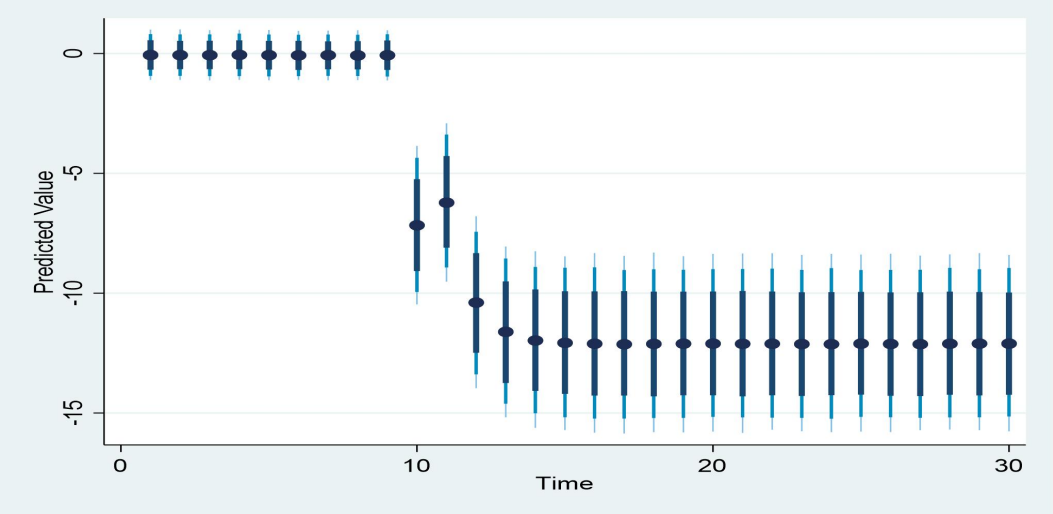


Figure 2 shows that 5% negative changes in the real exchange rate increased foreign direct investment to about 10.2% in the long run. It indicates that a 5% reduction in the real exchange rate (devaluation or depreciation) in Nigeria will boost foreign direct investment inflow by more than 10% in the long run. This will assist in establishing the pace at which the naira will be devalued or depreciated to achieve the desired amount of growth in foreign direct investment inflows into Nigeria. The response in the short run showed a decline in the first year, then increased from the second year.

Figure 3: 5% positive change in lnREXR



Conversely, Figure 3 shows that a 5% increase in the real exchange rate (revaluation or appreciation) in Nigeria will reduce the foreign direct investment inflow by approximately 10.2% in the long run. The short-run response showed a rise in the first year, followed by a fall from the second year.

4.10 Granger causality test result

Table 4.10 Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
D(LNREXR) does not Granger Cause D(LNFDI)	39	4.42901	0.0424
D(LNFDI) does not Granger Cause D(LNREXR)		2.02373	0.1635
LNREXR does not Granger Cause LNFDI	40	3.61582	0.0650
LNFDI does not Granger Cause LNREXR		0.58672	0.4485

Source: Author's computation

At both first difference and in level form, the pairwise Granger causality tests show that there is unidirectional causality between the real exchange rate and foreign direct investment that runs from the former to the latter. It indicates that the real exchange rate happens before foreign direct investment in Nigeria. It means that the past values of the real exchange rate provide statistically significant information about the future values of foreign direct investment, beyond what can be predicted by using only the past values of foreign direct investment.

5. CONCLUSIONS AND RECOMMENDATIONS

Following the study's findings that the real exchange rate has a significant negative impact on foreign direct investment in both the short and long run and that a 5% negative change in the real exchange rate will increase foreign direct investment to about 10.2% in the long run and vice versa. The study concludes that the exchange rate is a vital factor that determines foreign direct investment inflow in Nigeria. Its devaluation or depreciation will encourage foreign direct investment inflow, whereas its revaluation or appreciation will discourage it.

Based on the findings, the study recommends caution in devaluing or depreciating the naira to attract more foreign direct investment inflow in Nigeria. The dynamic ARDL simulation results will serve as a guide on the pace at which the naira should be devalued or depreciated to avoid over-devaluation or depreciation and its negative repercussions. The government should combine the exchange rate policy with other policies that bring

about an increase in foreign direct investment inflows, such as financial development, capital account liberalization, streamlined regulatory processes, and investment protection guarantees will attract international investors.

A stable political environment with strong governance and the rule of law is essential for reassuring foreign investors' confidence in Nigeria. It would assist in halting the large-scale movement of international companies from Nigeria to other African countries. Effective enforcement of the anti-corruption measures by the EFCC will deter corruption and attract foreign direct investment to the economy. Fighting Nigeria's high degree of insecurity to an absolute minimum will increase foreign direct investment inflows. Increased marketing campaigns that highlight Nigeria's strengths and opportunities to attract foreign investors. Reducing red tape, minimizing unnecessary regulation, and simplifying business registration procedures will encourage more foreign direct investment into the economy.

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