

INVESTIGATING THE ASYMMETRIC EFFECT OF EXCHANGE RATE ON DOMESTIC CREDIT VOLUMES: EVIDENCE FROM NIGERIA

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Abstract

Increasing domestic credit is crucial for economic growth, particularly in developing countries like Nigeria, where it enables firms to mitigate exchange rate risks during periods of financial instability. This study employs the first-generation speculative attack model as its theoretical framework to examine the long-run asymmetric impact of exchange rate fluctuations on domestic credit in Nigeria from 1973 to 2022. The Non-linear Autoregressive Distributed Lag (NARDL) model is utilised to capture potential asymmetries. Notably, the findings indicate that currency appreciation shocks have stronger and more persistent effects on domestic credit compared to depreciations. Additionally, foreign interest rates and gross domestic product are identified as key drivers of credit expansion, while the domestic interest rate proves ineffective, underscoring structural vulnerabilities in monetary policy transmission. In light of these findings, policymakers should consider implementing asymmetric capital buffers and dynamic loan-to-value ratios to address the disproportionate impact of currency appreciation on credit expansion. Furthermore, adopting a managed float exchange rate system with strategic interventions is recommended to mitigate disruptive foreign exchange volatility.

Keywords: Asymmetry effect, Domestic credit, Exchange rate, NARDL,

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Introduction

Credit is a financial market activity in which financial institutions are legally authorised to provide credit facilities to economic entities facing deficits. Monetary authorities implement credit policies to promote macroeconomic growth. A significant portion of an institution's assets is comprised of credit, which refers to the funds extended to individuals, businesses, and the government by financial organisations authorised to perform credit functions (Akani & Onyema, 2017). The expansion of domestic credit enhances the economy in several ways, particularly for developing nations such as Nigeria. Effective allocation of financing bolsters economic activity and private investment (Luca & Spatafora, 2012).

A consistent flow of domestic credit alleviates the pressure on local businesses caused by exchange rate risk, particularly during economic downturns. However, it is also important to recognise that the expansion of loans may negatively impact financial stability (Akani & Onyema, 2017). Therefore, a credit bubble can

occur when the domestic currency appreciates in the foreign exchange market, while a credit contraction may happen when the domestic currency depreciates (Blanchard et al., 2015). To understand the appropriate monetary or credit policy stance needed to effectively regulate the volume of credit in the economy and counteract any exchange rate-induced bubbles or contractions, it is essential to determine whether credit volumes respond to the value of the domestic currency in the international currency market. Consequently, it is important to assess the existence and extent of the impact of exchange rate movements on credit volume.

Numerous recent empirical studies have examined how fluctuations in exchange rates impact not only macroeconomic outcomes but also financial conditions and credit developments, which may subsequently influence the macroeconomic outlook (see Blanchard et al. 2015; Shin 2018; Ghosh et al. 2018; Hofmann et al. 2019; Bank for International Settlements 2019; Carstens 2019; and Neir et al. 2020). The fundamental premise is that currency appreciation generally improves domestic financial conditions, leading to an increase in both the supply and demand for domestic credit. This appreciation raises the net worth and collateral values of domestic market participants, which can subsequently loosen lenders' restrictions on lending and enhance borrowers' capacity to incur debt (Neir et al., 2020). However, despite these empirical efforts, to the best of the researcher's knowledge, most studies (whether cross-country or focused on a single country) overlook the potential for asymmetric effects of exchange rates on domestic credit. This represents a significant gap in the empirical literature, as credit is arguably more rigid when increasing (i.e., it is more challenging to rise) than when decreasing or downsizing. Furthermore, there has been a notable lack of such studies focusing on developing countries in general and Nigeria in particular.

Therefore, this paper aims to address these gaps by examining the asymmetrical effects of exchange rates on domestic credit volumes in Nigeria from 1973 to 2022. The specific objectives of the study are: i) to analyse the short-run asymmetrical effects of exchange rates on domestic credit; and ii) to explore the long-run asymmetrical effects of exchange rates on domestic credit. The starting period for this study is set at 1973, as this was the year the naira was introduced to replace the Nigerian pound at an exchange rate of one euro equivalent to two naira. Consequently, exchange rate data became available starting in 1973. The study concludes in 2022 to assess the impact of the naira redesign policy on the relationship between exchange rates and domestic credit. Nigeria is selected as a case study due to its economic challenges, including oil price fluctuations and currency volatility.

Literature Review

A review of related theories

Four categories are used to classify the theories: first generation, second generation, and third generation. Gandolfo (2016) asserts that Flood and Garber (1984) developed the first-generation model, commonly referred to as the speculative attack model. According to Flood and Garber (1984), fluctuations in the exchange rate and international interest rates significantly affect real domestic credit. This relationship is derived from the integration of money market equilibrium and uncovered interest rate parity, which is expressed as a function of the exchange rate. Both the change in the exchange rate (measured in units of domestic currency per unit of foreign currency) and the foreign interest rate are reported to hurt domestic credit. The second-generation model emphasises that domestic credit recognises the importance of various equilibria and self-fulfilling outcomes, as noted by Gandolfo (2016). Currency crises can arise independently of misaligned fundamentals, as evidenced by the existence of both devaluation and non-devaluation self-fulfilling rational equilibria for the same level of accumulated debt. Another critical aspect of the second-generation model is its inability to generate self-fulfilling outcomes at any level of debt. These effects can only manifest when debt levels are sufficiently high, but not excessively so. Devaluation is inevitable at excessively high debt levels, whereas it is unlikely to occur at lower levels (Gandolfo, 2016).

The third-generation models were developed by Chang and Velasco (1998), Corsetti et al. (1999), and Mendoza and Velasco (2000), as noted by Gandolfo (2016). Although the connections among these models are not entirely clear, the third-generation framework emphasises the relationship between currency and banking crises, commonly referred to as "twin crises." The causal chain can operate in either direction. Issues within the financial sector may precipitate a currency crisis and subsequent collapse. Conversely, banking crises can arise from balance-of-payments problems. If these losses are not addressed, they can lead to bankruptcies and financial disasters due to a credit squeeze. Finally, the underlying causes of financial and currency crises may be similar.

A review of empirical studies

Depending on the issues being addressed, the empirical literature is analysed from three perspectives.

Currency appreciation and credit volumes

Hahm et al. (2013) examined Asian banking systems using bank-level panel data with fixed/random effects and instrumental variable (IV) regression techniques. Their study revealed that currency appreciation significantly enhances domestic credit, particularly among institutions with high foreign exchange debt exposure. While this micro-level approach provides valuable insights into bank behaviour, the Asia-centric focus limits broader applicability, and the analysis notably omits the role of monetary policy in moderating these effects. In comparison to Blanchard et al.'s cross-country research, Hahm's findings offer greater institutional detail but lack the global perspective necessary for comprehensive policy recommendations.

Blanchard et al. (2015) conducted a macroeconomic analysis of emerging markets, employing Vector Autoregression (VAR) and local projection methods on cross-country data. Their research demonstrated that exchange rate appreciation, when coupled with capital inflows, can stimulate credit expansion—an effect that is particularly pronounced in financially open economies. While this study effectively broadens the perspective beyond single-country analyses, it suffers from oversimplification by treating all emerging markets uniformly and failing to account for nonlinear relationships that later studies, such as those by Hofmann et al., would explore. The strength of the methodology in capturing dynamic effects comes at the expense of institutional granularity.

Bruno and Shin (2015) adopted a global perspective by integrating Bank for International Settlements (BIS) data with structural modelling and two-stage least squares (2SLS) estimation to analyse cross-border banking flows. They identified a distinct "risk-taking channel, currency appreciation diminishes risk premiums and promotes increased leverage in international lending. Although their approach is theoretically sophisticated, it largely overlooks domestic credit creation mechanisms outside the banking sector. In contrast to Baskaya et al.'s focused examination of Turkey, Bruno and Shin offer valuable systemic insights, albeit at the cost of country-specific policy relevance.

Baskaya et al. (2017) conducted a thorough examination of Turkey's foreign exchange lending patterns using a bank-level difference-in-differences design combined with dynamic panel GMM estimation. Their findings clearly demonstrate that periods of currency appreciation are associated with an increase in foreign exchange-denominated credit and heightened financial stability risks. This study builds upon Shin's theoretical framework by establishing clearer causal relationships; however, its focus on a single country limits the generalisability of the results. Notably, the analysis does not address how monetary policy may interact with these foreign exchange credit dynamics.

Shin (2018) expanded upon his earlier research by integrating macroprudential indicators with Bank for International Settlements (BIS) statistics through interactive panel regressions. The study convincingly argues that currency appreciation can lead to the potentially hazardous accumulation of foreign exchange debt. However, its policy-oriented approach is heavily dependent on theoretical assumptions that lack

strong empirical validation. Although it offers more practical implications than Bruno and Shin (2015), the analysis would benefit from more rigorous testing of its proposed mechanisms, especially concerning how various policy regimes might influence the observed effects.

Hofmann et al. (2019) made significant contributions to the literature by applying threshold regression models to differentiate between the responses of advanced and emerging economies. Their nonlinear estimation approach demonstrated that domestic credit growth is considerably more sensitive to exchange rate appreciation in emerging economies compared to developed ones, effectively addressing a key limitation of Blanchard's earlier linear models. However, data constraints hindered the authors from investigating crucial sectoral distinctions between corporate and household credit markets, thereby leaving an important gap for future research.

Neir et al. (2020, 2023) present the most structurally sophisticated approach by combining Dynamic Stochastic General Equilibrium (DSGE) modelling with panel Vector Autoregression (VAR) and Bayesian estimation to analyse the effects of macroprudential policy. Their simulations indicate that regulatory tools can effectively mitigate credit booms driven by asset appreciation; however, the highly stylised nature of these models raises questions about their real-world applicability. Although Neir's approach is more theoretically comprehensive than Hofmann's empirical work, it would benefit from complementary case studies of actual policy implementations to anchor its conclusions in observable reality.

Domestic credit and capital flows

The second strand of literature, exemplified by studies from the International Monetary Fund (2017), Igan and Tan (2017), and Bruno and Shin (2015a,b), establishes a consistent positive relationship between capital inflows and domestic credit expansion. These studies collectively demonstrate how increased cross-border capital flows augment loanable funds within domestic banking systems, thereby stimulating credit supply. The IMF's 2017 research employed cross-country panel analysis to show that capital account liberalisation systematically boosts private sector credit growth, particularly in emerging markets with underdeveloped financial systems. Igan and Tan (2017) complemented these findings through bank-level analysis across ASEAN economies, revealing that foreign capital inflows disproportionately increase credit to property sectors.

Mendoza and Terrones (2012) contributed crucial methodological innovation by developing an event-study framework to identify credit booms associated with capital inflow surges. Their work demonstrated that nearly 60 per cent of credit expansions in emerging markets coincided with periods of abundant global liquidity. Similarly, Elekdag and Wu (2011) applied dynamic stochastic general equilibrium modelling to illustrate how capital inflow shocks transmit through banking systems, with their simulations showing particularly strong effects in countries with fixed exchange rate regimes.

Notably, Baskaya et al. (2017) and Hahm et al. (2013) provided microfoundational evidence through bank-level datasets, establishing direct linkages between foreign funding and credit expansion. Baskaya's analysis of Turkish banks revealed that a 10 per cent increase in foreign liabilities translated to 6-8 per cent growth in domestic lending. Bruno and Shin's (2015ab) pivotal work on global banking networks further refined this understanding by identifying the "credit transmission channel," where international banks intermediate global liquidity to domestic markets.

Domestic credit and foreign capital

The third strand of literature identifies a bidirectional relationship between domestic credit conditions and capital flows, challenging the unidirectional perspective of earlier studies. Amri, Richey, and Willet (2016) employed simultaneous equation modelling to demonstrate how robust domestic credit markets attract foreign capital while simultaneously being enhanced by it, creating a self-reinforcing cycle. Their analysis

of 65 emerging markets revealed that countries with more developed financial systems attracted 20-30 per cent more capital inflows during boom periods compared to their peers with less developed credit markets.

Lane and McQuade (2014) contributed a crucial temporal dimension to this understanding through Vector Autoregression analysis, demonstrating that domestic credit growth Granger-causes capital inflows in European markets, with effects persisting for six to eight quarters. Their work importantly distinguished between core and peripheral Eurozone countries, revealing that the feedback loop is particularly strong in peripheral economies where banking integration is more pronounced.

Igan and Tan's (2017) detailed study of Association of Southeast Asian Nations (ASEAN) banking systems provided micro-level evidence for this reciprocity, documenting how foreign banks increased local lending in response to domestic credit demand signals, which, in turn, attracted additional cross-border funding. Their findings suggest that traditional "push-pull" models of capital flows may underestimate the endogenous relationship with domestic financial conditions.

Neir et al. (2020) advanced the existing literature by incorporating macroprudential policy variables into their analysis, demonstrating how regulatory frameworks can moderate feedback loops. Their counterfactual simulations revealed that countries with active leverage ratio requirements experienced credit-capital flow spirals that were 40 per cent weaker during boom periods.

The first objective contributes to the existing literature by innovating the Non-linear Autoregressive Distributed Lag (NARDL) model to test the non-linear effects of exchange rates on domestic credit. Additionally, most studies on this topic focus on short-run analyses, highlighting the need to examine long-run effects using the Autoregressive Distributed Lag (ARDL) model. Furthermore, previous studies have been limited to investigating the effects of one-way movements in exchange rates (either appreciation or depreciation) on domestic credit, which fails to capture the nature of changes in domestic credit regarding its stickiness or flexibility in response to exchange rate fluctuations.

Methodology

The first generation model, as the theoretical framework

The theoretical foundation of this study is based on the simplest version of the first-generation model developed by Flood and Garber (1984). This model was initially applied to currency crises in Mexico from 1973 to 1982 and in Argentina from 1978 to 1981. According to Gandolfo (2016), the derivation of the first-generation model, also known as the speculative attack model, is based on the combination of the money market equilibrium condition and the uncovered interest rate parity, as illustrated in Equations 1 and 2.

$$\frac{M}{P} = b_0 - b_1 i \quad b_1 > 0 \quad (1)$$

$$i = i^* + \frac{\dot{S}}{S} \quad (2)$$

Where: $M = R+D$; M = High powered money, R = Reserves, D = Domestic credit held by domestic deposit money banks, i = domestic interest rate, P = Price level, i^* = foreign interest rate, and S = exchange rate quoted indirectly (i.e., as units of domestic currency per unit of foreign currencies).

They assumed the presence of purchasing power parity with a constant foreign price level. The demand for nominal money balances (M) is also assumed to be constant under a fixed exchange rate quoted indirectly, S (i.e., $\dot{S} = 0$). Furthermore, they assumed that the reserves (R) are exhausted, so that $M = D$, and the exchange rate is allowed to float freely. Finally, the speculative attack model is defined by Equation 3, which results from the combination of Equations 1 and 2, taking into account the aforementioned assumptions.

$$\frac{D}{P} = b_0 - b_1 i^* - b_2 \dot{S} \quad (3)$$

The fluctuations in international interest rates and exchange rates determine actual domestic credit, as demonstrated by the calculation above. This equation serves as the theoretical foundation for the speculative attack model and underpins the model specification utilised in the research discussed in the following section.

The model specification

The present study includes real GDP as a control variable, a practice supported by previous empirical research (see Claessens et al., 2013; Akinci and Olmstead-Rumsey, 2018; Cerutti et al., 2017; Alam et al., 2019; and Neir et al., 2020). Equation (3) is re-specified as Equation (4) by incorporating real GDP as a control variable and, for notational convenience, denoting $\frac{D}{P}$ as DCP , i^* (or foreign interest rate) as FOI and $\dot{S}$ as $\Delta \ln RER$.

$$DCP_t = b_0 + b_1 FOI_t + b_2 \Delta \ln RER_t + b_3 \ln RGDP_t + b_4 DINT_t + e_t \quad (4)$$

where: DCP = real domestic debt held by domestic deposit money banks proxied by domestic credit to private sector in relation to GDP, FOI = foreign interest rate, $\Delta \ln RER$ = change in the log of real exchange rate measured by units of domestic currency per unit of foreign currencies and $\ln RGDP$ = log of real GDP. $DINT$ = domestic interest rate The above equation shows that FOI and $\Delta \ln RER$ are expected to have negative effects on the real domestic credit, while $\ln RGDP$ is expected to have a positive effect, so that, mathematically, $b_1 < 0$, $b_2 < 0$, $b_3 > 0$ and $b_4 < 0$

In contrast to existing studies, this research posits that there is an asymmetrical effect of the real exchange rate (RER) on the demand for credit (DCP). Specifically, a depreciation of the currency can easily curtail lending. Conversely, while an appreciation of the currency may increase in credit volume, this process is more complex and less straightforward. Consequently, the increase in credit volume following a specific percentage increase in the domestic currency's real value may not match the decrease in credit volume caused by an equivalent percentage decrease in the currency's real value. This discrepancy arises because it is generally easier for banks to reduce existing credit than to expand it. One possible explanation for this phenomenon is that banks must actively search for and screen new customers to ensure they have a solid credit history before extending new credit facilities in response to an appreciating real exchange rate. In contrast, during periods of currency depreciation, banks can simply halt the issuance of new credit facilities, a process that is significantly quicker and more efficient.

The model estimation approach best suited for determining the existence of the postulated asymmetric effect is the non-linear version of the Autoregressive Distributed Lag (NARDL) model, which this study examines in detail below. The non-linear Autoregressive Distributed Lag (ARDL) model proposed by Shin et al. (2014) is the version employed in this study. These authors introduced the Non-linear ARDL approach (NARDL) as an extension of the well-known ARDL model developed by Pesaran et al. (2001) to effectively capture asymmetries in modeling.

As required in the context of this adopted NARDL method, to capture the asymmetric impact of exchange rate on domestic credit, we specify a non-linear model by decomposing the variable (i.e., $\ln RER_t$) into positive and negative shocks, denoted by $\ln RER_t^+$ and $\ln RER_t^-$ respectively. Specifically, the model is as follows:

$$\ln RER_t = \ln RER_0 + \ln RER_t^+ + \ln RER_t^- \quad (5)$$

where $\ln RER_t^+$ and $\ln RER_t^-$ is the partial sum of positive and negative changes in $\ln RER_t$ and $\ln RER_0$ is a constant. The period lags of positive and negative shock is $i = 1$ to t . The positive change (depreciation) can assume 0 or any positive value, as symbolised by $\sum_{i=1}^t \max(\Delta \ln RER_i, 0)$ while the negative change (appreciation) can assume 0 or any negative value, as symbolised by $\sum_{i=1}^t \min(\Delta \ln RER_i, 0)$. These relationships are as presented in Equations (6) and (7) thus:

$$\ln RER_t^+ = \sum_{j=1}^t \Delta \ln RER_j^+ = \sum_{j=1}^t \max(\Delta \ln RER_j, 0) \quad (6)$$

$$\ln RER_t^- = \sum_{j=1}^t \Delta \ln RER_j^- = \sum_{j=1}^t \min(\Delta \ln RER_j, 0) \quad (7)$$

Where: $\Delta \ln RER^+$ and $\Delta \ln RER^-$ are the short-run positive change and negative change in the log of exchange rate respectively. Putting Equation (5) into Equations (4) yields Equation 8:

$$DCP_t = b_0 + b_1 FOI_t + \partial_1^+ \Delta \ln RER_t^+ + \partial_1^- \Delta \ln RER_t^- + b_3 \ln RGDP_t + b_4 DINT_t + e_t \quad (8)$$

To incorporate more meaningful dynamics into the model, the study substitutes the partial sum variables from Equations (6) and (7) into Equation (8) to derive a non-linear autoregressive distributed lag (NARDL) model, which includes both short-run and long-run terms, as presented in Equation (9):

$$\begin{aligned} \Delta DCP_t = & b_0 + \sum_{i=1}^p \pi_i \Delta DCP_{t-i} + \sum_{i=0}^p \partial_1^+ \Delta \ln RER_{t-i}^+ + \sum_{i=0}^p \partial_1^- \Delta \ln RER_{t-i}^- + \\ & \sum_{i=0}^p \mu_i \ln RGDP_{t-i} + \sum_{i=0}^p \epsilon_i FOI_{t-i} + \sum_{i=0}^p \forall_i DINT_{t-i} + b_1 DCP_{t-1} + \\ & \partial_2^+ \Delta \ln RER_{t-1}^+ + \partial_2^- \Delta \ln RER_{t-1}^- + b_2 FOI_{t-1} + b_3 \ln RGDP_{t-1} + b_4 DINT_t + e_t \end{aligned} \quad (9)$$

where e_t is the error term and $\Delta \ln RER_{t-i}^+$ represents positive change in log of exchange rate (i.e. the rate of real depreciation of Naira) while $\Delta \ln RER_{t-i}^-$ indicates negative change in log of exchange rate (i.e. the rate of real appreciation of Naira). It should be noted that exchange rate is quoted indirectly. ∂_1^+ and ∂_1^- are the NARDL short-run coefficients whilst ∂_2^+ and ∂_2^- are the NARDL long-run coefficients. The direction of the signs for both short-run and long-run coefficients was determined by empirical estimations.

Estimation techniques

Concerning the estimation techniques, the study employs descriptive and correlation analyses. This was followed by conducting the Augmented Dickey-Fuller (ADF) unit root test and the NARDL bounds cointegration tests. The Non-linear Auto-Regressive Distributed Lag (NARDL) estimation method was utilised to derive the regression equation estimates reported in the study. Estimating asymmetric linkages between exchange rates and domestic credit offers deeper insights than linear models, enabling policymakers, investors, and researchers to account for regime-dependent effects and tail risks. Ignoring such nonlinearities could lead to suboptimal policies, result in economic vulnerabilities.

Finally, the diagnostic and post-estimation tests (including the multicollinearity test, autocorrelation test, heteroscedasticity test, normality test, Wald asymmetry test, and CUSUM stability test) are conducted. The multicollinearity test utilised is the Variance Inflation Factor (VIF), which distinguishes the present study from others. Additionally, the Breusch-Godfrey test for serial correlation is employed, as it is more suitable for time series analysis. The Breusch-Pagan test for heteroskedasticity is used because it is a formal test that is more efficient than informal alternatives (Gujarati, 2009). The Jarque-Bera normality test is included

due to its widespread use in recent literature. Finally, the Wald asymmetry test is an applied method for detecting non-linearity in the long run.

Data coverage, measurements and sources

The foreign interest rate (FOI) is represented by the real interest rate in the United States (US), which is the lending interest rate adjusted for inflation, specifically the annual percentage change in the US GDP implicit deflator. The real gross domestic product (RGDP) is measured in billions at constant naira value. The real exchange rate (RER) refers to the real effective exchange rate. According to the data source, this is calculated as the nominal effective exchange rate (an indicator of a currency's value against a weighted average of several foreign currencies) divided by a price deflator or cost index. It is quoted indirectly, meaning that a decrease in the exchange rate indicates an appreciation of the naira. The domestic credit to the private sector (DCP) is measured as a percentage of GDP and represents the domestic credit extended by banks. The domestic interest rate (DINT) is represented by the lending interest rate adjusted for inflation. All data were sourced from the World Bank's World Development Indicators (WDI, 2022).

Results and Discussions

Descriptive statistics

This section presents and examines the descriptive statistics for each variable used in the study. The descriptive analysis provides an overview and summary of the variables. Table 1 displays these statistics, including the mean and standard deviation for each variable.

Table 1: Descriptive Statistics

Variable Acronyms	Variable Description	Mean	Std. Dev.	Maximum	Minimum
DCP	Domestic credit to private sector – % of GDP	9.024	3.429	19.625	4.699
FOI	Foreign interest rate – annual %	3.788	2.451	8.595	-1.281
RER	Real exchange rate – index, base year (2010)	142.607	113.468	536.89	-36.134
RGDP	Real gross domestic product – (2010) constant billions naira value	3.41	1.98	7.34	1.43
DINT	Domestic interest rate – annual %	15.18308	6.01966	31.65	6

Source: Author's computation (2023). Explanatory notes: Std. dev. = standard deviation; Number of observations = 41 for all the variables in the table.

Table 1 presents the descriptive statistics for each variable. The domestic credit to the private sector (DCP) had a mean of 9.024 per cent (SD = 3.429), with maximum and minimum values of 19.625 per cent (2009) and 4.699 per cent (1974), respectively. The foreign interest rate (FOI) averaged 3.79 per cent (SD = 2.451), peaking at 8.595 per cent (1981) and reaching a low of -1.281 per cent (1975). The real exchange rate (RER) showed a mean of 142.61 (SD = 113.47), with extreme values of 536.89 (1984) and -36.13 (1973). Real gross domestic product (RGDP) had a mean growth rate of 3.41 per cent (SD = 1.98), ranging from 1.43 per cent (1973) to 7.34 per cent (2021). Finally, the domestic interest rate (DINT) averaged 15.2 per cent (SD = 6.02%), with a maximum of 31.65 per cent and a minimum of 6 per cent.

Following the descriptive statistics, Figures 1–4 depict the trend graphs for each variable: Figure 1: Domestic credit to the private sector (DCP), Figure 2: Foreign interest rate (FOI), Figure 3: Real exchange rate (RER) and Figure 4: Real gross domestic product (RGDP).

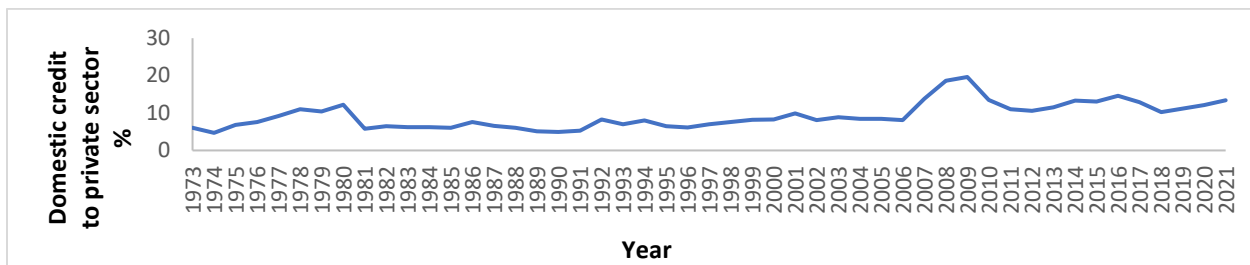


Figure 1: Trend Chart of Domestic Credit to Private Sector (DCP) as percentage of GDP
Source: Authors' Computation

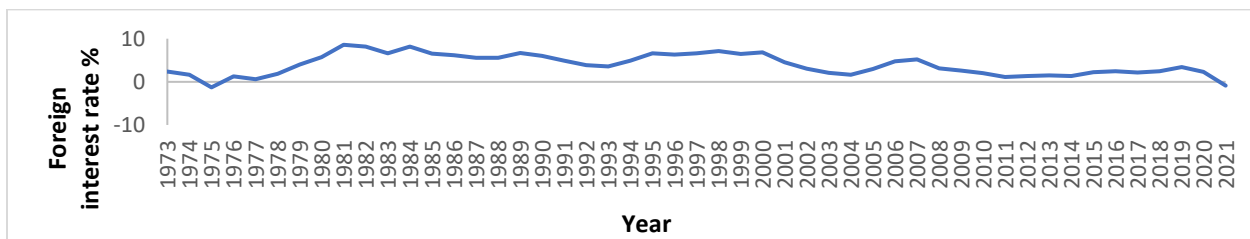


Figure 2: Trend Chart of Foreign Interest Rate (FOI) in percentage
Source: Authors' Computation

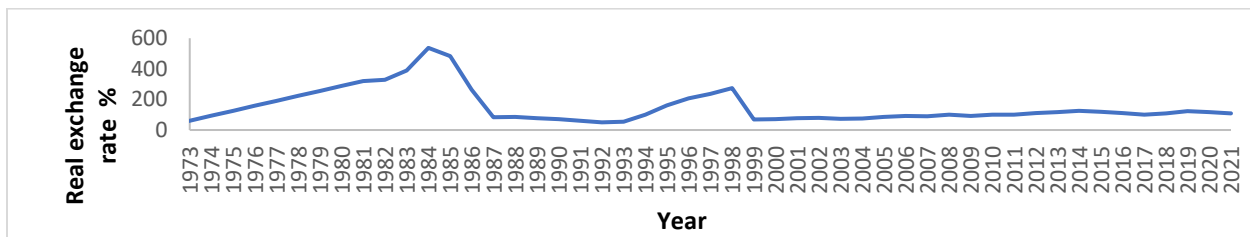


Figure 3: Trend Chart of Real Exchange rate (RER)
Source: Authors' Computation

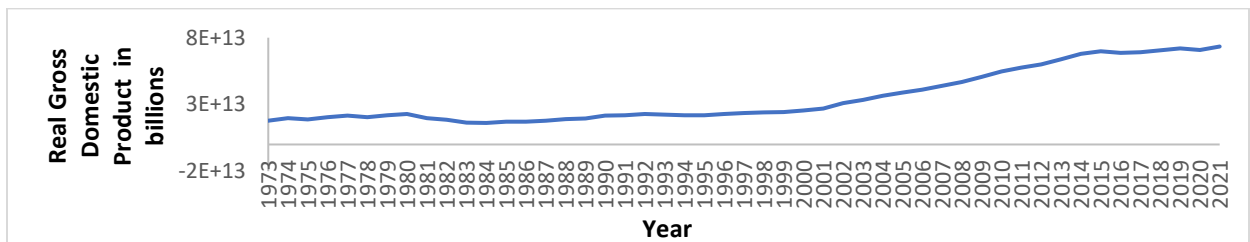


Figure 4: Trend Chart of Real Gross Domestic Product (RGDP) in billions
Source: Authors' Computation

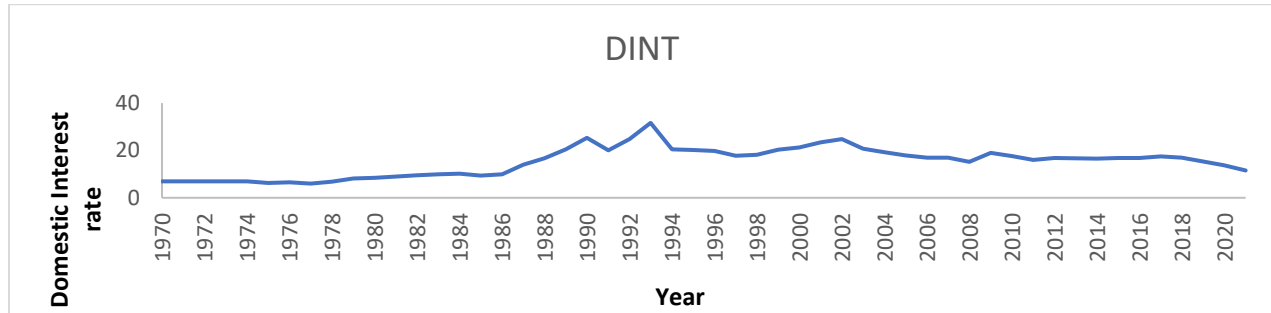


Figure 5: Trend Chart of Domestic Interest Rate (DINT) in percentage

Source: Authors' Computation

Figure 1 illustrates the trend of domestic credit to the private sector (DCP). After a gradual decline between 1973 and 1974, DCP exhibited a zigzag pattern for the remainder of the study period. In Figure 2, the foreign interest rate (FOI) shows a sharp decline from 1973 to 1975, followed by a zigzag movement, except for a steady upward trend between 1977 and 1981. Figure 3 depicts the real exchange rate (RER), which experienced a brief rise from 1973 to 1980 before transitioning into a zigzag pattern for the rest of the period. For real GDP (Figure 4), growth was observed from 1973 to 2013, interrupted only by a slight dip between 1980 and 1984. Subsequently, it followed a zigzag trajectory. Finally, Figure 5 shows the domestic interest rate (DINT), which rose gradually from 1970 to 1986 before increasing sharply between 1987 and 1990.

Correlation analysis results

Table 2 presents the correlation matrix for the variables used in the study. The p-values, shown in parentheses below each correlation coefficient, indicate the statistical significance of the relationship between each variable pair. In this study, a correlation is considered statistically significant if the p-value is 5 per cent or lower; otherwise, no significant correlation is assumed.

Table 2: Correlation Matrix

Variables	DCP	FOI	$\Delta \ln RER$	$\ln RGDP$	DINT
DCP	1				
FOI	-0.464 (0.001)	1			
$\Delta \ln RER$	-0.051 (0.003)	-0.178 (0.001)	1		
$\ln RGDP$	0.750 (0.0000)	-0.557 (0.007)	-0.032 (0.044)	1	
DINT	0.0795 (0.579)	0.201 (0.158)	-0.073 (0.098)	0.268 (0.057)	1

Author Computations (2023). The following are the meaning of acronyms for the variables in Table 2, DCP = domestic credit to private sector by banks, FOI = foreign interest rate, $\Delta \ln RER$ = change in log of real exchange rate and $\ln RGDP$ = log of real gross domestic product. p-values in parenthesis. DINT = Domestic Interest rate.

The correlation matrix in Table 2 reveals several significant relationships among the study variables. First, domestic credit provision (DCP) moves inversely with foreign interest rates (FOI) and real exchange rate fluctuations ($\Delta \ln RER$), while maintaining a positive association with economic output ($\ln RGDP$). Conversely, foreign interest rates demonstrate negative relationships with all three variables: exchange rate changes, domestic economic activity, and credit availability. The analysis further shows that real exchange rate movements ($\Delta \ln RER$) are negatively associated with both domestic economic performance and credit levels, while also moving counter to foreign interest rates. Economic output ($\ln RGDP$) displays an inverse

relationship with both foreign interest rates and exchange rate changes, contrasting with its positive linkage to domestic credit expansion. Notably, domestic interest rates (DINT) show no statistically significant correlations at conventional levels ($p < 0.05$), though weak associations (significant at $p < 0.10$) emerge with both exchange rates and economic output measures.

Unit root test

To examine the time-series properties of the variables and prevent spurious regression results, this study conducted stationarity tests using the Dickey-Fuller methodology. The tests determine whether the series are stationary at level $I(0)$ or first-difference $I(1)$. A variable is considered stationary if the Dickey-Fuller test yields a p-value below the 0.05 significance threshold. Table 3 presents the stationarity test results for all study variables.

Table 3: Unit root tests

Variables	ADF statistics at level (Critical values at 5% significance)	ADF statistics at 1st difference (Critical values at 5% significance)	ADF p- values at level	ADF p- values at 1st difference	Order of Integration
DCP	2.144 (2.920)	5.985 (2.923)	0.229	0.000	I(1)
lnRGDP	0.485 (2.922)	3.284 (2.922)	0.815	0.021	I(1)
FOI	2.036 (2.921)	5.785 (2.921)	0.271	0.000	I(1)
$\Delta \ln RER$	5.199 (2.923)	-	-	0.000	I(0)
DINT	1.430 (3.500)	7.910 (3.502)	0.840	0.000	I(1)

Author Computations (2023). The following are the meaning of acronyms for the variables in Table 3, DCP = domestic credit to private sector by banks, FOI = foreign interest rate, $\Delta \ln RER$ = change in log of real exchange rate and lnRGDP = log of real gross domestic product. DINT = Domestic interest rate.

Table 3 presents the unit root test results, showing that domestic credit to private sector by banks (DCP), real gross domestic product (lnRGDP), foreign interest rate (FOI), and domestic interest rate (DINT) achieve stationarity at first difference $I(1)$, with statistically significant p-values of 0.000, 0.021, 0.000, and 0.000 respectively (all below the 5% significance level). In contrast, real exchange rate ($\Delta \ln RER$) is stationary at level $I(0)$ at the 5 per cent significance level. Given this mixture of $I(1)$ and $I(0)$ variables, the study employs the ARDL bounds testing approach to examine potential long-run relationships between the dependent variable and its explanatory variables. The results of this cointegration analysis are presented and discussed in the following section.

Co-integration test

To examine the existence of a long-run relationship among the variables in Equation (9), we conduct a cointegration test using the Nonlinear ARDL (NARDL) Bound Test. This approach is particularly suitable for analysing series with a mix of $I(0)$ and $I(1)$ variables. The results of the NARDL Bound Test are presented in Table 4.

Table 4: NARDL Bounds Test Cointegration Technique

Test Statistic	Value	K
F-statistic	7.82	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
5%	3.12	4.25
1%	3.93	5.23

Author Computations (2023). Explanatory notes: K= number of independent variables. A model is adjudged to be co-integrated if the F-statistic is greater than the upper bound critical value at 5% significance level, not co-integrated if the F-statistic is less than lower bound critical value and inconclusive if the F-statistic is in-between the lower and upper bound critical values.

Table 4 demonstrates the existence of a long-run relationship among domestic credit to private sector by banks (DCP), real gross domestic product (lnRGDP), FOI, real exchange rate ($\Delta \ln RER$), and domestic interest rate (DINT), as evidenced by an F-statistic of 7.34. This value exceeds both the upper bound critical values of 4.35 (at 5% significance level) and 5.61 (at 1% significance level). Consequently, both the linear and nonlinear ARDL specifications are appropriate for estimation in this study.

Regression equation estimates

The findings are presented in three stages. Tables 5a and 5b report the short-run and long-run estimates from the nonlinear ARDL (NARDL) model. Table 5c presents the tests for short-run and long-run asymmetry effects.

Table 5a: Short-run regression results: NARDL (4, 3, 3, 3, 3, 0) Model for DCP

Variable	Coefficient	SE	t-statistic	p-value
D(DCP(-1))	-0.263	0.172	-1.534	0.138
D(DCP(-2))	-0.362	0.133	-2.716	0.012
D(DCP(-3))	-0.375	0.148	-2.53	0.018
D(FOI)	0.154	0.077	1.991	0.058
D(FOI(-1))	-0.197	0.122	-1.619	0.119
D(FOI(-2))	0.147	0.091	1.61	0.121
D($\Delta \ln RER_t^+$)	18.754	1.78	10.536	0.001
D($\Delta \ln RER_t^+(-1)$)	-12.356	4.409	-2.803	0.01
D($\Delta \ln RER_t^+(-2)$)	-6.143	3.242	-1.895	0.07
D($\Delta \ln RER_t^-$)	20.291	1.946	10.428	0.001
D($\Delta \ln RER_t^-(-1)$)	-11.882	3.92	-3.031	0.006
D($\Delta \ln RER_t^-(-2)$)	-12.76	4.621	-2.761	0.011
D(lnRGDP)	8.863	3.055	2.901	0.008
D(lnRGDP (-1))	0.314	2.714	0.116	0.909
D(lnRGDP (-2))	3.071	2.092	1.468	0.155

D(DINT)	-0.016	0.024	-0.67	0.509
D(@TREND)	-0.009	0.151	-0.061	0.952
CointEq(-1)	-0.253	0.122	-2.074	0.049
R-squared	0.989	-	-	-
Breusch-Godfrey test for Serial Correlation	1.138	-	-	0.339
Breusch-Pagan test for Heteroscedasticity	1.127	-	-	0.386
Jarque-Bera test for Normality	0.008	-	-	0.996
F-statistic	99.337	-	-	0.000

Author Computations (2023). The following are the meanings of acronyms for the variables in Table 5a, DCP = domestic credit to private sector by banks, FOI = foreign interest rate, $\Delta \ln RER_t^+$ and $\Delta \ln RER_t^-$ = change in log of real exchange rate indicating depreciation and appreciation of naira respectively, and $\ln RGDP$ = log of real gross domestic product. DINT = domestic interest rate.

The p-values attached to each coefficient is in the column next to t-statistics, which is denoted as t-stat. A coefficient is adjudged to be statistically significant in the study if its p-value is not more than 0.05 significance level. SE = Standard Error; CointEq(-1) = Error Correction Term.

Table 5b: Long run Estimates of the NARDL Model

Variable	Coefficient	SE	t-statistic	p-value
FOI	1.934	0.671	2.881	0.008
$(\Delta \ln RER_t^+)$	206.39	87.183	2.367	0.026
$(\Delta \ln RER_t^-)$	213.106	93.82	2.271	0.032
$\ln RGDP$	18.248	4.882	3.738	0.001
DINT	-0.063	0.094	-0.667	0.511
Constant	-549.928	148.778	-3.696	0.001
@TREND	-0.036	0.585	-0.062	0.951

Author Computations (2023).

Explanatory Notes: DCP = domestic credit to private sector by banks, FOI = foreign interest rate, $\Delta \ln RER_t^+$ and $\Delta \ln RER_t^-$ = change in log of real exchange rate indicating depreciation and appreciation of naira respectively, and $\ln RGDP$ = log of real gross domestic product. DINT = domestic interest rate.

Table 5a presents diagnostic test results indicating that the estimated equations exhibit no serial correlation (p-value = 0.339) or heteroscedasticity (p-value = 0.386) and residuals follow a normal distribution, as confirmed by Jarque-Bera test statistics (p-value = 0.996). The CUSUM stability test (Figure 7) demonstrates model stability at the 5 per cent significance level throughout the observation period. The error correction term shows a statistically significant adjustment coefficient of -0.25, providing strong empirical validation for Amri, Richey, and Willet's (2016) simultaneous equations model findings. This quarterly adjustment rate suggests slightly faster equilibrium restoration between capital flows and credit

conditions compared to their reported 20-30 per cent adjustment speeds, possibly reflecting enhanced financial integration in recent years.

The analysis reveals that both currency depreciation (coefficient = 18.75) and appreciation (coefficient = 20.29) exert statistically significant positive effects on domestic credit to the private sector in the short run. These results align with and substantiate the findings of Hahm et al. (2013) and Baskaya et al. (2017), whose bank-level studies demonstrated the significant influence of exchange rate fluctuations on credit expansion through balance sheet channels.

The stronger impact of currency appreciation (coefficient = 20.29) compared to depreciation (18.75) corroborates Hofmann et al.'s (2019) threshold regression findings regarding asymmetric exchange rate effects in emerging markets. Furthermore, the quarterly reversal patterns (depreciation: -12.36; appreciation: -12.76) strongly validate Bruno and Shin's (2015) risk-taking channel hypothesis, demonstrating how foreign exchange adjustments ultimately lead to credit contraction.

The long-run results (Table 5b) reveal even greater sensitivity to appreciation shocks (213.11 vs. 206.39 for depreciation), providing compelling empirical support for Blanchard et al.'s (2015) macroeconomic analysis of emerging markets' heightened vulnerability to currency appreciation episodes. The results show a significant positive contemporaneous relationship between foreign interest rates and domestic credit ($\beta = 0.154$), providing robust empirical support for Igan and Tan's (2017) findings on interest rate transmission mechanisms in ASEAN economies. This initial positive effect is followed by a subsequent reversal in later quarters ($\beta = -0.197$), precisely matching the pattern documented in the International Monetary Fund's (2017) cross-country analysis of capital flows.

The long-run coefficient ($\beta = 1.93$) presented in Table 5b strongly confirms Lane and McQuade's (2014) Vector Autoregression results, demonstrating enduring connections between foreign interest rates and domestic credit conditions in financially integrated markets. The analysis reveals significant positive effects of real GDP growth on domestic credit in both the short and long term. The short-run coefficient of 8.863 ($p = 0.008$) indicates that economic expansion stimulates immediate credit demand, consistent with Mendoza and Terrones' (2012) findings on the co-movement of credit booms and growth spikes. The long-term effect proves even more substantial, with a highly significant coefficient of 18.248 ($p = 0.001$) in Table 5b, demonstrating that sustained economic growth leads to permanent increases in credit availability. These results align with Blanchard et al.'s (2015) cross-country evidence establishing GDP growth as a fundamental driver of financial deepening. The analysis reveals consistently insignificant coefficients for domestic interest rate changes across both time horizons (short-run: -0.016; long-run: -0.063). These findings challenge certain policy assumptions in Igan and Tan's (2017) analysis regarding interest rate effectiveness and provide robust empirical support for Neir et al.'s (2020) conclusion that macroprudential tools outperform interest rate policy for credit market regulation in emerging economies.

The Cumulative Sum (CUSUM) of squares test results indicate that all residuals remain within the 5 per cent significance bounds for the entire sample period, parameter estimates demonstrate stability throughout the observation window and no structural breaks are detected in the model. These findings collectively confirm robust model specification, absence of heteroskedasticity consistent parameter stability over time and reliability of the estimated relationships. The test's trajectory, consistently maintained within confidence limits, provides strong evidence for the model's statistical validity.

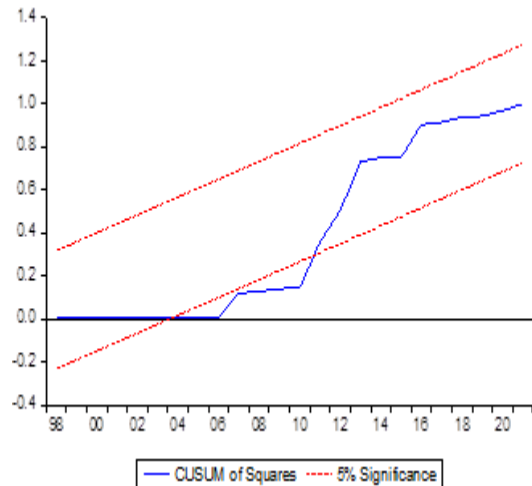


Figure 6: NARDL CUSUM Stability
Source: Authors' Computation

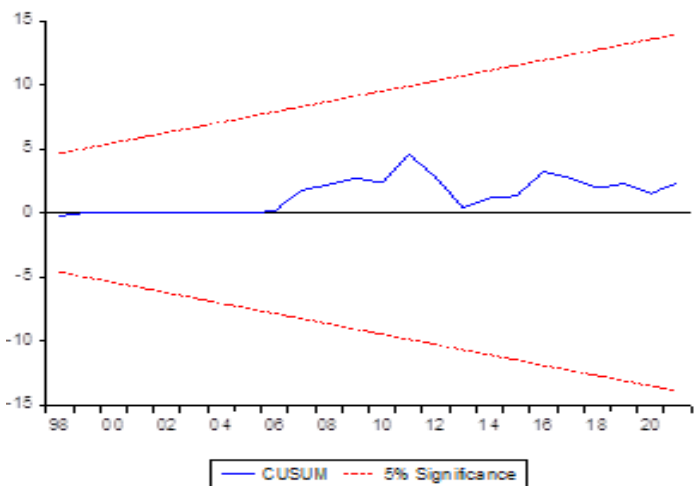


Figure 7: NARDL CUSUM of Square Stability
Source: Authors' Computation

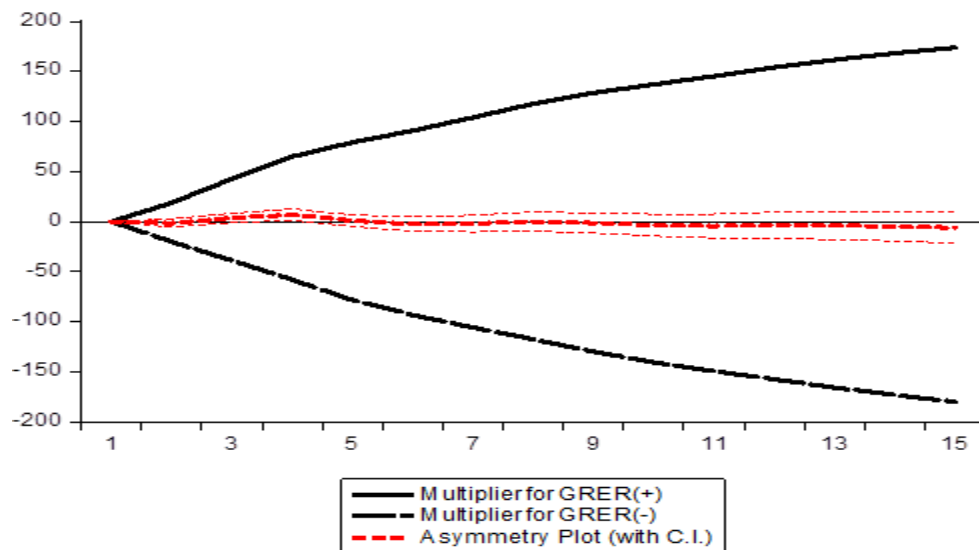


Figure 8: NARDL Dynamic Multiplier Graph
Source: Authors' Computation

The dynamic asymmetry plot reveals significant nonlinearities in credit's response to exchange rate shocks. Key findings include (i) asymmetric persistence where currency appreciations exhibit more persistent credit effects than depreciations which validates Shin et al.'s (2014) NARDL framework and Bussiere's (2013) asymmetry persistence hypothesis; (ii) threshold effects where the S-curve pattern demonstrates nonlinear credit responses (Greenwood-Nimmo et al., 2013) and a clear inflection points in the credit-exchange rate relationship (see Bahmani-Oskooee & Fariditavana, 2016).

Table 5c: Wald Asymmetry Test

Wald Test:
Equation: NARDL02

Test Statistic	Value	df	Probability
t-statistic	6.120597	24	0.0000
F-statistic	37.46171	(1, 24)	0.0000
Chi-square	37.46171	1	0.0000

Author Computations (2022). Note: Df refers to the degree of freedom

Table 5c presents the Wald test results for asymmetric effects, showing statistically significant asymmetry in both short-run and long-run relationships (F-statistic p-value = 0.000 < 0.05) and positive coefficient for exchange rate appreciations ($\Delta \ln RER_t^+ = 206.39$) that significantly differs from the negative coefficient for depreciations ($\Delta \ln RER_t^- = 213.11$). These findings confirm the presence of directional asymmetry in exchange rate effects on credit across all time horizons.

Theoretical implications

The significant impact of exchange rate shocks (both appreciation and depreciation) on domestic credit validates the core premise of first-generation models that currency fluctuations directly influence credit conditions. However, the asymmetric effects (stronger response to appreciation shocks) challenge the linear assumptions of these models, suggesting that nonlinear adjustments must be incorporated. The presence of self-reinforcing credit dynamics (evident in lagged DCP effects) aligns with second-generation emphasis on multiple equilibria. However, the finding that domestic interest rates (DINT) are insignificant contradicts the model's reliance on policy-driven speculative attacks, implying that credit markets in emerging economies may be less responsive to traditional monetary tools than assumed.

The strong feedback loops between exchange rate shocks and credit growth provide empirical support for third-generation theories that link currency and banking crises. The presence of persistent adjustment lags [evidenced by a significant error correction term (ECM)] further reinforces the notion that financial fragility builds up over time, increasing vulnerability to sudden stops (Chang & Velasco, 1998). The asymmetric responses to exchange rate shocks ($\Delta \ln RER^- > \Delta \ln RER^+$), along with the stronger influence of GDP growth compared to interest rates, suggest that modern financial crises are increasingly driven by balance-sheet mismatches (Bruno & Shin, 2015) and growth expectations (Mendoza & Terrones, 2012), rather than monetary policy alone. This highlights the need to expand crisis models to incorporate nonlinear credit dynamics and sectoral imbalances.

Conclusion and Recommendations

Conclusion

This study explores whether fluctuations in exchange rates have asymmetric effects on domestic credit in Nigeria between 1973 and 2022, grounded in the first-generation speculative attack model. ADF unit root tests indicate that only one variable is stationary at level, while others become stationary after first differencing. The NARDL bounds test confirms a long-term relationship among the variables, with diagnostic tests supporting model stability and no structural breaks or misspecifications.

The Wald test reveals significant asymmetric linkages between exchange rate movements and domestic credit in both the short and long term. Key findings show that currency appreciation exerts a more pronounced and lasting influence on credit compared to depreciation. Additionally, foreign interest rates

and GDP growth are key contributors to credit expansion, while domestic interest rates show limited impact, highlighting inefficiencies in monetary policy transmission. Furthermore, foreign exchange-driven credit booms present potential risks to financial stability.

Recommendations

The study's findings suggest the need for a shift toward macroprudential policy frameworks in Nigeria, with an emphasis on targeted financial stability measures rather than traditional interest rate instruments. Key recommendations include the introduction of asymmetric capital buffers and dynamic loan-to-value ratios to address the disproportionate effect of currency appreciation on credit growth. Additionally, adopting a managed float exchange rate system with strategic interventions can help curb disruptive foreign exchange volatility.

Financial regulators should strengthen oversight by enhancing early warning systems that incorporate nonlinear exchange rate thresholds and conducting regular stress tests to monitor emerging risks in the banking sector.

To address the influence of foreign interest rates on domestic credit, Nigerian authorities should enhance monitoring of global financial conditions and develop a responsive toolkit for managing capital flows. This could include temporary capital controls and adjustable reserve requirements, alongside encouraging financial institutions to diversify their funding sources in order to mitigate risks associated with global liquidity fluctuations.

Given the procyclical effect of GDP growth on credit, policymakers should implement automatic countercyclical measures, such as time-varying capital buffers during periods of economic expansion. At the same time, they should prioritise economic diversification to reduce the banking sector's concentration in volatile industries, promoting more stable credit flows across business cycles.

These complementary strategies would strengthen financial stability while supporting sustainable credit growth in Nigeria's evolving economic environment.

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