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RESEARCH PAPER

Real Exchange Rate and Economic Growth: The Interacting Role of Financial Development in Nigeria

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Abstract
This article gives empirical evidence that the real exchange rate can significantly affect sustainable productivity growth, which confirms the hypothesis that the effect critically depends on the degree of the economy's financial development. Following the relatively underdeveloped financial system in Nigeria, its exchange rate reduces the productivity growth of the economy. In this article, we consider the interacting effect of exchange rate fluctuation and the level of financial development instead of analyzing the exchange rate fluctuation in isolation. The empirical estimation is based on Nigerian data set covering the years 1980-2019; through the application of threshold autoregressive non-linear co-integration and the non-linear ARDL estimation. We further deploy a test of causality using the frequency domain that enables us to differentiate a temporal as well as a permanent causality. The findings appear that financial development amplifies the positive effects of the real exchange rate on Nigeria's economic growth. It also records that the uncertainty in foreign capital flows adversely affects Nigeria's output growth. The paper recommends that Nigerian policymakers should in their attempt to diversify and improve the future growth of the economy, promote adequate financial sector development since financial shocks are amplified with poorly implemented credit markets.
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Introduction

The choice of an exchange rate system in the developing countries is perhaps the most controversial feature of macroeconomic policy. The value to which one country exchanges its currency for the other has far more reaching implications. It determines their financial capacity regarding purchasing power parity on the international market. It defines the ability to attract foreign direct investment through conventional approaches to the cost-benefit analysis of investment opportunities. It also determines the value of export of the country's goods and services as well as the nation's ability to import adequate technological know-how needed to propel the economy for better productivity.

Considering the intense foreign criticism of the flexible exchange rate, system of China, on the other end, characterizes the Nigerian policymakers for doing not pretty good to stabilize the highly volatile Naira currency of the country. Yet, despite the supposed significance of the exchange rate system to sustainable economic growth and stability, the few existing empirical and theoretical literature gives not much guidance. In the theoretical studies, it is primarily geared towards the richer economies with strongly advanced markets and institutions (Obstfeld

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and Rogoff, 1996; Garber and Svensson, 1995), and offers almost little or no discussion of sustainable growth. While, the empirical literature on the volatility of the exchange rate and sustainable growth has increased tremendously with conflicting findings (Nwosu, 2016; Ismaila, 2016; Adeniran et al., 2014; Danmola, 2013; and Adelowokan, 2012) concentrated on the aggregate growth pattern of the exchange rate, with little or no attention to the interacting role of financial development in the relationship between exchange rate volatility and economic growth.

As a developing country, Nigeria's market size is small compared to its counterparts in Asia and other part of the world, with GDP and GDP per capita around US$398.19b and US$2,028b, respectively (World Bank, 2019). Nigeria found itself into recession by the year 2016 due to a fall in oil price at the foreign market. Nigeria's economy is affected by many macroeconomic factors, such as high rate of unemployment reaching a record highest of 23.1% in 2018, up from 18.1% in 2017 (World Bank, 2019). However, economic growth in Nigeria is yet to attain the desired level despite the effort put in place to diversify the economy. Nigeria have observed continuous currency depreciation since 1970s, which could be the reason behind the sluggish GDP growth. Salisu (2007) argued that this can also be linked to various reasons ranging from political instability to macroeconomic uncertainties. Taking in to account all of these instances, Nigeria's exchange rate–growth relationship needs to be examined.

In this article, we believe that it is essential to look at the relationship between real exchange rate and the level of financial development, instead of examining the volatility of the exchange rate in isolation. Earlier researches have shown that the development of the financial sector encourages growth sustainability, induces macroeconomic instability, or can play a key role in financial crises. Whether the extent of financial advancement also influences the effect of monetary structures, like that of the exchange rate regime, is an important issue that needs to be determined. Our underlying argument is that when economies are financially underdeveloped, the exchange rate regime, or, quite frequently, exchange rate fluctuation, has a negative effect on (long-term) growth. To validate these assertions, we take into account production function regressions to which the measure of the real exchange rate is added and also interact the real exchange rate with financial development in relation to Nigeria's economic growth.

This study organizes the structure of the research into four parts. First part presents the introductory section and the overview of the Nigerian exchange regime. The second section provides the reviews of related literature. The third part presents the data and the econometrics techniques deployed for the study. And finally, the fourth section present and discusses the results.

Overview of the Nigerian Exchange Regime

The real exchange rate and its impact on macroeconomic development continue to attract attention from multiple parties, including policy-makers, scholars, and development professionals, particularly in the developing and purchase-dependent nations like Nigeria. In these environments, policymakers follow different exchange rate regimes and regulations to mitigate imbalance and minimize volatility as often as plausible (Velasco, 1999), intending to create a conducive atmosphere to macroeconomic improvement and market development. Since the institution of the Bretton Woods in 1947, the Nigerian government has implemented different exchange-rate regimes. Table 1 shows the different exchange-rate regimes practiced by Nigeria and their related outcomes from 1957 to date.

Table 1. Transitional Process of the Nigerian Exchange Rate Regime

Exchange Rate Regime	Year	Transformations	Results
Fixed	1957 to 1973	*Nigerian Pound *Oil Boom *No devaluation	Nigerian Pound appreciated
Fixed	1974 to 1985	*Introduction of Naira *Currency devaluation *Import licenses and exchange control reform	Naira depreciated
Flexible	1986 to 2014	*Financial liberalization *Bidding and forex auction *CBN Interventions	Naira continues depreciation
Float	2014 to date	*Intentional CBN intervention and control measures *Realignment of the Naira *BDC reforms	Stable inter Bank rate with wider BDC rate

Source: Research finding.

With the 1958 creation of the Central Bank of Nigeria (CBN), as a benchmark for foreign settlement, the pound sterling had also been implemented as the legal tender comparable to the gold. The CBN managed a fixed-exchange-rate regime throughout this time, with a US dollar representing the gold (Ajakaiye and Ojowu, 1994). The crisis of the early 1970s that negatively hit the Bretton Woods system, where it greatly contributed to the fall in the value of the US currency and other foreign currencies, was a significant development throughout this period. The appreciation of the Nigerian pound from NP / US$2.80 throughout 1971 to NP / US$3.80 by 1973, despite the crisis. The tremendous inflow of foreign money from the first oil boom of 1973 resulted from this Nigerian Pound appreciation. 1973 through 1985 period witnessed another turning point in the foreign exchange process of Nigeria because the naira substituted the Nigerian pound by 1973. This era was dominated by enormous pressure on the naira to depreciate. That pressure arose from the assertion that, in relation to the anchor currency, the naira was overpriced. Following that, it devalued the naira to N0.66 / US$1 exchange rate.

Fortunately, it documented a barely noticeable appreciation of 0.2 percent to N0.62 / US$1 through 1974, before regulating between 1975 and 1979 by 0.1 percent to an average of N0.64 / US$1 due to a decrease in crude oil prices. As export earnings rose after enhanced oil prices, in 1980, the naira rose to N0.55 / US$1 prior to losing value by 2.9 percent and 14.6 percent to N0.74 and N0.89 / US$1 through 1983 and 1985, respectively. Throughout 1986, to deregulate the economy and remove disruptors that severely hampered viable growth, the Nigerian government formed the Structural Adjustment Program (SAP). The 1986 implementation of a flexible exchange-rate regime by the CBN was a critical feature of SAP (Nnanna, 2002; Adeoye and Atanda, 2012). Under SAP, numerous versions of flexible exchange rates occurred, reflecting the different reforms of forex market liberalization. The first one was launched in 1986 of the Second-Tier Foreign Exchange Market (SFEM). This was accompanied by the 1987 Foreign Exchange Market (FEM), the 1988 Interbank Foreign Exchange Market (IFEM), the 1995 Independent Foreign Exchange Market (AFEM), the 1999 IFEM, and the 2002 Dutch Auction System (DAS). The foreign exchange demand increased significantly following the two tiers merger via the FEM, leading to a gradual naira devaluation.

The emergence of the IFEM made it possible for banks to start trading in foreign currency with one another. Conversely, the exchange rate registered a loss in value of 55.9 percent from N0.89 through 1985 to N2.02 by 1986 and N7.65 / US$ by ending 1990. Increased dollar demand led to a further devaluation of N22.69 / US$ in 1993 under that same FEM before becoming relatively stable at an average of N21.88 / US$ by 1994 to 1998 (Danmola, 2013). Consequently, a drop in oil prices throughout the late 1990s, combined with the banking system's excess funds and a sustained fiscal deficit, led to a 76 percent devaluation of the naira

from N21.88 / US$1 as of 1998 to the corresponding N92.69 / US$ by 1999. The economic recession of 1997–1999 contributed to yet more devaluation of the naira to N116.12 / US$ throughout 2002. In the year 1999-2002, however, fluctuations in the parallel market price were partially mediated due to CBN interventions. The CBN formed the rDAS in 2002 as part of an attempt to rebalance the rate of exchange and eventually adopted the wDAS by 2005. That being said, the 2007 global financial crisis, which also followed a reduction in the value of crude oil, spurred to a further devaluation of the naira from N149.58 / US$ as of 2009 to N158.27 / US$ by 2011. As part of strategic approaches to managing the financial crisis, the reinstatement of the rDAS by 2012 contributed to a further devaluation of the naira to N180 / US$ by October 2014 supposed to follow oil-price volatility. Since that time, the exchange rate has seen a constant devaluation. The unstable price of oil in the global market can be identified as the main cause of fluctuation in the Naira exchange rate. This would be the direct consequence of a unitary economy largely dependent on revenues from crude oil.

Literature Review

After the deregulation of the international foreign exchange markets, more research interest has been paid to exchange-rate dynamics. The contributing factors of the exchange rate are also included in a special area of research. Several researchers have documented the correlation between exchange-rate fluctuations and economic growth. Prior studies involve Connolly (1983), Gylfason and Schmid (1983), and Kamin and Klau (1998), who predominantly observed that depreciation led to expansionary growth. Subsequent research, however, offered evidence for the contractionary impact of devaluation on the development (Gylfason and Radetzki, 1985; Berument and Pasaogullari, 2003; El-Ramly and Abdel-Haleim, 2008; Odusola and Akinlo, 2001). Other research showed mixed findings. For instance, El-Ramly and Abdel-Haleim (2008) concluded that the negative impacts of exchange-rate movements on growth lasted many years until the simulative effect could emerge. In the meantime, Rhodd (1993) and Edwards (1986) found a short-term expansionary impact and a long-term expansionary response.

In the meantime, with the Autoregressive Distributed Lag (ARDL) co-integration analysis approach, Obeng (2017) looked at the impacts of exchange-rate fluctuations on non - conventional exports in Ghana. Such a study showed that exchange-rate fluctuations had damaging consequences on Ghana's non - conventional exports, the consequences become more prominent in the longer term than in the shorter term. Comparably, Phiri (2018) examined the standard assertion of a linear association between exchange-rate fluctuations and smooth transition regression (STR) in South-Africa and established a non-linear association between exchange-rate fluctuations and economic growth. The study indicated, indeed, that the Reserve Bank of South Africa regime-shifting conduct is encouraged by the size of government, but that exchange-rate uncertainty has a major impact on economic growth, particularly when government spending growth is below 6%. However, the result revealed that the degree to which exchange-rate fluctuations will influence economic growth depends completely on how fiscal authorities react to global economic shocks.

Employing the annual dataset of China from 1980 to 2017, Khan et al. (2019) used the ARDL boundary test to evaluate the impact of macroeconomic parameters on the USD / CYN exchange rate. The analysis indicated that trade openness and the GDP had a positive impact on the exchange rate, although interest rates negatively affect inflation. Research findings have used various approaches to estimate the adverse effects of exchange-rate fluctuations on the growth of the Nigerian economy (Oloyede and Fapetu, 2018; Eneji et al., 2018). Besides, Iyeli and Utting (2017) observed a long-term positive correlation between exchange-rate fluctuations and the growth productivity in Nigeria, through the Johansen cointegration approach. With the

application of GARCH, Dickson (2012) utilized the annual data of 1970-2009 to assess the impact of exchange rate fluctuation on Nigeria's output growth, and reported that economic growth reacted positively to the volatility of the exchange rate in the short term, but negative in the long-term. Likewise, Owolabi and Adegbite (2013) analyzed the annual dataset from 1991 to 2010 employing OLS and discovered that exchange-rate fluctuations negatively impacted Nigeria's economic output of products local and imported. Yakub et al. (2019) examine the influence of exchange-rate fluctuations on international trade in Nigeria through GARCH and ARDL bound technique of cointegration and observed a negative effect in the short term, but no clear effects in the long term. Similarly, Nsofor et al. (2017) investigated the impact of exchange-rate fluctuations using GARCH and GMM on Nigeria's output growth and, like most others, observed that the uncertainty and FDI had a major adverse effect on such growth output. Through the application of VECM, Adelowokan et al. (2015) also recorded that fluctuation in exchange rates had a negative effect on Nigeria's investment and growth.

The findings have indeed been mixed, amid an array of literature mostly on linkages between exchange-rate fluctuations and Nigeria's real sector growth. For instance, Lawal et al. (2016) found no impact on output growth in the long term from exchange-rate fluctuations, although they discovered proof of a short-run association. Though, for most of the part, uncertainty has been observed to have an adverse impact on Nigeria's economic prosperity. As far as we know, no prior studies in this field have used composite econometrics techniques of threshold autoregressive non-linear co-integration, non-linear ARDL, and frequency domain causality methods for the analysis. Besides, the choice of the variables (i.e., exchange rate volatility, financial development, financial globalization uncertainty, and economic growth), more so, the interactive role of financial development in the relationship between exchange rate fluctuation and economic growth distinguishes this study from the past literature, therefore we intend to fill this gap.

Methodology

We build the empirical model for the analysis on the endogenous growth model with such an expansion to dynamic productivity improvements that describes the association between growth as a function of the marginal product of capital and technological change (A) as proposed by Rebelo (1991).

$$Y_t = AK_t \tag{1}$$

Where Y_t denotes the productivity growth over the period $_t$, A stands for the technological transformation, while K_t represents capital over the period $_t$, that comprises of both financial and human resources. The total factor production equals the marginal product of capital. More so, $Y = C + S$, implying that the output can only be consumed or saved.

In the current study, therefore, we are extending the endogenous growth model in order to examine the Nigerian economic situation in the presence of financial development and the lingering volatility in the exchange rate. The model mathematical function is specified as:

$$GDP = f(FD, EXR, FGU) \tag{2}$$

Where GDP represents Nigerian economic growth, FD represents the financial development, EXR stands for exchange rate volatility measured; FGU denotes the financial globalization uncertainty.

The econometric equation of the model is given as:

$$GDP_t = \beta_0 + \beta_1 FD + \beta_2 EXR + \beta_3 FGU + u_t \tag{3}$$

where u_t represents the error term and $\beta_1 to\ \beta_3$ are the variable estimates of the model. The parameters are in logarithm to enable adjustment for differences in measurements and units.

Data Sources and Measurements

Our study used annual time series data for the Nigerian economic growth (real GDP annual growth), the exchange rate volatility (Real effective exchange rate), the financial globalization uncertainty (lagged one period of foreign direct investment inflows), and financial development (through principal component analysis using five components i.e. market capitalization, domestic credit to the private sector by other financial institutions, lending rate, domestic credit provided to the private sector by the banks and broad money). The aforementioned indices are widely applied in the literature to measure the scrutinized variables (Ahmad et al., 2018; Adusei, 2016; Karimo and Ogbonna, 2017; Farouq et al., 2020c; Danlami et al., 2018). The study covers the period from 1980 to 2019 (Chen et al., 2020). The availability of data informed the time period. The data are mainly obtained from the World Bank Database (World Bank, 2019). For this research, we deployed the threshold autoregressive non-linear co-integration, non-linear ARDL, and frequency domain causality. The study considers the asymmetric technique because; it first decomposes the variable of interest into their respective partial sum of negative and positive squares and examine their impacts without incorporating a dummy locking up shifts in regimes while significantly reporting their asymmetric behaviors. Secondly, it integrates bound testing into the long run and synchronously calculate with the short run while reserving the data-generating procedures, leading to robust estimates. Thirdly, its ability to assess the temporal dynamics in exchange rates as it tries to adjust from a background generated by short-run dynamics and initial disequilibrium to new-found stability (the dynamic multiplier).

BDS Test

The test of BDS was first developed by Brock Dechert and Scheinkman in the year 1987. BDS is one of the most powerful methods in time series for the identification of serial dependency. The BDS analysis is used to check the presence of nonlinear dependency in the residual series estimated after the fitness of the ARIMA model has been established (Chu, 2001). Test statistics are followed asymptotically by the normal curve. The null hypothesis indicates the independent distribution of the residuals and likewise against the alternate hypothesis that the instances assume many variations that make their dependency nonlinear. The fundamental theory of the BDS experiment is based on the idea of integral association, which tests the intensity at which the sequence reinforces the spatial pattern. The BDS analysis depends only on signs of a concurrent return, with no interest in its measurements, and does not include any assumptions about the nature of returns. A sequence of considerably fewer or many runs shows that the study is also not spontaneous (Chu, 2001). The BDS assumption follows:

$$H_O: f_n = f_1^n \tag{4}$$

$$H_1: f_n \neq f_1^n \tag{5}$$

the null hypothesis is commonly rejected at 5 percent P-value when the $f_n > 1.96$

$$I_t = 1\ if\ |x - y| < \in \tag{6}$$

Similarly, BDS relies on the correlation as:

$$\mathrm{C}(m, \in, T) = \frac{I[(t,s):\|X_t^m - X_s^m\| < \in]}{T^2} \tag{7}$$

where $X_t^m = (x(t).....,x(t-m+1)), \|.\|$ Is the l_∞ norm on R^m, and $I[.]$ indicates the number of elements subject to only modest regularity conditions as $T \to \infty, \mathrm{C}(m, \in, T)$ has limit $\mathrm{C}(m, \in)$ such that if $\{x(t)\}$ is iid, it then follows:

Unit Root

This research used the advanced ESTAR unit root put forward by Kapetanios et al. (2003) and the DF-GLS unit root. Regarding an attempt to resolve the eminent low-power issue of unit root tests, Elliott et al. (2006) developed a series of powerful unit root tests based on GLS-distended results. In their paper, ERS suggested a simple change of the ADF test based on GLS-detrending and demonstrated that the suggested test, known to as the DF-GLS test, was more effective than the ADF test. KSS 's nonlinear unit root testing is based on the fraying of a unit root against the nonlinear and broad fixed exponential STAR (ESTAR) philosophy of the elective principle. Consider the accompanying protocol for ESTAR:

$$\Delta f_t = \rho f_{t-1} + \sigma f_{t-1}\{1 - \exp\{-\varphi(\sigma f_{t-1} - r)^2\} + \omega_t \quad (8)$$

$$\Delta f_t = \pi + \delta f_{t-1}^3 + \sum_{i=1}^{k} a\Delta f_{t-1} + \omega_t, \qquad t = 1,2, \dots \dots \dots .T$$

Threshold Autoregressive Model

In this segment, we will analyze the long-run relationship between exchange rate fluctuation, financial development, financial globalization uncertainty, and economic growth, through the application of Enders and Granger (1998) the threshold cointegration approach. This cointegration technique is built on the two phases of the residual-dependent procedures. The first phase equation is specified as:

$$y_{1t} = \alpha_1 + \alpha_2 y_{2t} + h_t \quad (9)$$

$$\Delta h_t = \rho h_{t-1} + z_t \quad (10)$$

$$\Delta h_t = \begin{cases} \rho_1 h_{t-1} + z_t, & if \quad h_{t-1} \geq 0 \\ \rho_2 h_{t-1} + z_t, & if \quad h_{t-1} < 0 \end{cases} \quad (11)$$

$$\Delta h_t = I_t \rho_1 h_{t-1} + (1 - I_t)\rho_2 h_{t-1} + z_t \quad (12)$$

$$\Delta h_t = I_t \rho_1 h_{t-1} + (1 - I_t)\rho_2 h_{t-1} + \sum_{i=1}^{q-1} \emptyset_i h_{t-1} + z_t \quad (13)$$

The pressing matter that emerges when testing a non-linear model is the option of an obscure limit. Strong econometric approaches have been developed to determine the ideal edge. That ideal edge value must be chosen so that the base RSS of the fitted model can be extracted from the Chan (1993) plot. Enders and Granger (1998) used Chan's procedure to measure the intelligence limit benefit. The AIC and BIC selection measures will be used to choose the suitable model (best fit model) between the TAR and the M-TAR models.

Asymmetric Error Correction Model

Building a non-linear integration with the M-TAR model threshold allows us to calculate the responses of exchange rate volatility to growth domestic product movements with an asymmetric error correction term. In this analysis, the correction of asymmetrical errors can be expressed as

$$\Delta LGDP_t = v_1 + v_2 Zplus_{t-1} + v_3 Zminus_{t-1} + \sum_{i=1}^{k} \Omega_i lfd_{t-1} + \sum_{i=1}^{k} \pi_i lfgu_{t-1} +$$

$$\sum_{i=1}^{k} \mu_i lexr_{t-1} + \sum_{i=1}^{k} \varphi_i lfgu_{t-1} + \sum_{i=1}^{k} \tau_i lexr * fd_{t-1} + z_t \quad (14)$$

Non-Linear Autoregressive Distributive Lag

The NARDL method is the asymmetrical creation of a basic linear ARDL technique to verify the degree of long-term associations. Pesaran et al. (2001) developed the method and expanded it to Shin et al. (2009), thus providing partial sum decomposition of nonlinearity. The approach, therefore, models long-term relationships and complex ways of adapting at the same time in a natural way. Applied to. This method includes the decomposition of the selected variable. Simply put, the analysis breaks down the exchange rate fluctuation into negative and positive sub-parameters. EXR+ and EXR- represents partial positively and negatively changes. It can be measured as:

$$X_t = b^{+}Y_t^{+} + b^{-}Y_t^{-} + u_t \quad (15)$$

where X_t is the f × 1 vector of economic growth, t stands for the period; Y_t is the f × 1 vector of multiple regressors given that $Y_t = Y_t + Y_t^{+} + Y_t^{-}$, standing in place of the natural logarithm of economic growth; μt represent error term; and b^{+} Are the integrated asymmetric parameters of the long run, depicting that exchange rate reacts asymmetrically during increase and decrease periods.

Frequency Domain Causality

For traditional causality tests implemented in prose, the causality of incidence space provides a systematic point-by-point representation of causality over multiple recurrence locations by plotting the allocation of causality with recurrence classes that run from low to large. The essential engagement of this approach involves the inefficiency of the causal effect over the different recurrence classes, is important, and can show how the causal force differs. By using a recurrence area causality technique, we are based around the prescient strength of exchange rate volatility variables that are urgent to the predicted future trend of natural corruption. Like the traditional causality test conducted by Granger (1969), the recurrence area strategy distinguishes the prescient strength of biological variables step by step from fluctuating and rapidly fluctuating groupings. The frequency-domain causality was commonly used to evaluate the correlation between the neural data (Zhou et al., 2016). It has been extended to include empirical studies in finance and economics (Ozer and Kamisli, 2016; Gül and Özer, 2018). The study specifies it as:

Let $P_t = \left[y_{1t,}\, x_{1t}\right]$ be a two-dimensional vector of length T. consequently, the VAR illustration of the system can be stated as below:

$$\emptyset(L)Z_t = \varepsilon_t \quad (16)$$

The system can be expressed as:

$$Z_t = \emptyset(L)\varepsilon_t = \lceil \varphi_{11}(L)\varphi_{12}(L) \rceil \quad (17)$$

$$Z_t = \emptyset(L)\varepsilon_t = \begin{vmatrix} \varphi_{11}(L) & \varphi_{12}(L) \\ \varphi_{21}(L) & \varphi_{22}(L) \end{vmatrix} \begin{vmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{vmatrix} \quad (18)$$

$$= \tau(L)\varepsilon_t = \begin{vmatrix} \tau_{11}(L) & \tau_{12}(L) \\ \tau_{21}(L) & \tau_{22}(L) \end{vmatrix} \begin{vmatrix} \pi_{1t} \\ \pi_{2t} \end{vmatrix} \quad (19)$$

where $\emptyset(L) = \emptyset(L)^{-1} and\ \tau(L) = \emptyset(L)G^{-1}$. y_t can be written as below:

$$f_x(\omega) = \frac{1}{2\pi}\{\left|\sigma_{11}\left(\varepsilon^{-i\omega}\right)\right|^2 + \left|\sigma_{12}\left(\varepsilon^{-i\omega}\right)\right|^2\} \quad (20)$$

$$M_{x\to y} = \log\left(1 + \frac{\left|\sigma_{12}(\varepsilon^{-i\omega})\right|^2}{\left|\sigma_{11}(\varepsilon^{-i\omega})\right|^2}\right) \quad (21)$$

$$x_{1t} = \partial_1 x_{1t-1} + \ldots\ldots\ldots + \partial_p x_{1t-p} + \theta_1 y_{1t-1} + \ldots\ldots\ldots + \theta_p y_{1t-p} + \varepsilon_{1t} \quad (22)$$

The null hypothesis $M_{x\to y}(\omega) = 0$ which can be computed as:

$$H_o: \begin{cases} \sum_{j=1}^{p} \rho_{1j} \cos(j\omega) = 0 \\ \sum_{j=1}^{p} \rho_{1j} \sin(j\omega) = 0 \end{cases} \quad (23)$$

Result and Discussion

Table 2 shows the descriptive statistics along with the correlation matrix. The findings indicate that EXR has the highest volatility among the variables, and economic growth appear to be less volatile than the financial globalization uncertainty and financial development. Meanwhile, in all the parameters, the mean surfaces the standard deviation, which tells well about the data collection. Besides, the kurtosis and skewness values of the data show potential asymmetry in the distribution. Thus, we pay attention to the asymmetric in the empirical analyses. For the correlation matrix results, considering the correlation values, none of the variables appear to have a multicollinearity issue.

Table 2. Descriptive Statistics

	LGDP	**LEXR**	**LFD**	**LFGU**
Mean	1.323	15.953	11.227	23.084
Std. Dev.	1.019	12.575	5.105	2.915
Skewness	-2.181	1.710	1.100	0.407
Kurtosis	8.638	5.095	2.510	1.721
	LGDP	LEXR	LFD	LFGU
LGDP	1.000			
LEXR	0.327*	1.000		
	(0.000)			
LFD	0.309*	0.314*	1.000	
	(0.000)	(0.000)		
LFGU	0.043*	0.331*	0.327*	1.000
	(0.000)	(0.000)	(0.000)	

Source: Research finding.

Diagnostic Tests

Table 3. Diagnostic Tests

χ^2_{NT}		χ^2_{SERIAL}	χ^2_{ARCH}
GDP=F(EXR, FD,FGU)	0.523	0.710	1.813
	(0.405)	(0.439)	(0.207)

Source: Research finding.

All the P-values in the three diagnostic tests above are insignificance. Hence, the data is said to be free from serial correlation and heteroscedasticity; also, the normality test shows the data is normally distributed.

BDS Test

The test of BDS is used to assess the asymmetric nature of time series results. In specific, the test was used for the residual data series generated from ARIMA models (Dorina and Simina, 2007). The test was named after prominent economists, Brock, Dechert, and Schneinkman. The test is premised on the idea that the series exhibits randomness within the sequence against the alternative presumption that the sequence is asymmetric within the model. In addition, for the findings of the BDS test, see Table 4. This table indicates that the null hypothesis is dismissed at a significance level of 1% in all the proportions. This indicates a nonparametric structure.

Table 4. BDS Linearity Test

Series	D2	D3	D4	D5	D6
LGDP	0.376*	0.375*	0.231*	0.281*	0.926*
LEXR	0.510*	0.422*	0.132*	0.384*	0.503*
LFD	0.089*	0.120*	0.148*	0.659*	0.415*
LFGU	0.046*	0.058*	0.076*	0.051*	0.047*

Source: Research finding.

Unit Root

The below Table 5 shows the results of the standard unit root tests, DF-GLS, demonstrating that the unit root null could not be rejected at 5% for all the variables evaluated at a level. But after first differencing we were able to reject the null hypothesis of no stationary, thus I(1). It's quite well-founded that conventional linear unit root test possesses lower power when non-linear effects depict the process of generation of series results. Due to the higher level of heterogeneity and breakage in these datasets (exchange rate volatility), traditional unit root testing can result in misleading results. In this analysis, we will also conduct a newly developed unit root test that incorporates nonlinearities into the framework to estimate the nonlinear stationarity of the variables in the sequence. In addition, the results of the KSS root unit tests are shown in Table 4, which reveals that the KSS test does not reject the null hypothesis for all variables at level, rather at first difference. Thus, after the first difference I (1), our variables become nonlinear stationery.

Table 5. Stationarity Test of Unit Root

VARIABLES	DF-GLS	KPSS
LGDP	-1.723	-1.135
LEXR	-1.882	-2.912
LFD	-2.742	-3.808
LFGU	-1.130	-3.384
ΔlGDP	-4.921*	-4.162*
ΔlEXR	-4.491*	-5.733*
ΔlFD	-3.321**	-4.013*
ΔlFGU	-3.371**	-5.832*

Source: Research finding.

Optimal Lag Selection Criteria

The use of optimum lag selection criteria while selecting an acceptable lag is crucial in dealing with the recent econometrics methods as the case may be in the present study. In deciding the length lag, five parameters for the selection of orders in the table below are regarded. The

criterion of the lowest value gives us the optimum lag (Farouq et al., 2020).

Table 6. Lag Selection Summary

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-131.246	21.239	0.934	6.870	6.714	6.974
1	-53.813	67.474	0.416	2.530	2.807*	2.632
2	-21.412	21.824*	0.105*	2.276*	3.535	2.752*
3	-20.056	2.932	0.966	2.348	3.670	3.182
4	-31.126	15.863	0.132	2.872	4.253	3.734

Source: Research finding.
Note: * indicates lag order selected by the criterion.

Co-integration Test

Table 7 below presents the MTAR and TAR models. We estimate the M-TAR through the adjustment speed differential variation. With the HQC vectors indicating the TAR and the M-TAR models having an optimal lag of 2. The BIC and AIC all show that the momentum model is the most appropriate for Nigeria. The results of the M-TAR and TAR reveals that we can reject the null hypothesis of $\rho 1 = \rho 2 = 0$ at the 1% significance level. This follows that exchange rate fluctuation, financial development, financial globalization uncertainty, and economic growth are cointegrated, the asymmetric. The study evaluates the null hypothesis through normal F-statistics (Enders and Granger, 1998).

The symmetric adjustment could not reject the null hypothesis in both the M-TAR and TAR estimates. The result reveals that in line with the M-TAR and TAR specifications, there is no symmetric in the adjustment between exchange rate fluctuation, financial development, financial globalization uncertainty, and economic growth. However, the TAR threshold model rejects both the null hypothesis of no long-run relationship and the corresponding symmetric adjustment at a 1% significance level. This means that the aforementioned variables are cointegration with a significant asymmetric adjustment. This offers empirical evidence to the presence of an asymmetrical threshold for the long-run relationship between exchange rate fluctuation, financial development, financial globalization uncertainty, and economic growth in Nigeria. As such, these variables are asymmetrically interdependent, making it extremely hard for investors to achieve adequate diversification of portfolios.

Table 7. Cointegration Asymmetric Results

	TAR	T-Statistics	Momentum TAR	T-Statistics
ρ^1	-0.952**	2.566	-0.971**	2.742
ρ^2	-0.784**	2.412	-0.743**	2.191
γ^1	0.857*	3.456	0.781**	2.304
γ^2	0.436*	5.891	0.429**	0.174
Tau	0.000		0.000	
F-Joint $\rho^1 = \rho^2 = 0$ $\Phi/_{\phi M}$	4.432**	10.770	4.532*	10.309
F-equal $\rho^1 \neq \rho^2 \neq 0$	0.191*	3.542	0.349*	1.582

Source: Research finding.

Besides that, we observe that the speed of adjustment to the long-term equilibrium appears to be statistically significant going by Table 7. Following that, the model satisfies the convergence criteria. This implies that it will take only 15 percent (the coefficient. of

$Zminust-1$) speed for the model to reverts to its equilibrium in the case of deviations from the lower regime. While higher regime disequilibrium term, approximately 12% (coefficient. of $Zplust-1$) adjustments speed to revert to its long-term equilibrium. Regarding the findings below, we can make a conclusion that the speed of adjustment is quicker in the lower regime.

Table 8. MTAR Error Correction Model

Dependent variable: $LGDP_t$			
Variables	**Coefficients**	**Standard error**	***p*-value**
$\Delta LGDP_t$	0.734*	0.154	0.000
	[4.766]		
$\Delta LEXR_t$	1.444*	0.138	0.000
	[10.438]		
ΔLFD_t	0.410**	0.041	0.000
	[3.417]		
$\Delta LFGU_t$	0.350*	0.058	0.000
	[6.050]		
$ZPLUS$	-0.102*	0.102	0.003
	[-3.185]		
$ZMINUS$	-0.152*	0.042	0.000
	[-3.618]		

Source: Research finding.

Estimation

Following the below NARDL estimation result in table 8, the long-run result depicts both the positive and the negative decomposition of the variable of interest (exchange rate). For the positive decompose variable of the exchange rate (, considering its insignificant P-value. This signifies that no significant relationship exists between the increase in the exchange rate and the corresponding productivity growth decrease in Nigeria. It is widely expected that as a country's exchange rate appreciates, the accompanying economic growth of such an economy decreases, and the expected reason is due to the increase in the price of such currency to the outside world, which normally makes its import cheaper as against export. More so, the country's import is thereby encouraged in relation to the corresponding export. Thus, aggregate economic growth decreases. But this is contrary to what is obtainable in the Nigerian context, as Nigeria is nearly a mono-cultural economy, such that the substantial proportion of its export is from a single product (i.e. crude oil), thus, the accompanying disadvantage of the exchange rate appreciation is not reflected on the country's growth, because the economy is still yet to attain the needed active diversification required to make changes on the export opportunities. This result supports the findings of Adeniran et al. (2014) among others.

On the other side, the second leg of the decompose exchange rate variable (reveals that the depreciation of the Nigerian exchange rate is accompanied by a complementing decrease in the productivity growth of the Nigerian economy. Table 8 below shows that one unit decrease in exchange rate brings about a 21 percent decrease in the Nigerian economic growth. And the possible explanation to this is linked to the real options theory and the purchasing power parity theory, following the justification of Serven (1997); Belke and Setzer (2003); Hirschman (1943); Belke and Gros (2001), who reveals that exchange rate continuous devaluation explains waiting and postponement behaviors in relation to investment decisions. Therefore, an increase in devaluation in the exchange rate may discourage firms from increasing investment and creating employment, which will subsequently affect the productivity growth of the economy.

Meanwhile, the financial development in relation to economic growth result indicates that a one-unit increase in FD will increase economic growth by 34 percent, the finding supports the wide range of literature (Shahbaz et al., 2017; Asteriou and Spanos, 2019; Afonso and Blanco-Arana, 2018). Similarly, in the case of financial globalization uncertainty, the result reveals that

a one-unit increase in the FGU will also bring a negative change in the Nigerian economic growth by 12 percent. Notably, financial globalization uncertainty implies shocks in foreign capital flows. Therefore, a feasible explanation for this result is that a shortage in the foreign capital flows to the Nigerian economy will have an adverse effect on its economic growth, and this is considering its high dependence on the foreign finances towards the local investments.

Lastly, it is worthy of note that our interaction term shows a statistically significant and positive result, which indicates that the effect of the exchange rate in relation to the Nigerian economic growth increases with the presence of financial development. This implies that the relationship between the exchange rate and economic growth is strengthened if accompanied by financial development. As such, a one-unit increase in the exchange rate will result in a corresponding increase in economic growth following the interactive role of financial development by 43 percent. We, therefore, conclude that financial development assists in mitigating the adverse effect of exchange rate misalignment. This finding reveals that as the financial development increases, the adverse effect of the exchange rate on growth productivity reduces, which means that FD provides protection to the economy through the provision of better hedging techniques against exchange rate risks. We, therefore, recommend that Nigeria still needs to enhance the performance, structure, and efficiency of the financial sector so as to reap from the benefit. This is in line with Jehan and Irshad (2020); Sekkat (2012); Aghion et al. (2009); and Elbadawi et al. (2012) among others.

Table 9. Short Run NARDL

Variable	Coefficient	Estd.Error	t-Statistics
$LEXR_t^+$	0.601*	0.149	4.035
$LEXR_t^-$	0.315*	0.067	4.702
LFD_t	0.407*	0.124	3.283
$LFGU_t$	-0.303*	0.087	3.483
$LInt_t$	0.237*	0.049	4.837
F-Statistics	237.43[0.006]		
R-Squared	0.528		
Adjusted R-Squared	0.454		
Long Run NARDL			
Variable	**Coefficient**	**Estd.Error**	**t-Statistics**
$LEXR_t^+$	-0.142	0.893	0.159
$LEXR_t^-$	0.215*	0.068	5.102
LFD_t	0.346*	0.093	3.697
$LFGU_t$	-0.128*	0.041	3.122
$LInt_t$	0.433*	0.087	4.970

Source: Research finding.

Causality

The below Table 10, presents the causality result summary which shows that the Wald statistics surface the critical values at a 5% frequency level of significance, which indicates the short and long-run causality across LFD and LFUG to LGDP, and in line with Moses et al. (2020), there exist only a short run causality concerning EXR in relation to GDP. Similarly, FGU is also having a short run causality as well. The result clearly implies that LFD is the most essential factor for predicting LGDP at different frequencies. To be precise, the findings follow the evidence that LFD leads to the transformation of real sector growth at a very higher frequency phase corresponding to the short and long-term. It implies that for short and long-run cycles, the financial development, exchange rate, and financial globalization uncertainty can be used

to calculate variability in the Nigerian Economic growth. The causality result support many past theoretical and literature studies whose findings show that FD causes GDP (Farouq et al., 2020; Ohlan, 2017; Kassi et al., 2017; Sehrawat and Giri, 2016; Ductor and Grechyna, 2015; Schumpeter, 2011; King and Levine, 1993).

Table 10. Frequency Domain Causality Test

	Long-run		**Medium-term**		**Short-run**	
	0.01	0.05	1	1.5	2	2.5
$LEXR_t \rightarrow LGDP_t$	0.471	0.293	0.752	0.893	6.258*	9.728*
$LFD_t \rightarrow LGDP_t$	8.8927*	14.731*	0.221	0.698	6.794*	6.394*
$LFUG_t \rightarrow LGDP_t$	0.502	0.328	0.516	0.763	5.752*	4.560*

Source: Research finding.

Conclusion

This paper presented empirical evidence regarding the relationship between the exchange rate, financial development, financial globalization uncertainty, and Nigeria's economic growth. We first carried out a co-integration test to validate the presence of long-run asymmetric relationship among the variables, after which we conducted a test to ascertain the nonlinear relationship between the exchange rate and the economic growth, where we found the positive decomposed variable of the exchange rate to be insignificant in relation to economic growth. On the other hand, the negative decomposed variable of the exchange rate recorded a negative and significant relationship with economic growth. Meanwhile, through the interactive role of financial development, the exchange rate became positively related to economic growth. In the case of financial globalization uncertainty, the relationship appeared to be negative. We additionally examined the frequency causality among the variables, finding that financial development is the true causal factor for Nigeria's economic growth, even though the result recorded that both the financial globalization uncertainty and the exchange rate causes economic growth, but only in the short term regime, which does not necessarily translate into sustainable growth.

Nevertheless, from our empirical analysis, it was highlighted that the exchange rate in the presence of an efficient financial system is positively related to productive growth. Therefore, we recommend that policymakers should pay more attention to policies that would promote the efficient and functional financial system in order to become resilient in the event of foreign capital shortage, as well as encourage local production and active diversification, thus, export promotion to a sustainable surplus balance of trade. In addition, there should be a conducive business-friendly environment, sufficient security, infrastructural facilities, and effective fiscal and monetary policies to attract foreign investors in Nigeria.

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