Lafia Journal of Economics and Management Sciences: Volume 7, Issue 1; 2022
ISSN: 2550-732X
Published by Department of Economics, Federal University of Lafia, Nigeria

Institutional Quality and Exchange Rate Volatility in Nigeria: A Nonlinear Autoregressive Distributed Lag Approach

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Abstract
This study examines the impact of institutional quality on exchange rate volatility in Nigeria. The period of investigation spans 1981 – 2020, using annual data from World Bank, Central Bank of Nigeria, international country risk guide and National Bureau of Statistics. The technique of analyses is based on the Nonlinear Autoregressive Distributed Lag model this was purposely to examine the asymmetric impacts of the measure of institutional quality on exchange rate volatility in Nigeria. The institutional quality variables used are contact intensive money, revenue source volatility, political risk factor and policy unpredictability proxied as changes in exchange rate policy while trade openness and financial sector development were used as control variables. The Nonlinear Autoregressive Distributed Lag model was carried out after ensuring the stationarity properties of all variables and establishing the existence of long run relationship among the variables. Specifically, political risk factor and revenue source volatility all have negatively significant impacts on exchange rate volatility in Nigeria. Also the level of financial sector development and trade openness has negative impact of exchange rate volatility for the period under study. The findings are suggestive of restructuring of the political space and economic diversification as the major antidotes to reducing the volatility of exchange rate in Nigeria. Also, there should be diversification away from monolithic economy such that attendant global dynamics in oil prices and demand would have less effect on exchange rate volatility in the country. Doing this will substantially reduce revenue source volatility of the Nigerian economy.

Keywords: Exchange Rate Volatility, Institutional Quality, Nonlinear Autoregressive Distributed Lag
JEL Classification: C22, C52, D72, E02, F31

1. Introduction

Institutional quality is to be understood in its widest sense, including both formal rules of the game, such as laws and regulations, and informal

rules of the game, such as norms and values. Formal and informal institutions are often interconnected and affect each other both ways. The most prominent societal role of institutions is to reduce uncertainty (Menard & Shirley, 2005). Early insights into the role that institutional quality can play in good economic outcome can be dated back to (Smith, 1776; Buchanan, 1977; North, 1990). As it gives the prerequisite for an efficient institution and it clearly states the roles of government. These include protection of property right, maintenance of law and order and a clear blue print of the rule of law and arbitrary power exercise by the state. (North, 1990) clearly states that political and economic institutions are the underlining determinant of economic outcome as they form he fulcrum of the society. Different factors from the literature have been attributed to the reason for the volatility of exchange rate, but the quality of institution is another instituted salient factor also contributing to the undesirable exchange rate in Nigeria through the exchange rate management.

A verifiable inference from the literature is that, the quality of institutions act as an important precondition for good exchange rate management. The more qualitative are institutions, it is expected that the greater the tendency for increase in efficiency of the exchange rate management by ensuring the stability of exchange rate. It is clear that the right exchange rate policies and programmes in developing countries like Nigeria are not fully implemented due to largely institutional weaknesses (Chousa, Pineiro, Haider, Melikyan & Tamazian, 2005). Institutional factor and reforms are necessary prerequisites for a good exchange rate management in Nigeria. In Nigeria, traditional emphasis has been placed on the maintenance of good macroeconomic policies which keeps inflation low, stabilizes the exchange rate and maintaining equitable balance of payment. Recent developments, however, have moved away from such considerations to one that essentially deals with the role of institutions as driver of good economic outcome (Acemoglu, Simon, James & Thaicharon, 2003).

In curtailing the volatility of exchange rate in Nigeria, the Federal Government, through the Central Bank of Nigeria, has adopted several policies and programmes to galvanize the economy into a steady growth path (Bilquees, 2004). Since the wake of independence in the 1960s, the domestic currency of naira has been pegged against one international reference currency or the other. It began with the United Kingdom pound sterling and later against the United States dollar. At later time, the exchange rate management followed a market liberal approach where the domestic currency alternates between fixed and floating systems (Belke, 2015). Over the years, the central bank of Nigeria (CBN) has employed more of managed-float exchange rate arrangement where the domestic currency is

only allowed to fluctuate around a particular band or threshold. Still, the volatility of the exchange rate is prominently evident.

Despite the various efforts by the Nigerian government to maintain a stable exchange rate, the naira fluctuated throughout the 1980s and continued to the year 2020. It dwindles around ₦0.61 to ₦3.507 from 1980 to 1990 and from 1991 to 2000 it depreciates around ₦21.886 to ₦ 65.047 against US dollar. Between 2001 to 2010, it further remains unstable and move around ₦118.97 to ₦198.65 against the dollar. Policy aimed at salvaging the situation could not yield the desired result as it continue to be volatile from 2011 to 2020 from ₦157.5 to ₦440.2 (CBN, 2020). In fact, some economists and financial analysts have posited that exchange rate intervention has been under price (that is, under-value) or overprice (that is, over-value) the domestic currency and that the efforts to correcting these imbalances would even introduce more volatility. Despite all efforts, it is still clear and obvious that the objectives linked to these policies and programmes have not been achieved. Similarly, political office holders, rent seeking and the long rain of military incursion in the decisions of the management of the economy could be some of the salient issues that has prevented exchange rate to be stable in Nigeria. Also the conventional parameters necessary to stabilize the exchange rate like the quality of institution are not given many attentions (Cechhetti, 1999)

It is plausible to say that when political and economic institutions are not properly checked, the stability of exchange rate cannot be guaranteed. However, the relationship between institutional quality and exchange rate volatility has been assumed to be linear as well as symmetric in nature. The reality is that the components of political risk would not have symmetric impact on exchange rate volatility. It is not unexpected that positive and negative outcomes from these components will have the same effects on exchange rate volatility in the country. For example, positive and negative outcomes of revenue source volatility could not have the same moderating effect on the behaviour of the exchange rate when the economy operates a managed-float or fixed exchange rate regimes. It is for these reasons that the asymmetric as well as nonlinear relationships among the components of institutional quality and exchange rate volatility cannot be over-emphasized. This is one area that has not been explored in the literature. Hence, this study is, therefore, motivated to investigate the asymmetric effects of institutional quality on exchange rate volatility in Nigeria. A cursory look at the previous studies indicates that researchers have not really accrued sufficient attention to the interaction between institutional quality and exchange rate volatility in Nigeria; this could be the reason for scanty assessment of empirical investigation. This gap is part of the motivation for the present study.

From the foregoing, the study is further motivated to investigate the asymmetric impacts of institutional quality on exchange rate volatility in Nigeria, using four acknowledged but sparingly used measures of institutional quality, namely; political risk factor, revenue source volatility, contract intensive money, policy unpredictability linked with changes in exchange rate policy In addition to this introductory section, this study will be discussed under four other sections. Section 2 considers the review of literature; the methodological framework is put forward in Section 3 while Section 4 discusses results and Section 5 conclusion.

2. Literature Review

According to Mundell (1995); Abdulweli and Ali (2005) and Mordi (2006) all agreed that exchange rate volatility refers to the swings or fluctuations in the exchange rates over a period of time or the deviations from a benchmark or equilibrium exchange rate. The latter which also reflects the misalignment of the exchange rate could occur where there is multiplicity of markets parallels with the official markets. On the other hand, Ikechi and Nwadiubu (2020), views exchange rate volatility to be the tendency of an exchange rate to either fluctuate favourably (an appreciation), or an unfavorable one (a depreciation); which in turn generates obstacles to profitability of trades in the foreign exchange market. On the other hand, Levchenko (2007) defines institutional quality as the quality of contract enforcement and property rights, captured in a parameter expressing to what extent an investor can get back her/his exante investment. A similar definition is given by Klein (2005), who defines institutional quality as the extent to which an investor is protected against expropriation. Perfect institutions in this case correspond to zero risk of expropriation.

Theoretical propositions regarding institutional quality have evolved overtime and recorded contributions from several proponents Weber, 1958; North, 1981; North, 1990; Olson, 1993). Weber (1958) opines a theoretical framework that gives priority to the societal norms and believes in shaping the quality of institutions. The central paradigm of the framework is that adequate effectiveness of an institution depends on the held beliefs of the society. Currently, the modern theoretical proposition to discuss institution as well as institutional quality is known as the new institutional economics. The new Institutional economics provides the bedrock that economic outcome depends on both political and economic institutions. The New Institutional Economics (NIE) is an extension of mainstream neoclassical economics that focuses on how property rights, transaction costs and asymmetric and incomplete information affect social interaction. The leading proponents of NIE are North (1990) and Buchanan (1977).

Also, exchange rate dynamics have also been exploited theoretically, birthing several propositions Mundell (1961); Dornbusch (1976); Devereux & Lane (2001) among others. Dornbusch (1976) in his sticky price model opines attributing exchange rate overshooting or undershooting from its market-clearing rate, to the pace of recalibration in both good and money markets. With rational expectations, the model duels that monetary policy changes can induce huge movements in exchange rate. Mundell (1961) extended the Optimal Currency Area (OCA) hypothesis, which was later extended by McKinnon (1963) and Kenen (1969). The hypothesis points out that exchange rate variability as a result of disturbances can be tackled via integration of high factor market nations. Lastly, Devereux and Lane (2001) relate the volatility of a country's exchange rate to be as a result of financial claims across nations, in addition to balance of payment dynamics. Configured on bilateral credit relations between a developed nation and a developing nation, the model proposed the exchange rate of a developing nation to be affected by the magnitude of debt it has accumulated from the developed nation.

Several literatures have been conducted on the impact of institutional quality on exchange rate stability, using different measures or proxies for institutional quality (Kutan & Zhou, 1995; Rodrick, 1999; Kutan & Zhou, 1995; Crowley & Loviscek, 2002; Shapiro & Globerman 2004; Qadir Zarif and Syed., 2012; Barro, 2013; Asteriou & Sarantidis, 2016). Majority of the empirical findings indicate that there is a statistical relationship between institutional quality and exchange rate volatility. Moreover, the positive relation between institutional quality and exchange rate volatility is consistent for different institutional quality indicators. The evidence for a positive relationship between institutional quality and the exchange rate of emerging economies have also been recorded. Empirical studies that found this result include studies of Meftah and Nassour (2020); Adegboye, Osabohien, Olokoyo, Matthew and Adediran (2020); Kechhagia and Metaxas (2020); Sakanko, Obilikwu and David (2020); Yakubu (2019); Aziz (2017); Nguyen (2015); Chaib and Siham (2014); while Jurcic, Franc and Barisic (2020) obtain in support of a negative relationship between both variables. There is also evidence indicating that institutional quality is a significant predictor of cross-country differences in exchange rate management Shleifer & Vishey, 1993; Diamonte, Liew and Stevens 1996; Radelet & Sachs, 1998; Cecchetti, 1999; Perotti & Van Oijen, 2001; Crowley & Loviscek, 2002; Chau et al., 2014; Lehkonen & Heimonen, 2015).

In other studies, political stability, being an indicator of institutional quality, has been examined to obtain its effect on the volatility of both developed and emerging economies exchange rates (Bahmani-Oskooee,

Amor, Nouira & Rault, 2019; Ngwakwe & Sebola, 2019); Asteriou, Dimistras & Sarantidis, 2019). Unanimously, these studies reported the existence of higher political instability to induce higher exchange rate volatility. One major lacuna in the literature is that none of these studies investigate asymmetric as well as nonlinear relationship between the components of institutional quality and exchange rate volatility. This is the contribution to knowledge that this study seek to achieve.

3. Materials and Method

Annual data for the period 1981 to 2020 were used in the study. The data of exchange rate volatility was obtained from the regressed residual of the nominal exchange rate within a univariate generalized autoregressive conditional heteroscedasticity (ARCH) framework. The data for the nominal exchange rate was obtained from the Annual Statistics of the CBN Statistical Bulletin (2020). The data on changes in exchange rate policy is obtained from the annual statement of the CBN and policy extant of the monetary policy committee (CBN, 2020), the data for political risk (POLITR) was sourced from the databank of the International Country Risk Guide (ICGR, 2016 as updated). Contract intensive money (CIM), Revenue source volatility (RSV), trade openness (TOPEN) and financial sector development (FD) were all sourced from the Annual Statistics of the Central Bank of Nigeria (CBN, 2020).

Exchange rate volatility was measured from the nominal exchange rate through a generalized autoregressive conditional heteroscedasticity (GARCH) estimation, contract intensive money (CIM) was measured as the difference between broad money (M2) and currency held outside circulation as a proportion of broad money supply, while a trend pattern of the total oil revenue of the economy was extracted to measure Revenue source volatility (RSV). The Holdrick Prescott filter is employed for this extraction. According to Carroll and Goodman (2011), an exponential trend is generated from the observed data and the residuals from the trend are used as measure of revenue source volatility, Political risk (POLTR) is from the political risk service group it comprises of wide array of institutional features, changes in exchange rate policy (EXRP) was captured as a dummy variable. The dummy variable bears 1 whenever there is evidence of changes in exchange rate policy and zero elsewhere. Trade openness (TOPEN) was measured as the ratio of total trade to gross domestic product while financial sector development (FSD) was measured as the ratio of broad money supply to gross domestic product. The estimations were carried out using Eviews 10.

The theoretical framework for this study is the New Institutional Economics (NIE) model. In line with the stated objective, this study employs

the nonlinear ARDL (NARDL) model to investigate the impact of institutional quality on exchange rate volatility. The use of the NARDL is important as it affords the researcher to identify asymmetric as well as nonlinear relationships that the conventional linear ARDL would not be able to find. The measures of institutional quality are political risk factor, contract intensive money, revenue source volatility and changes in exchange rate policy. In general, the study will adopt the stepwise regression approach to obtain the estimates. This aligns with the regression technique used by Abdiweli and Ali (2005); Fatas and Mihov (2006) and Afonso and Jalles (2012) with little modification in the context of new institutional economics framework. The Nonlinear Autoregressive Distributed Lag (NARDL) specification of equation (1) can is specified below thus:

$$\text{EXRVOL} = \text{f}(\text{CIM}, \text{POLITR}, \text{RESV}, \text{FSD}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

The econometrics model can further be normalized as:

$$EXRVOL_t = \beta_0 + \beta_1 CIM_t + \beta_2 POLITR_t + \beta_3 RESV_t + \beta_4 \Delta EXPR_t + \beta_5 TOPEN_t + \beta_6 FSD_t + \varepsilon_t \text{----------(2)}$$

This was further modified to capture the true model which is stated as thus:

$$\Delta \text{InERVOL}_t = \beta_0 + \sum_{i=1}^{\rho}(\Phi_1 \text{minus}\, \Delta \text{lnERVOL}_{t-1} + \phi 1 \text{plus} \Delta \text{lnERVOL}_{t-1}) + \sum_{i=0}^{\rho}(\phi_1 \text{ minus} \Delta \text{lnPOLITR}_{t-i} + \phi 1 \text{plus} \Delta \text{lnPOLITR}_{t-i}) + \sum_{i=0}^{\rho}(\psi_1 \text{minus}\, \Delta \text{InCIM}_{t-i} + \psi_1 \text{plus} \Delta \text{InCIM}_{t-i}) + \sum_{i=0}^{\rho}(\delta_{1\text{minus}}\, \Delta \text{lnTOPEN}_{t-i} + \delta_{1\text{plus}} \Delta \text{lnTOPEN}_{t-i}) + \sum_{i=0}^{\rho}(\delta_{1\text{minus}}\, \Delta \text{lnRESV}_{t-i} + \delta_{1\text{plus}} \Delta \text{lnRESV}_{t-i}) + \sum_{i=0}^{\rho}(\delta_{1\text{minus}}\, \Delta \text{lnEXRP}_{t-i} + \delta_{1\text{plus}} \Delta \text{lnEXRP}_{t-i}) + \sum_{i=0}^{\rho}(\delta_{1\text{minus}}\, \Delta \ln(\frac{\text{M2}}{\text{GDP}})_{t-i} + \delta_{1\text{plus}} \Delta \ln(\frac{\text{M2}}{\text{GDP}})_{t-i}) \gamma_5 \text{ECT}_{t-1} + \mu_t \text{ - - - - - - - - (3)}$$

From equation 3 shows that the NARDL is a modified model of the ARDL model. It seeks to account for asymmetric relationship among the variables included in the empirical model. The NARDL model presumes that both positive and negative outcomes of each of the independent variables would not have convergent effects on the dependent variable (exchange rate volatility, in this case). The underlying assumption of the NARDL implies that both positive and negative outcomes of the independent variables have asymmetric effects on exchange rate volatility in Nigeria. Importantly, the NARDL has all the features that make the ARDL attractive. Like ARDL, NARDL is superior to other cointergration techniques on the following basis. First, it can be applied when the variables are I (0) or I(1) or mutually integrated, it is pre-requisite that none of the variables is of I(2) or higher order. Second, it takes care of problem of endogeneity. Third, applying NARDL is helpful in data generating process through taking sufficient number of lags generated-to-specific modeling framework. Finally, NARDL

approach performs better and gives more robust result in case of small data set.

The estimation procedures for this study follow a systematic approach. These begin with several preliminary tests that seek to provide insights into the appropriateness of technique adopted for empirical investigation. The specified model – NARDL – is estimated and various robustness checks and diagnostics tests are performed for validity and reliability of estimates obtained. For time series data, pre-estimation diagnostics involve tests of unit and cointegration. The Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski-Philips-Schmidt-Shin (KPSS) test will be considered for the purpose. The last two tests shall be unit root test with structural breaks here, Perron (1997) and Zivot and Andrew (1992) will be used. The choice of the last two stationarity tests was informed as a result of peculiar problem associated with most of the time series data of structural breaks in data. Generally, the choice of using five unit root test is to allow robustness and comparison and to avoid spurious regression. Although PP unit root test is considered to have a greater reliability than the ADF due to its robustness in the midst of serial correlation and heteroskedascity in orders words the PP test is useful over the ADF in that it allows for the possibility of heteroskedasic error term (Hamilton, 1994). However, because it has been shown that both ADF and PP suffers from high size distortion, it was considered appropriate to include the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test under the traditional frame work. The test for unit for a variable S is carried out using the following specification:

$$\Delta S_t = \beta_0 + \beta_{1t} + \beta_2 S_{t-1} + \sum_{i=0}^{p} \varphi_i \Delta S_{t-i} + \varepsilon_t \text{----------(4)}$$

Where β_0 , β_1, β_2 and ψ_i----------ψ_p are parameters to be estimated, and ε_t is normally and identically distributed. S is a vector of regressor as defined previously, Δ is the lag operator

Similarly, in order to test the non-linearity of the variable used in the model, The Brock- Dechert-Scheinkman test (BDS test) was used for this purpose, the test was first devised by (Brock, Dechert & Scheinkman, 1996) and can be used as a general test of model misspecification. The BDS test has been utilized as a diagnostic tool to determine the adequacy for detecting non-linearity of the series (Guglielmo, 2005). BDS test is a two-tailed test; the null hypothesis of the BDS test statistic is that the series are linearly dependence. While the alternate hypothesis is indicating that the series are not linearly dependent.

To further ensure the stochastic properties of variables, lag length based on the sequential modified likelihood (LR). Final prediction error (FPE) and Akaike information criterion (AIC) test statistic is considered. the major advantage of the LR test is that it facilitates cross-equation restriction to test shorter versus longer lags, AIC is relatively better than the Schwartz Bayesian Criterion (SBC) when selecting lags for models that the true data generating process is one of the long lags (Ozcicek & Mcmillin, 1999). The AIC and the FPE are superior to other criteria in the case of small sample (60 observation and below) for estimating autoregressive lag length, in that they minimize the change of underestimation and maximize the chance of recovering the true lag length (Liew, 2004).

4. Results and Discussion

The descriptive statistics for the variables employed are presented in Table 1 below. The data comprises 40 observations for each variable.

Table 1: Descriptive Statistics

	CIM	EXRP	EXRVOL	M2_GDP	POLIT_RISK	RESV	TOPEN
Mean	0.812	0.475	2.122	15.868	45.846	3606.405	29.691
Maxi.	0.931	1	64.761	24.805	54.333	9288.658	55.022
Mini.	0.661	0	-14.772	9.063	38.792	-33.500	7.523
Std.Dev	0.087	0.506	18.422	4.168	3.602	3730.783	11.436
Skewnes.	0.025	0.100	2.132	0.445	0.731	0.395	-0.193
Kurtosis	1.710	1.010	6.464	2.053	3.340	1.432	2.399
Jarque-Bera	2.776	6.667	49.045	2.814	3.752	5.133	0.851
Prob.	0.250	0.036	2.24E-11	0.245	0.153	0.0768	0.654

Sources: Authors Computation using E-Views 10

As depicted above, it is evident that the revenue source volatility has the highest standard deviation value of 3730.783. This suggests that the revenue source of the Nigerian economy deviates most widely from its expected values. This has lend credence to the over-reliance of the Nigerian economy on oil revenue as the mainstay of the economy and the fact that the economy has widely been affected by series of global economic and financial dynamics that has affected sustainable flows of financial resources into the country over the years. The contract money intensity has the least standard deviation of 0.087. This implies that the country is doing so much in the

areas of contract enforcement and ownership of private property. Interestingly, exchange rate volatility has standard deviation of 18.422; indicating that the deviation of exchange rate volatility from expectation is not relatively huge. Except for the degree of trade openness that has a skewness value of -0.193, all the other variables skewed positively for the period under consideration. The implication is that the degree of trade openness unfavorably contrasted and became less open than expected during the period under investigation.

Table 2: Correlation Matrix

	EXRP	**CIM**	**EXRVOL**	**M2_GDP**	**POLIT_RISK**	**RESV**	**TOPEN**
EXRP	1	0.28	0.10	0.17	-0.04	0.33	-0.16
CIM	0.28	1	0.21	0.84	-0.44	0.88	-0.21
EXRVOL	0.10	0.21	1	0.28	0.09	0.27	-0.11
M2_GDP	0.17	0.84	0.28	1	-0.16	0.83	-0.10
POLIT_RISK	-0.04	-0.44	0.09	-0.16	1	-0.22	0.39
RESV	0.33	0.88	0.27	0.83	-0.22	1	0.13
TOPEN	-0.16	-0.21	-0.11	-0.10	0.39	0.13	1

Sources: Authors Computation using E-Views 10

The correlation matrix in table 2 above details the correlation coefficients among the variables. The correlation coefficients indicate that there is no problem of either collinearity or multicollinearity in the series as none of the correlation coefficient attains the 0.90 threshold. Although, the correlation coefficient between contract intensive money (CIM) and the level of financial sector development – measured as the ratio of broad money supply to gross domestic product $\left(\frac{M2}{GDP}\right)$ is 0.84, this is still marginally less than the 0.90 threshold value for collinearity. Similarly, the correlation coefficient between contract intensive money (CIM) and revenue source volatility (RESV) is 0.88. Also, the correlation between $\left(\frac{M2}{GDP}\right)$ and RESV is 0.83. All these indicate that the correlation between these two respective variables are positively strong but could not warrant the problem of collinearity or multicollinearity since these coefficients are lesser than the 0.90 threshold value.

The results obtained from both the ADF, PP and KPSS unit-root tests are done with intercept in table 3 and at trend and intercept table 4. The results detailed in table 3 for both ADF and PP indicate that all the variables

except the volatility of exchange rate in Nigeria (proxied as *exrvol*) are unit-root as well as non-stationary. The null hypothesis that the series have unit-root cannot be rejected, at least, at the 5 percent level of significance. The implication is that these variables could not be included in the empirical and methodological models without ensuring that these variables are made integrated to become stationary. In contrast, the result of the Kwiatkowski-Phillip-Schmidt-Shin (KPSS) suggests that three variables are stationary at levels. The null hypotheses that exchange rate policy (proxied as exrp), political risk (proxied as polit_risk) and trade openness (proxied as topen) are stationaries at levels cannot be rejected at the 1 percent levels. The corresponding test statistic values for these variables are 0.178, 0.108 and 0.274 respectively. These values are all less than the critical values at the 1 percent level of significance. For the other variables such as the contract money intensity (proxied as cim), exchange rate volatility (proxied as exrvol), level of financial development – measured as the ratio of broad money supply to the gross domestic product (proxied as $(\frac{M2}{GDP})$ and the revenue source volatility (proxied as *resv*) became stationary only integrating at order 1 i.e. I(1).

Table 3: Unit Root Test Result (with intercept)

Variable	ADF	PP	KPSS
CIM	-1.478	-0.701	0.499
EXRP	-2.063	-2.196	0.178*
EXRVOL	-4.347*	-4.245*	0.362
M2_GDP	-1.603	-1.732	0.564
POLIT_RISK	-2.681	-2.681	0.108*
RESV	-2.435	-0.396	0.713
TOPEN	-2.538	-1.943	0.274*
ΔCIM	-3.824*	-3.965*	0.155*
ΔEXRP	-6.000*	-6.000*	0.134
ΔEXRVOL	-5.917*	-13.831*	0.264*
ΔM2_GDP	-5.064*	-4.983*	0.069*
ΔPOLT_RISK	-8.146*	-8.237*	0.127*
ΔRESV	-4.998*	-8.184*	0.276*
ΔTOPEN	-8.209*	-9.228*	0.500*

Note:*,**and *** denote the rejection of the null hypothesis at 1%, 5% and 10% level of significance respectively. Source:

Sources: Authors Computation using E-Views 10

For the conventional unit-root at trend and intercept for both ADF and PP, the same orders of integration are observed for these variables. There is a mix of both unit-root and non-unit-root variables to be included for model estimations. However, the KPSS stationarity test indicates that higher order of integrations would be required for both revenue source volatility (proxied as *resv*) and trade openness (proxied as topen) to become stationary. This further enriches our conclusion that the relationship between exchange rate volatility and the components of institutional quality in Nigeria can adequately be modelled with an autoregressive distributed lag model.

Table 4: Unit Root Test Result (with intercept and linear trend)

Variable	ADF	PP	KPSS
CIM	-2.846	-1.532	0.151
EXRP	-2.275	-2.275	0.133
EXRVOL	-4.760*	-4.553*	0.081*
M2_GDP	-2.817	-2.416	0.133
POLIT_RISK	-2.674	-2.674	0.010*
RESV	-1.850	-2.071	0.158
TOPEN	-2.440	-2.203	0.201
ΔCIM	-3.814**	-3.944**	0.102*
ΔEXRP	-6.064*	-6.063*	0.045*
ΔEXRVOL	-5.836*	-13.186*	0.189*
ΔM2_GDP	-4.994*	-4.876*	0.071*
ΔPOLT_RISK	-8.062*	-8.171*	0.115*
ΔRESV	-4.998*	-0.909	0.158
ΔTOPEN	-8.238*	-21.164*	0.359*

Note:*, **and *** denote rejection of null hypothesis at 1%, 5% and 10% level of significance respectively. Source: Researchers

Sources: Authors Computation using E-Views 10

In addition, the unit-root with structural break point test also lends credence to the submission that the variables are mix of stationary and unit-root trends Table 2C). Specifically for the structural break-point test, the contract intensity money (proxied as *CIM*), exchange rate policy (proxied as *exrp*) and trade openness (proxied as *topen*) are the three variables that have unit-root and have to be integrated at order 1 before they become stationary. More so, the break-point periods appears to be variable-specifics. The contract intensity money, exchange rate policy and trade openness have their stationary breakpoints in the 1990s, specifically in the years 1994, 1995 and 1995 respectively.

Table 5: Structural Break-Point Test

	Perron (1997)		Zivot and Andrews (1992)	
Variables	BP	T-Stat	BP	T-stat.
CIM	2005	-3.754	1990	-3.329
EXRP	2010	-3.375	2007	-5.632*
EXRVOL	2014	-5.658*	2014	-5.666*
M2_GDP	2007	-5.481*	2007	-5.259*
POLIT_RISK	1999	-6.217*	1996	-5.098**
RESV	2013	-5.764*	2010	-7.605*
TOPEN	1989	-4.103	1989	-4.823
ΔCIM	1994	-5.131*	2008	-7.061*
ΔEXRP	1995	-6.869*	1999	-6.978**
ΔEXRVOL	2018	-7.545*	2018	-8.572**
ΔM2_GDP	2008	-6.225*	2006	-5.680**
ΔPOLIT_RISK	1998	-9.144*	1994	-8.859**
ΔRESV	2012	-6.559*	2016	-6.388**
ΔTOPEN	1995	-9.333*	1994	-6.839*

Notes: *, ** Denotes 1%, 5% significance levels. Note: BP is the Break Point year.
Sources: Authors Computation using E-Views 10

The implication is that these variables have a single breakpoint period. Some of these variables have different structural breaks as regards their levels of stationarity and as regards intercept alone and with trends and intercept altogether. Incidentally, all the indicators of institutional quality exhibit this pattern. The implication is that these variables have multiple breaks. It suggests that there has been many instances that the Nigerian economy have been confronted with many institutional disturbances and distortions. Only three of these variables have the same structural break point period regardless of the levels of stationarity and the patterns of trending. These variables are the exchange rate volatility, financial sector development and trade openness.

Table 6: Non-linearity Test (BDS Test Result)

Variable	BDS statistic	Standard Error	Z-statistics	Prob.
EXRP	0.155431	0.000200	778.4773	0.0000
CIM	0.166363	0.007003	23.75537	0.0000
EXRVOL	0.083484	0.050528	1.652225	0.0985
M2-GDP	0.119379	0.008252	14.46655	0.0000
POLIT-RISK	0.138205	0.025292	5.358454	0.0000
RESV	0.182654	0.009033	20.22138	0.0000
TOPEN	0,218600	0.018106	12.07360	0.0000

Sources: Authors Computation using E-Views 10

The result of the BDS test in table 6 shows that test statistics is far greater than the critical values, thus we reject the null hypothesis that the series are linearly dependent. The results actually suggested that the variables used in the model are non-linearly dependent which is a pointer to the chaotic behavior of institutional time series data. The result further lends credence to the use of nonlinear autoregressive distributive model (NARDL). The result of the lag length selection criteria are not reported to conserve space but are available on request.

The estimations of the NARDL is undertaken using stepwise least square regression. The procedure of estimations is through a general-to-specific stepwise procedure and a unidirectional approach. A decision will be reached based on the most optimal results of these two procedures; considering certain parameters such as the goodness-of-fits, test statistics, squared coefficient of correlation, Durbin-Watson statistics and F-statistics. The various scenario analyses done suggest the unidirectional procedure of the stepwise regression is the most optimal and it is upon that the estimations of the short-run (immediate) nonlinear autoregressive distributed lag would be analysed and discussed. As detailed in (Table 7), the lagged exchange rate volatility negatively impacts on the current level of exchange rate with -0.08 coefficient and 0.000 probability value. This suggests that an increasing previous level of exchange rate volatility reduces the volatility of the exchange rate in the current period. This indicates that exchange rate volatility in Nigeria has a counter-cyclical behaviour. Statistically, this also lends credence to the autoregressive component of the NARDL model employed for analyses.

The impacts of the positive and negative outcomes of contract intensity money on exchange rate volatility in the short-run have alternating positive and negative impacts respectively. These are procyclical behaviour as the positive outcome of contract intensity money (proxied as cimpositive) has 1412.1 coefficient and 0.001 probability value while the negative outcome of the contract intensity money (proxied as cimnegative) has -636.1 coefficient with corresponding 0.001 probability value respectively. However, irrespective of the positive and negative outcomes of the exchange rate policy (proxied as exrppositive and exrpnegative respectively) political risk factor (proxied as polit_riskpositive and polit_risknegative respectively) and revenue source volatility (proxied as resvpositive and resvnegative respectively), all have negatively significant impacts on exchange rate volatility in Nigeria. All these are significant at the 5 percent level of significance. In tandem with theoretical expositions, the two control variables of financial sector development and trade openness are properly signed and significant too. The impact of both variables on exchange rate volatility is

negatively signed with -5.99 and -2.72 coefficients and corresponding probability values of 0.001 and 0.000 respectively. These indicate that the higher the level of financial development and the extent the degree of trade openness, the lower the volatility of exchange rate volatility in the economy.

Table 7: Stepwise Regression for Nonlinear Autoregressive Distributed Lag

Variable	Coefficient	T-statistics	Prob.
C	12.72	21.40	0.030
exrvol(-1)	-0.08	-1717.6	0.000
cimpositive(-1)	1412.10	492.71	0.001
cimnegative(-1)	-636.10	-554.40	0.001
exrppositive(-1)	-3.43	-37.19	0.017
exrpnegative(-1)	-148.16	-983.01	0.017
m2_gdp (-1)	-5.99	-814.25	0.001
polit_riskpositive	-12.22	-674.09	0.001
polit_risknegtive(-1	-4.84	1125.21	0.001
resvpositve (-1)	-0.014	-117.03	0.005
resvnegative(-1)	-1.56	-128.43	0.005
topen(-1)	-2.72	-1173.55	0.000
Adj R^2	0.999		
DW_Stat.	2.44		
F_Stat.	2683990		
Pr ob. (F_Stat.)	0.000		

Sources: Authors Computation using E-Views 10

The adjusted coefficient of determination as well as squared coefficient of correlation shows that the explanatory variables included in the model substantially explained virtually for all the movement in the explained variable. Putting it differently, the Adjusted R-squared of 0.999 suggests that institutional quality alongside the control variables of financial sector development and trade openness account for 99.9 percent movement in exchange rate volatility in Nigeria. This indicates that the model has goodness of fit. The Durbin Watson statistics of 2.44 suggests that the model does not suffer from any autocorrelation problem; either at first order or serial correlation. In addition, the Fischer statistics of 2683990 is highly significant at the 1 percent level and further lends credence to the overall fitness of the model; away from specification or measurement errors.

The test for long-run equilibrium condition among the variables is validated at the 1 percent level of significance. The null hypothesis is that there is no long-run and this hypothesis is rejected; both with the F-statistics and Chi-square test statistic with corresponding probability values of 0.015 and 0.000 respectively. The implication, therefore, is that exchange rate volatility and the measures of institutional quality have equilibrium conditions that keep them together into the long-run situation.

In furtherance of the analyses, the long-run impact analyses among the measures of institutional quality coupled with the control variables of financial sector development and trade openness on exchange rate volatility are investigated. The results detailed in table 3B considered the long-run asymmetric impacts. With the long-run asymmetric impacts, it is presumed that both positive and negative outcomes of each of these variables would not have the same impact of exchange rate volatility. As a rule of thumb, it is expected that both the positive and negative outcomes give the same sign and significant effects for the impacts to be asymmetric as well as nonlinear. Otherwise, the effect is said to be symmetric as well as linear. However, only a formal test of asymmetry is expected to fully validate the prima facie evidence of alternating signs of nonlinear impacts. The results detailed in table 8 are highly instructive as they showed that the impacts of the components of institutional quality on exchange rate volatility in Nigeria are classified in terms of positive and negative outcomes. This is to investigate the asymmetric as well as nonlinear impacts of these variables on exchange rate volatility.

Specifically, the positive outcome of contract intensity money (proxied as cimpositive) positively impact on exchange rate volatility with 2627.3 coefficient and corresponding 0.013 probability value. On the other hand, the negative outcome of contract intensity money (proxied as cimnegative) has negative effect on exchange rate volatility in Nigeria with -376.9 coefficient and corresponding 0.03 probability value. These impacts are both significant at the 1 percent and 5 percent levels respectively. These imply that an increasing degree of contract intensity money would significantly aggravates the volatility of exchange rate in the country while a decreasing degree of contract intensity money would significantly reduce the volatility of exchange rate in the country. Also, the positive and negative outcomes of political risk factors have alternating sign impacts on exchange rate volatility in Nigeria. However, the positive outcome of political risk factor has negative effects on exchange rate volatility with -2.83 coefficient and 0.04 probability value. On the other hand, the negative outcome of political risk factor has positive impact of exchange rate volatility with 15.93 coefficient and 0.02 probability value. The implication of these findings is that political factor has a counter-cyclical impact on the volatility of exchange rate in Nigeria.

Table 8: Long-Run Impact Analyses

Variable	Coefficient	Std. Error	Prob.
$cimpositive(-1)$	2627.3	55.04	0.013
$cimnegative(-1)$	-376.9	16.79	0.03
$exrppositive(-1)$	60.97	2.07	0.02
$exrpnegative(-1)$	47.67	2.86	0.04
$m2\_gdp(-1)$	-6.29	0.17	0.02
$polit\_riskpositive(-1)$	-2.83	0.20	0.04
$polit\_risknegative(-1)$	15.93	0.53	0.02
$resvpositive(-1)$	-0.039	0.00	0.02
$resvnegative(-1)$	-6.64	1.58	0.15
$topen(-1)$	-7.22	0.19	0.02

Sources: Authors Computation using E-Views 10

In contrast, the positive and negative outcomes of exchange rate policies (proxied as exrppositive and exrpnegative respectively) have significant positive impacts on exchange rate volatility in Nigeria with corresponding 60.97 and 47.67 coefficients and corresponding 0.02 and 0.04 probability values respectively. The implication is that exchange rate policy has a procyclical effects on the volatility of exchange rate in Nigeria. Although, the positive and negative outcomes of revenue source volatility (proxied as resvpositive and resvnegative respectively) have same and negative impacts on exchange rate volatility but the latter is negligible as the negative sign impact is insignificant at the 5 percent level of significance. This suggests that the asymmetric as well as nonlinear impact of revenue source volatility on exchange rate volatility in Nigeria cannot be ascertained on a prima facie basis.

The control variables of financial development (proxied as $(\frac{M2}{GDP})$ and trade openness are important variables that drive the volatility of exchange rate in Nigeria, thus, justifying their inclusions into the model. The level of financial sector development has negative impact of exchange rate volatility with -6.29 coefficient and 0.02 probability value. This suggests that as the financial sector develops, the volatility of exchange rate reduces. This lends credence to the efficient market hypothesis that a developed financial sector goes with full market information that makes arbitrage activities of investors to be impossible as the market only makes zero or normal profit. The degree of trade openness (proxied as topen) also negatively impacts on exchange rate volatility with -7.22 coefficients and 0.02 corresponding probability

values. An open market economy promotes the policy of foreign exchange rate practices. With this, the deviations of the foreign exchange rate from its expected value will be near zero, thus, eliminating all forms of volatility.

The results in table 9 show that contract intensity money has asymmetric relationship with exchange rate volatility in Nigeria. This is more so that the null hypothesis that there is no asymmetry between these two variables is rejected at the 5 percent level of significance with 3004.173 coefficients and 0.013 corresponding probability value. The implication is that the modelling this relationship both variables with the use of nonlinear autoregressive distributed lag model have been justified. Specifically, the null hypotheses that the positive and negative outcomes of contract money intensity, political risk factor, revenue source volatility and exchange rate policy have respective symmetric impact on exchange rate volatility have been rejected at the 1 percent level.

Table 9: Results of Asymmetric Relationships

Variable	Coefficient	Std. Error	Prob.
Positive and negative cim	3004.173	60.004	0.0127
Positive and negative $polit\_risk$	-18.7637	0.6315	0.0214
Positive and negative $resv$	6.5988	1.5795	0.0496
Positive and negative $exrp$	13.3023	1.8729	0.0890

Sources: Authors Computation using E-Views 10

The diagnostic tests employed are heteroscedasticity and autocorrelation tests. The Breusch-Pagan-Godfrey test is the test of heteroscedasticity and the null hypothesis of the no heteroscedasticity cannot be rejected at the 5 percent level. The value of the Breusch-Pagan-Godfrey test is 0.055 with corresponding probability value of 1.000. Also, the autocorrelation test at lag 3 has a probability value of 0.236. The lags 1 and 2 are also insignificant at the 5 percent level. Altogether, these imply that the null hypothesis of no autocorrelation cannot be rejected at the 5 percent level of significance.The coefficient diagnostic tests centered on the CUSUM and CUSUM of squares stability tests. As expected, the estimates as at 2020 is to lie between the confidence intervals of CUSUM as depicted in Figure 1 and CUSUM sum of squares Figure 2 at the 5 percent levels in order to ensure stability of the estimates.

5. Conclusion and Recommendations

In the empirical analysis, the NARDL is used for the analysis, after accounting for structural breaks and ensuring the nonlinearity of the variables

employed. In the short run, the results indicate that exchange rate volatility in Nigeria has a counter-cyclical behaviour. An interesting result is that political risk factor and revenue source volatility are significant variable explaining exchange rate volatility in Nigeria in both short and long run. Contract intensive money is insignificant in the short and long run. The results are more revealing that as the financial sector develops, the volatility of exchange rate reduces. This lends credence to the efficient market hypothesis that a developed financial sector goes with full market information that makes arbitrage activities of investors to be impossible as the market only makes zero or normal profit, which is in line with previous studies. On the whole, the result shows institutional quality is a strong measure in curtailing exchange rate volatility in Nigeria, a result that is consistent with previous studies. Political restructuring, economic diversification and proper exchange rate management are suggested policy recommendations.

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APPENDICES

Figure 1: CUSUM

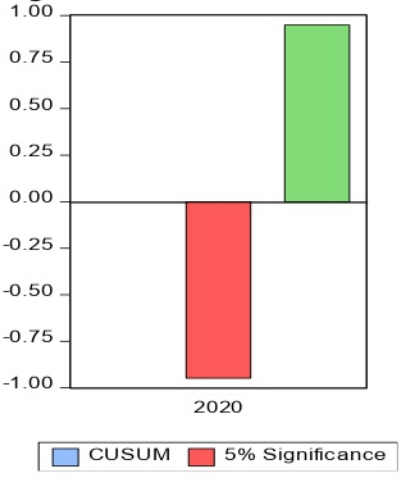

Figure 2: CUSUM of Square