INSTITUTIONAL QUALITY AND EXCHANGE RATE VOLATILITY IN NIGERIA: A CAUSALITY IMPLICATION

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Abstract
The problem of exchange rate volatility has become pronounced in Nigeria. The role of institutional quality seems to be a major cause of this ominous predicament. This study employed the Toda-Yamamoto causality framework to examine the causal link between institutional quality and volatility of the exchange rate in Nigeria for the period 1981-2020, using data from secondary sources. The result shows a unidirectional causality from revenue source volatility to exchange rate volatility, while a bi-directional causality was found between exchange rate volatility and political risk as well as between exchange rate volatility and revenue source volatility. This suggests that political risk and revenue source volatility are important institutional variables that enhance exchange rate volatility in Nigeria. The study concludes that political risk and revenue source volatility pose significant threats to exchange rate management in Nigeria. The study recommends an overhaul of the political space and revenue diversification if exchange rate volatility is to be curtailed.

Keywords: Causality; Exchange rate volatility; Institutional quality; Toda-Yamamoto test; Nigeria
JEL Classification Code: C22, C52, O14

1. INTRODUCTION

Exchange rate volatility is viewed as changes in exchange rates or the movement from a benchmark or equilibrium exchange rate. Exchange rate volatility also reflects the imbalance of the exchange rate that could appear where there is a parallel market with an official market Mundell (1995). The follow-up of these markets is important because they tend to give a signal on exchange rate imbalance, particularly when the expected rate moves widely from what is expected from a free market. Mundell (1995), Mordi (2006), and Abduweili (2005) agreed that exchange rate volatility is the persistent changes in the exchange rates over some time. Exchange rate volatility is known to have an unpleasant implication on the domestic currency. The swings are usually a result of uncertainty and adjustment costs and consequently as a result of government policies. The investment will thrive when there is a conducive economic environment (stable exchange rate) that is devoid of certain uncertainties. Exchange rate volatility is usually deepened when there is a high level of uncertainty (Abduweili, 2005). Fluctuations in exchange rates of less developed countries are inherent causes of economic dwindling around the world. The implications experienced in the global economy on developing countries like Nigeria are consequently enhanced by the fluctuations experienced by the currencies of the major economic powers like the United States. Over time, exchange rates have been increasingly volatile and continuously unrelated to the underlying local economic fundamentals of many emerging economies like Nigeria and this has prompted the apex bank of emerging economies that are abreast with the more developed countries with more stable exchange rates to interfere on a complete episodic basis, without signal of causality with the exchange rate management and the quality of institutions (Chen, 2006).

In this regard, Exchange rate volatility is a serious issue in developing countries like Nigeria as far back as the 1980s. For this reason, several policies were pursued with intense opposition to devaluation, for fear of its inflationary impact, and other consequences. Nigeria has faced such a situation in the past and as a result, there has been interest in economic outcomes as a result of exchange rate volatility. Hence, volatility is a bad signal for an economy. It affects price in a market-driven economy and hence production and consumption. It also impacts on investment, savings and inflation. Consequently, when there is exchange rate stability, it promotes investment, increases foreign exchange earnings, increases production capacity and enhances the stability of the economy. Nigeria, being an import-dependent nation, particularly for capital goods, the exchange rate is central to its trading partners. its status as a developing economy implies a lack of collateral to manage the shocks from an exchange rate system subject to volatile exchange rates (Bankole & Ayinde, 2014).

For the aforementioned reasons, the federal government has continued to intervene, as done on several occasions, in the management of exchange rates in Nigeria. In handling this unwanted situation, the apex bank of Nigeria has adopted several policies and programmes to ensure a stable exchange rate. Since the 1960s, the domestic currency of the naira has been pegged against one international reference currency or the other. It began with the United Kingdom's pound sterling and later against the United States dollar. At a later time, the exchange rate management followed a market liberal approach where the domestic currency alternates between fixed and floating systems. Over the years, the Central Bank of Nigeria has employed more of a managed-float exchange rate arrangement where the domestic currency is only allowed to fluctuate around a particular band or threshold. In all these, the volatility of the exchange rate is prominently evident (Bankole & Ayinde, 2014).

Despite the various efforts by the Nigerian government, the naira fluctuated throughout the 1980s and continued till 2020. It fluctuates around N0.61 to 3.57 from 1980 to 1990 and from 1991 to 2000 it fluctuates around 21.886 to 65.047 against the US dollar.

Between 2001– 2010, it continued to fluctuate from around 118.97 to 198. 65. Policy actions aimed at arresting the situation could not yield the desired result as it continued to fluctuate from 2011 to 2020 from 157.5 to 440.2 (Central Bank of Nigeria, 2020). Consequently, policy measures aimed at dealing with the unwanted situation in Nigeria have achieved little as the exchange rate remains volatile with an inelastic response to the policies. The reasons attributed include dependency on the importation, lags and weak productive capacity (Cecchetti, 1999).

Several contributions have emanated from the literature on the significance of institutional quality in economic volatilities. Notable among them is Acemoglu et al. (2003) who investigated the determinants of macroeconomic volatility (measured as the standard deviation of GDP per capita growth) from 1970 to 1997 and reported that institutional quality (rule of law, protection of property rights and executive constraints) are the most important factors that influence volatility and consequently economic performance. The findings further revealed that the effect of macroeconomic policies on volatility is small when institutional factors are controlled for, implying that unstable institutions are the fundamental reasons for macroeconomic volatility via different channels. In light of this, Nelson (2001) expresses the institutional environment as not being limited to the rules, but should also capture agents that are to apply the rules and ensure respect for the rules by other agents. These agents include societies, industrial organizations, judicial settings, and government, among others. Institutional quality as perceived by Ostrom (2015) entails the set of guidelines followed by human beings in their daily activities, which are organized by a set of regulations, norms, as well as strategies that individual agents make within the available structure of gains. North (1990) stressed that institutional quality usually promotes productive incentivize and wealth-increasing actions such as capital and education acquisition, innovations ensure property rights and prevent predatory, wealth-damaging attitudes (e.g. corruption, theft and rent-seeking). Thus, institution enhances good economic outcomes, although, its relevance had been attributed by classical economists like Smith (1776), its intensive examination is recent (Knack & Keefer, 1995; Mauro, 1995; Hall & Jones, 1999; Acemoglu et al., 2002; Doucouliagos & Ulubasoglu, 2006; Knowles & Weatherston, 2007; Abdel-Latif & Schmitz, 2009; Cammack & Kelsall, 2010).

This paper contributes to the empirical literature by testing for the direction of causality between institutional quality and the volatility of exchange rates in Nigeria. The empirical literature on the causality linking institutional quality and exchange rate volatility are virtually very scarce. Utilizing three aspects of institutional quality—contract-intensive money, political risk, and income source volatility—the analysis establishes the direction of causality between institutional quality and exchange rate volatility. The study also examines causality during series breaks, which may have a major impact on the accuracy of inference. The Toda-Yamamoto paradigm was not used in any of the earlier studies to investigate the relationship between institutional quality and exchange rate volatility in Nigeria. Following the introduction, part two reviews the literature, and section three describes the study's methods. Section four presents and discusses the empirical findings, and Section five brings the study to a close.

2. LITERATURE REVIEW

2.1 Conceptual Literature Review and Theoretical Framework

Chen (2006), Fata and Mihov (2007) and Ikechi and Nwadiubu (2020) are of the view that exchange rate volatility is the ability of an exchange rate to either swing favourably (an appreciation) or an unfavourable one (a depreciation); which in turn generates obstacles to the profitability of trades in the international market. Exchange rate volatility in this study is viewed as the risk associated with the unanticipated movement in the exchange rate. Bekaert et al. (2005) and Levchenko (2007) viewed 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 *ex-ante* investment. In this study, institutional quality is considered the required guideline necessary for the operations of both private and public institutions in other to optimize wealth. The enactment of these guiding principles is based on the act that set up the institution, which is mostly in line with international practice.

This study is anchored on the New Institutional Economics (NIE), which contains anin-depth of neoclassical economics which is centred on how property rights, transaction costs, and asymmetric and imperfect information distort social interaction. The leading proponents of NIE are North (1990) and Buchanan (1977). Exchange rate dynamics have also been exploited theoretically (e.g. Mundell, 1961; Dornbusch, 1976; Devereux & Lane, 2001). 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 rates. Mundell (1961) extended the Optimal Currency Area (OCA) hypothesis, which was later extended by McKinnon (1963) and Kenen (1969).

2.2 Empirical Review

In a study investigating the causal nexus between institutions, foreign direct investment and monetary policy of 82 countries from 1974 to 2013 using the system GMM, Calderón and Kubota (2018) posited that the structure of trade and composition of financial openness is critical for real exchange rate stability. Additionally, other factors that influence exchange rate volatility include international portfolio flows (Chaban, 2009; Menla & Spagnolo, 2016), volatility in the returns of a home stock (Caporale et al., 2017), in addition to a country’s level of development and extent of diversification (Ganguly & Breuer, 2010). It needs to be noted that with a floating exchange rate regime, exchange rate volatility differs among countries even if they have a similar macroeconomic environment (Jeanne & Rose, 2002). Overall, while some studies emphasize the importance of monetary variables as the determinants of exchange rate volatility, based on monetary models of exchange rate determination (Grydaki & Fountas, 2009), others emphasize the role of trade linkages, underpinned by models of Optimum Currency Areas (Devereux & Lane, 2003) with such factors as country size, geography and differences or similarity of economic shocks to output, as critical to exchange rate volatility. Yet other studies have emphasized the role of both monetary and non-monetary factors, based on New Open Economy Macroeconomics in investigating the factors that determine exchange rate volatility (Calderón, 2004; Caporale et al., 2009).

Only a few works have been done on institutional quality and exchange rate volatility. Some of these studies include Chong and Calderon (2000) which investigated the direction of causality between institutional measures and economic outcomes. They found a bi-directional causality between institutional quality and economic outcome. Specifically, their findings show that the poorer the country, and the larger the wait, the higher the effect of institutional quality on the economic outcome. Also, the findings of Dollar and Kraay (2003) suggest that there is a bidirectional causality between the quality of institutions (proxied by good governance) and economic outcome (exchange rate) and the direction of influence is from institutional quality to exchange rate. Again, Kaufman (2012) examined the causality linkages between good governance and economic outcome of 173 countries, for the years 1997-98. Findings show that there is a significant positive impact moving from good governance to economic outcome. Thomas (2009) and Kaufmann et al. (2011) concluded that institutional quality causes economic outcomes. Similarly, Jeleta and Paul (2017) examined the causal relationship between institutional quality and economic outcome (exchange rate) in sub-Saharan Africa. Employing panel data from 27 countries from 1996 to 2014 using panel co- integration and Wald panel causality, the findings show that there is unidirectional causality from the economic outcome (exchange rate) to institutional quality.

Danish and Qazi (2019) investigated the causality between institutional quality and economic outcome in Pakistan between 1984-2014 utilizing Engel and Granger causality test. The result shows there is a strong linkage between institutional quality and exchange rate in the long run. The ECM appears insignificant. The results further indicate that there is a uni-directional causality between exchange rate and institutional quality. The result further suggests that institutional quality causes the exchange rate in Pakistan. In a study conducted by Eichler and Littke (2017) from 1990 to 2015, using the Granger technique the result shows that when there is good information on monetary policy objectives, exchange rate volatility falls. This effect is more evident in economies where central bank conservatism is smaller. Additionally, transparency (with regards to a country's central monetary authority) as an institutional quality indicator was found to raise exchange rate fluctuations in developed countries, while in the case of developing countries, it has no effect (Weber, 2017).

Only a handful of research is devoted to the direction of causality between institutional quality and exchange rate in Nigeria. Adogamhe (2010) examined the direction of causality between institutional quality (proxied by bureaucratic quality) and the exchange rate in Nigeria. The result indicates a bidirectional causality between bureaucratic quality and exchange rate. Again, Abdulai and Ndekugri, (2008) examined ifthe institutional quality (proxied by business environment) Granger causes economic outcomes in Nigeria. A reverse causality outcome was found between institutional quality and economic outcome.

From the aforementioned studies, there is a lacuna in the causality between institutional quality and exchange rate volatility in Nigeria. This study complements the empirical literature on institutional quality and economic outcomes on one hand, and on the causality between institutional quality and exchange rate volatility with a focus on Nigeria, on the other hand.

3. 0 METHODOLOGY

3.1 Model Specification

A bivariate Toda-Yamamoto (TY) Model is specified as follows:

$$y_{1t} = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} y_{1t-i} + \sum_{j=k+1}^{k+d_{\max}} \alpha_{2j} y_{1t-j} + \sum_{i=1}^{k} \delta_{1i} y_{2t-i} + \sum_{j=k+1}^{k+d_{\max}} \delta_{2j} y_{2t-j} + v_{it} \qquad (1)$$

$$y_{2t} = \beta_0 + \sum_{i=1}^{k} \beta_{1i} y_{1t-i} + \sum_{j=k+1}^{k+d_{\max}} \beta_{2j} y_{1t-j} + \sum_{i=1}^{k} \phi_{1i} y_{2t-i} + \sum_{j=k+1}^{k+d_{\max}} \phi_{2j} y_{2t-j} + v_{2t} \qquad (2)$$

where y_1 and y_2 are two variables, and *k* denotes the optimal lag length. This is determined by information criteria such as AIC and SIC; $d_{\max}$ is the maximum order of integration, which is usually determined after establishing the orders of integration following a test of unit root or stationarity of all the variables. For example, if y_1 is I(1) and y_2 is I(2), then, the maximum order is 2, i.e $d_{\max} = 2$.

In equation (1), causality from y_2 to y_1 implies that $\delta_1 \neq 0$ for all *i* and the causality from y_1 y_2 to implies that $\beta_1 \neq 0$ *for all i* . Consequently, this study tests the causality between exchange rate volatility and each of the variables using the following specifications:

$$EXRVOL_t = \alpha_0 + \sum_{i=1} \alpha_{1i} EXRVOL_{t-i} + \sum_{j=k+1} \alpha_{2j} EXRVOL_{t-j} + \sum_{i=1} \delta_{1i} CIM_{t-i} + \sum_{j=k+1} \delta_{2i} CIM_{t-j} + v_{it} \quad (3)$$

$$POLITR_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} EXRVOL_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \beta_{2j} EXRVOL_{t-j} + \sum_{i=1}^{k} \phi_{1i} POLITR_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \phi_{2i} POLITR_{t-J} + v_{2t} \quad (4)$$

$$RESV_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} EXRVOL_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \beta_{2j} EXRVOL_{t-j} + \sum_{i=1}^{k} \phi_{1i} RESV_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \phi_{2i} RESVR_{t-J} + v_{3t} \quad (5)$$

$$CIM_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} EXRVOL_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \beta_{2j} EXRVOL_{t-j} + \sum_{i=1}^{k} \phi_{1i} CIM_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \phi_{2i} CIM_{t-J} + v_{4t} \quad (6)$$

$$FD_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} EXRVOL_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \beta_{2j} EXRVOL_{t-j} + \sum_{i=1}^{k} \phi_{1i} FD_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \phi_{2i} FD_{t-J} + v_{5t} \quad (7)$$

$$TOPEN_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} EXRVOL_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \beta_{2j} EXRVOL_{t-j} + \sum_{i=1}^{k} \phi_{1i} TOPEN_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \phi_{2i} TOPEN_{t-J} + v_{6t} \quad (8)$$

$$EXRP_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} EXRVOL_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \beta_{2j} EXRVOL_{t-j} + \sum_{i=1}^{k} \phi_{1i} EXRP_{t-i} + \sum_{j=k+1}^{k+d_{\max}} \phi_{2i} EXRP_{t-J} + v_{7t} \quad (9)$$

Where:
EXRVOL = Exchange rate volatility, POLITR= Political risk, RSV = Revenue source volatility
FD =Financial sector development, CIM = contract intensive money, TOPEN = Trade openness
EXRP= Exchange rate policy

3.2 Data Sources

Secondary data for the period 1981 to 2020 were used in the study. The data on the exchange rate (from which the exchange rate volatility was computed) was gotten from the statistical bulletin of the Central Bank of Nigeria (2020). Data on changes in exchange rate policy are from the annual statement and policy extracts from the Monetary Policy Committee of the Central Bank of Nigeria (2020). Data on institutional quality (i.e. political risk, POLITR) is from the International Country Risk Guide (ICRG, 2020). Data on contract-intensive money (CIM), Revenue source volatility (RSV), trade openness (TOPEN) and financial sector development (FSD) are from the Annual Statistics of the Central Bank of Nigeria (2020).

3.3 Measurement of Variables

Exchange rate volatility was measured from the nominal exchange rate through a (GARCH 1,1) estimation, consistent with previous studies including Holland et al. (2013) and Mileti´c (2015). An alternative measure for exchange rate volatility is the use of standard deviations of exchange rate or per cent changes (e.g., Schnabl, 2009; Janus

& Riera-Crichton, 2015; Morina et al., 2020). 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; the standard deviation of the growth rate of the total oil revenue was used to proxy Revenue source volatility (RSV). Institutional quality was measured by the Political risk (POLTR). Changes in exchange rate policy (EXRP) were captured as a dummy variable, which takes the value of 1 whenever there is a change in exchange rate policy and 0 otherwise. Trade openness was measured as the ratio of total trade to the gross domestic product while financial sector development was measured as the ratio of the broad money supply to gross domestic product.

3.4 Model Estimation Procedure

The data analysis begins with the investigation of the stationarity characteristics of the data used in the study. The stationarity properties were done by the use of Ng and Perron (2001). This is mostly preferred to the traditional ADF and PP tests, as they are mostly inherent with problems of finite sample power and size. Ng and Perron (2001) instituted different ways of dealing with these problems. In the Ng-Perron test, there is detrended time series by using a GLS estimator that enhances the tests when there is a huge autoregressive (AR) root as well as reduces the distortions and size differenced series. Ng-Perron test is an updated lag selection criteria, unlike the conventional lag procedures employed in the traditional unit root which utilizes a small lag length which accommodates more capacity in the traditional test. In each of the tests, constant and linear time and trend were included to generate the residual spectrum. As a result of the inability of the conventional unit root test, which does not take into account breaks, this paper adopts the Perron and Vogelsang (1992) framework (implying that changes occur gradually).

Toda-Yamamoto's (1995) framework is an augmented VAR, with a modified Wald Test statistic. The causality test is estimated within a VAR framework and presumes all variables are potentially endogenous. As a result, each dependent variable enters the VAR framework and also serves as an exogenous variable. This dependent variable is alternated as endogenous variables one after the other until the number of VAR equations is equivalent to the endogenous variables, the test is a multivariate framework and it accommodates mixed order of integration for the series. One interesting feature of this method to causality is that it does not require the test for cointegration Second, it is preferred as it reduces the risks embedded with likely misspecification identification of the nature of the integration of the series. Third, unlike the usual causality, the TY framework has a large capacity for series that combines different levels of integration. By this, the tendency for correct specification and avoidance of spurious causality is enhanced. Three steps are involved in the TY approach to causality. First, the traditional unit root test, Ng and Perron (2001) is used to examine the highest order of integration *(d-max)* to be employed. Second, VAR is assessed for stability, serial correlation and heteroskedasticity. Lastly, the modified Wald test is accomplished by over-fitting the underlying model with extra lags(Giles, 2011).

4. RESULTS AND DISCUSSION

As indicated in Table 1 below, the result of the unit root with intercept the result indicates that the variables tend to mixed order of integration. The result of the MZa and MZt tend to show that the variables are non-stationary, while for MSB and MPT, the variables are stationary.

Table 1: Unit Root Test Results (with Trend)

Variables	MZa	MZt	MSB	MPT
EXRVOL				
Levels	-8.1000	-2.5800	0.1564*	2.0953*
First difference	-17.001**	-2.7540*	0.1740	3.1700
POLITR				
Levels	-8.9388	-2.1107	0.2361*	2.7588*
First difference	-13.8001*	-2.9692**	0.1686	1.3984
RESV				
Levels	1.5442	4.1905	2.7138*	522.9181*
First difference	-10.6397**	-2.3064*	0.2168	2.3030
FD				
Levels	-3.4111	4.2180	0.3571*	7.1359*
First difference	-18.4862*	-3.0211*	0.1634	1.3945
TOPEN				
Levels	-7.7112	-1.9628	0.2543*	3.-1803*
First difference	-18.1474**	-2.9826**	0.1644	1.4571
EXRP				
Levels	-5.8020	-1.6830	0.2901*	4.2844*
First difference	-19.000**	-3.0822*	0.1622	1.2895

Note:*, **and *** denote rejection of null hypothesis at 1%, 5% and10% level of significance
respectively.

Source: Authors' computations, 2023

The same interpretation is true as shown in Table 2 with intercept and trend. It is theoretically plausible to say that both results lead to the same conclusion from the result, the order of integration is not more than 1.

Table 2: Unit Root Test Results (with Trend and Intercept)

Variables	**MZa**	**MZt**	**MSB**	**MPT**
EXRVOL				
Levels	-18.2856***	-2.9369*	0.1606*	5.5012*
First difference	-17.6327	-2.8358	0.1608	5.9601
POLITR				
Levels	-9.6556	-2.1953	0.2274*	9.4456*
First difference	-17.3203**	-2.9404*	0.1699	5.2637
RESV				
Levels	-0.3095	-0.3878	1.2531*	286.5902*
First difference	-507.2441**	-15.9158**	0.0314	0.1967
FD				
Levels	-16.7478*	-2.8794*	0.1719*	5.5272*
First difference	-18.4690	-3.02859	0.1640	4.9958
TOPEN				
Levels	-9.8919	-2.1535	0.2177*	0.5190*
First difference	17.1546**	-2.8920*	0.1686	5.5314
EXRP				
Levels	-6.6867	-1.7861	0.2671	13.6511
First difference	-18.9810	-3.0794	0.1622	4.8083

Note:*, **and *** denote rejection of the null hypothesis at 1%, 5% and 10% level of significance respectively.
Source: Authors' computations, 2023

The unit root test result amid an endogenous structural break (Innovational Outlier Model) is presented in Table 3. From the result, the null hypothesis of a unit root with a break is accepted for EXRVOL, POLITIR, RESV and FD. The break date appears consistent with the exemption RESV and EXRVOL where 2013 is reported with intercept and 2010 while for the EXRVOL, 1999 with intercept while 2016 with trend and intercept.

Table 3: Unit Root Test with Structural Break (Innovative Outlier Model)

Variable	Intercept		Intercept and trend	
	T-Statistics	Break Date	T- Statistics	Break Date
EXRVOL	-5.2957*	1999	-5.5861*	2016
POLITR	-6.2171**	1999	-5.8087**	1999
RESV	-5.7643*	2013	-4.6365*	2010
FD	-5.4810**	2007	-5.4486*	2007
TOPEN	-3.0157	1994	-6.8394**	1994
EXRP	-3.3752	2010	-3.6741*	2010

Notes: *, ** Denotes 1%, 5% significance levels. Note: BP is the breakpoint year.
Source: Authors' computations, 2023

The standard practice is to test for cointegration following the results of the unit root test. Co-integration was found, although T-Y does test require the test for co-integration and has therefore not been reported. In line with all the selection criteria, as presented in Table 1, the initial lag length for estimation is 3 while extra lag was used for the Toda-Yamamoto test as indicated in Table 4

Table 4: Lag Selection Criteria

Lag order	LR	FPE	AIC	SC	HQ
0	NA	3.15e+09	41.73	42.04	41.84
1	379.48	65601.58	30.90	33.37	31.76
2	110.80	7060.72	28.35	32.97	29.96
3	78.99*	1052.66*	25.43*	32.20*	27.79*

Source: Authors' computations, 2023

Appendix 1 provides the stability test result involving the inverse root of AR characteristics polynomial and inverse root of AR implying that no root is resting outside the unit circle, therefore the (Stability condition of VAR is satisfied). Consequently, as indicated in Appendix 2, the result of the heteroscedasticity with a chi-square value of 383.8317 and a corresponding probability value of 0.2276 is satisfied. Also as indicated in Table 5, the result of the autocorrelation test shows that at lag 3 and 4, there is no autocorrelation at more than 5% level of significance.

Table 5: Serial Correlation LM –Test Results

Lags	LM-stat	Prob.
1	76.63383	0.0070
2	81.10463	0.0027
3	42.02755	0.7494
4	55.38224	0.2466

Source: Authors' computations, 2023

By implication, the results show the collective direction of causality of the institutional quality measures and exchange rate volatility. The null hypothesis is that the measures of institutional quality do not Granger cause exchange rate volatility. The Toda-Yamamoto causality test result is presented in Table 6.

Table 6: Causality from other variables to EXRVOL

Variables	Chi-Square	Prob. Values
POLITR	2.3189	0.5089
RSV	7.1628	0.0669
CIM	1.2758	0.7349
FD	2.4215	0.4896
TOPEN	1.9017	0.5931
EXRP	1.8194	0.6107
ALL	27.0043	0.0789

Source: Authors' computations, 2023

As shown in Table 6, it is clear that the null hypothesis of no collective Granger causality among the measures of institutional quality and exchange rate volatility in Nigeria is accepted at more than 5% with a Chi-square value of 27.0043 and the probability value of 0.0789. However, it is evident that revenue source volatility as a measure of institutional quality influences exchange rate volatility in Nigeria at the 10 per cent level of significance. This is so as the null hypothesis of no causality between revenue source volatility and exchange rate volatility in Nigeria is rejected at the 10 per cent level with a Chi-square value of 7.162 and probability value of 0.0669.

Table 7: Causality from EXRVOL to other variables

Variables	Chi-Square	Prob. Values
POLITR	13.82544	0.0032
RESV	6.604382	0.0856
CIM	0.273246	0.9650
FD	2.208451	0.5303
TOPEN	3.064684	0.3818

EXRP	0.060161	0.9961

Source: Authors' computations, 2023

Furthermore, table 7 details the second leg of causal links moving from exchange rate volatility to each of the explanatory variables respectively. The results show that the null hypothesis that no causality from exchange rate volatility to these variables is accepted at a 5% significance level, except for the causal link to political risk and revenue source volatility. Thus, the direction of causality is from revenue source volatility to exchange rate volatility while the reverse causality holds from exchange rate volatility to political risk and revenue source volatility in Nigeria.

5. CONCLUSIONS

The study aimed to empirically investigate the causal link between institutional quality and exchange rate volatility spanning 1981-2020, using annual data generated from the World Development Indicator (WDI), International Country Risk Guide (ICRG) and the Central Bank of Nigeria. Institutional quality was proxied by revenue source volatility, contract-intensive money and political risk.

The Toda-Yamamoto causality test was employed for this purpose. The test for both unit root and the structural break was also conducted to affirm the behaviour of the data used, all these were satisfied before conducting the Toda-Yamamoto test. The result shows that there is unidirectional causality from institutional quality to exchange rate volatility while bi-directional causality was found from exchange rate volatility to institutional quality. What is more revealing about the result is that the measures of institutional quality appear endogenous to exchange rate volatility in Nigeria. Interestingly, political risk and revenue source volatility are significant variables that explain exchange rate volatility in Nigeria. Political restructuring, economic diversification and proper exchange rate management are suggested policy recommendations for Nigeria to be free from the volatility phenomenon.

It needs to be stressed that the result of this paper is based on the proxies used for institutional quality. Moreover, the method of generating the volatilities could also affect the result. It is therefore important to state that different results might as well be the case if different proxies of institutional quality and control variables are used. Future research that utilizes different proxies is likely to report different results from the current study.

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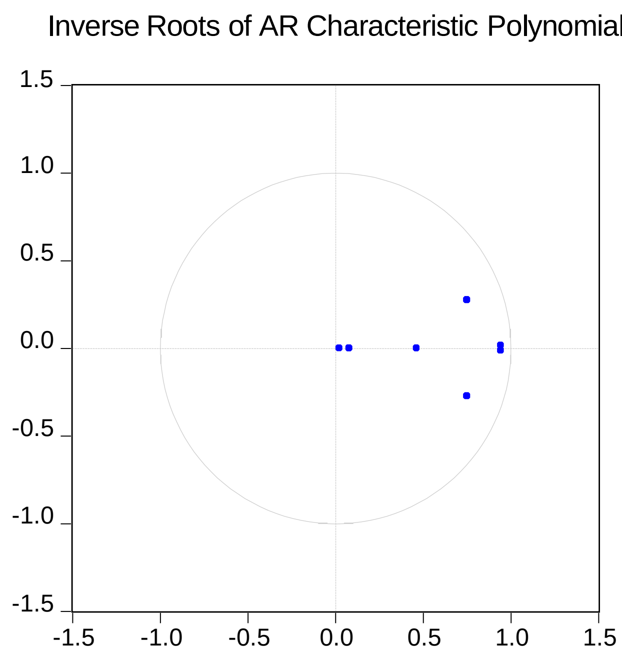
APPENDIX 1: Toda-Yamamoto Pre-estimation Diagnostics

Roots of Characteristic Polynomial

Root	Modulus
0.944808 - 0.013423i	0.944904
0.944808 + 0.013423i	0.944904
0.750859 - 0.274132i	0.799336
0.750859 + 0.274132i	0.799336
0.464864	0.464864
0.080347	0.080347
0.022992	0.022992

No root lies outside the unit circle.
VAR satisfies the stability condition.

Appendix 2: VAR Stability test result



Causality test Results

Dependent variable: EXRVOL

Excluded	Chi-sq	Df	Prob.
POLITR	2.318903	3	0.5089
RESV	7.162821	3	0.0669
CIM	1.275802	3	0.7349
FD	2.421493	3	0.4896

TOPEN	1.901660	3	0.5931
EXRP	1.819372	3	0.6107
All	27.00428	18	0.0789
Dependent variable: POLITR			

Excluded	Chi-sq	Df	Prob.
EXRVOL	13.82544	3	0.0032
RESV	6.070649	3	0.1082
CIM	10.12540	3	0.0175
FD	4.012733	3	0.2601
TOPEN	0.807039	3	0.8478
EXRP	0.096367	3	0.9923
All	34.77906	18	0.0101

Dependent variable: RESV

Excluded	Chi-sq	Df	Prob.
EXRVOL	6.604382	3	0.0856
POLITR	11.91829	3	0.0077
CIM	19.53067	3	0.0002
FD	4.877351	3	0.1810
TOPEN	1.382057	3	0.7097
EXRP	15.51156	3	0.0014
All	67.88873	18	0.0000

Dependent variable: CIM

Excluded	Chi-sq	Df	Prob.
EXRVOL	0.273245	3	0.9650
POLITR	3.561300	3	0.3129
RESV	20.48968	3	0.0001
FD	5.883822	3	0.1174
TOPEN	9.994724	3	0.0186
EXRP	1.661665	3	0.6455
All	45.13387	18	0.0004

Dependent variable: FD

Excluded	Chi-sq	Df	Prob.
EXRVOL	2.208451	3	0.5303
POLITR	3.829965	3	0.2804
RESV2	1.472835	3	0.6886
CIM	10.05727	3	0.0181
TOPEN	0.743188	3	0.8630

EXRP	3.136460	3	0.3711
All	37.30050	18	0.0048

Dependent variable: TOPEN

Excluded	Chi-sq	Df	Prob.
EXRVOL	3.064684	3	0.3818
POLITR	3.393517	3	0.3348
RESV2	4.021750	3	0.2591
CIM	5.281201	3	0.1523
FD	2.281284	3	0.5161
EXRP	2.027830	3	0.5667
All	26.34089	18	0.0922

Dependent variable: EXRP

Excluded	Chi-sq	Df	Prob.
EXRVOL	0.060161	3	0.9961
POLITR	2.480158	3	0.4789
RESV	1.291793	3	0.7311
CIM	1.422717	3	0.7002
FD	4.065524	3	0.2545
TOPEN	3.326547	3	0.344
All	27.60134	18	0.0684

Source: Authors' computation