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A Revisit of Exchange Rate Volatility and Trade Flow in Nigeria

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Abstract
Since the advent of floating exchange rates in Nigeria, exchange rate has been highly volatile. Excessive volatility has severe implications for international trade. This study revisits the long-standing debates on the link between exchange rate volatility and trade flow for the Nigerian economy, 1980-2020. We employ the Granger causality tests based on VECM\VAR model. The results show evidence for a bi-directional causality from trade to exchange rate volatility and vice versa. Since the Nigeria seeks export promotion, there is need to undertake measures that will check excessive fluctuations beyond fundamentals needed for the economy. Hence, we suggest that monetary authority should continue its periodic exchange rate intervention to curtail excessive swings. This should be carefully done to maintain policy rate that will not be counter-productive.

Keywords: Exchange Rate Volatility, Trade Flow, VAR, Granger Causality.

JEL Classification: H16; F41; F31; C1

Introduction

Since the advent of floating exchange rates in 1973, exchange rate has been highly unstable. Excessive volatility and risk associated with exchange rate swings has implications for trade flow. The impact of exchange rate swings on trade depends on the trader's attitudes toward risk. Notably, while risk averse traders avoid trade in response to an increase exchange rate swing, risk tolerant traders will increase trade to reduce loss of future income. The ultimate impact of exchange rate volatility depends on the market environment, adjustment costs, hedging opportunities, consumption pattern and productivity shock (Asteriou, Masatci, & Pılbeam, 2016; Aftab, Shah & Katper, 2017; Bahmani-Oskooee & Aftab, 2017; Arize *et al.*, 2017).

Bahmani-Oskooee, et al., (2021), Shaikh and Hongbing (2015), Aftab, Shah and Katper (2017) show how an increase in exchange rate volatility may have positive impact on trade volume. They see exports as an 'option' that is exercised in favourable conditions (Barone-Adesi, 2016). In line with option pricing theory, since the value of an option increases when the variability of the underlying asset increases, as exchange rate swings increases the chance of making a large profit increase, traders will increase trade with excessive volatility.

Exchange rate volatility impact on the economic variables depending on whether the countries are considered developed or less developed and the structure of the economy. Since how volatility affects trade flows is imperative for policy decisions in many economies, this paper revisit the issue of the effects of exchange rate volatility on trade flows in a developing economy. The rest of the study is organized as follows: Section II presents empirical literature. Section III describes the methodology and specify the models. Section IV presents the results. Section V concludes.

Essentially, empirical literature on the effects of exchange rate volatility on trade flows has followed three distinct paths in search of strong support for the theory. Some have used trade flows between one country and the rest of the world and some have used aggregate trade flows between two countries (Bahmani-Oskooee, et al., 2022; Lee, et al., 2022; Bahmani-Oskooee & Aftab, 2017; Bahmani-Oskooee *et al., 2021;* Xu, et al., 2020).

Arbabian et al., (2020) and Baek, (2020) focus on the profit opportunities created by greater uncertainty to explain how exchange rate volatility reduces trade volume. Hajilee, *et al., (2019)* notes that unanticipated exchange rate swings lead to greater uncertainty about future exchange rate and has negative effect on trade volume. The excessive fluctuation instigates uncertainty among profit maximizing traders, reduces firms' export transaction and overall trade flow declines.

Bahmani-Oskooee *et al., (2022)* compares the effects of exchange rate risk across manufacturing, agriculture and chemical sectors for the United State (US). He finds that bilateral agriculture trade between US and its Western trading partners is sensitive to exchange rate uncertainty. He argues that agriculture compared with manufactured goods trade is more responsible to exchange rate changes. Bahmani-Oskooee *et al., (2020)* show how exchange rates affects trade flows in Nigeria. He argues that due to low price elasticity in the import and export demand, exchange rate devaluation has no significant effects on the trade balance in the less developed countries.

Adubi and Okunmadewa (1999) studies exchange rate volatility effect on Nigeria's agricultural trade flows. They argue that if the exchange rates change is more volatile it tends to increase the prices of export crops, but the general effects lead to a decline in exports production. De-Vita and Abbott (2004) provides evidence that increase exchange rate fluctuations have an adverse effect on trade due to risk adverse trades. That is higher exchange rate fluctuation led to higher costs for risk averse traders and thus to less volume of trade.

Hajilee *et al., (2019)* examines the impact of exchange rate volatility on the imports of six West African Monetary Union member countries for the period 1976 - 1982. He employs ordinary least squares on the pooled import volume and concludes that the adverse effect of volatility was insignificant. Delatte and Lopez-Villavicencio (2012) offers a fourth line of study validating the proposition that the exchange rate volatility impact on real macroeconomic variables has quite different results for different countries. They show that in countries with relatively low levels of financial development, the exchange rate volatility reduces growth. Adeoye and Atanda (2015) use error correction model argued on the contrary that trade liberalization promoted sector and stabilized the exchange rate market between 1970 and 2006. They discovered a positive and significant relationship between index of industrial production and real export.

Methodology

Estimation Procedure

We examine the link between exchange rate volatility and trade flow using Granger causality tests based on vector autoregressive (VAR) model. The estimation process involves 3 stages (Kennedy, 2008 & Greene, 2017):

First, we test for unit root in our data series. This helps to verify the stochastic properties of the data generating process (DSG), hence confirm whether each variable is stationary or otherwise. Following Dickey and Fuller (1981), the Augmented Dickey Fuller (ADF) statistics[1] used to test for unit roots in each of the series x_t is obtained from:

$$\Delta x_t = \beta_0 + \beta_1 x_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta X_{t-1} + \mu_t ; \qquad \mu_t \sim NID\ (0, \sigma^2) \qquad 1$$

Second, we examine the existence of a long run equilibrium between trade and exchange rate volatility. We employ the maximum-likelihood test by Johansen and Juselius (1990). The Johansen

[1] The t-statistics are compared with the critical value constructed by Dickey Fuller (1979, 1981).

cointegration uses the trace and maximum eigenvalue tests to determine the rank, r^2, of matrix Π in (4) below. The trace test statistic is:

$$\text{TR} = T\sum_{i=r+1}^{N} \ln(1-\lambda_i); \qquad 2$$

λ_{r+1}, ..., λ_N are the *N-r* smallest squared canonical correlations between X_{t-k} and X_t series. The maximum eigenvalue statistic is:

$$\lambda_{\max} = T\ln\left|(1-\lambda_{r+1})\right| \text{ and } k = 1,2,\ldots,n; \qquad 3$$

The asymptotic distributions of TR and $\lambda_{\max}$ statistics follow *chi* square distributions.

Third, we estimate and test for causality in the framework of a multivariate vector error-correction model (VECM). If all the variables are stationary in level form, the standard vector auto regression (VAR) model is appropriate in detecting the direction of causality.

VECM\VAR Models

We present the procedure for granger-causality tests based on VECM and VAR approach. The VECM\VAR method provides a unified framework for testing cointegrating relations. VAR model is used to capture the short run dynamics of variables of in (1). In (1) since X_t is a vector of stochastic series, there is a *k*-lag VAR of the form:

$$\Delta X_t = a + \Gamma_1\Delta X_{t-1} + \ldots + \Gamma_{k-1}\Delta X_{t-k-1} + \Pi X_{t-1} + \eta_t \qquad 4$$

Γ_1, Γ_{k-1}, Π are coefficient matrices; a and η_t are vectors of deterministic trend and Gaussian white noise. The lag length based on Akaike's information criterion, AIC is:

$$\text{AIC} = \left(\ln|S_k|^2 + \frac{2d^2k}{T}\right) \quad k = 1,2,\ldots,n. \qquad 5$$

d is number of variables, *n* is maximum lag; S_k is residual covariance matrix for lag k.
The causality inferences in the multivariate framework are made by estimating the parameters of our reparameterised VECM equations:

$$\Delta TRAD_t = \sum_{j=1}^{m}\beta_j\Delta TRAD_{t-k} + \sum_{j=1}^{n}\gamma_j\Delta EXRV_t + \sum_{j=1}^{p}\delta_j\Delta INFL_t + \sum_{j=1}^{q}\phi_j\Delta OILP_t$$
$$+\sum_{j=1}^{r}\omega_j\Delta RGDP_t + \sum_{j=1}^{s}\tau_j\Delta INTR_t + \sum_{j=1}^{v}\varphi_j\Delta EXCH_t + \theta Z_{t-1} + \varepsilon_t \qquad 6$$

$$\Delta EXRV_t = \sum_{j=1}^{m}a_j\Delta TRAD_t + \sum_{j=1}^{n}b_j\Delta EXRV_{t-k} + \sum_{j=1}^{p}c_j\Delta INFL_t + \sum_{j=1}^{q}d_j\Delta OILP_t$$
$$+\sum_{j=1}^{r}e_j\Delta RGDP_t + \sum_{j=1}^{s}f_j\Delta INTR_t + \sum_{j=1}^{v}g_j\Delta EXCH_t + \rho Z_{t-1} + \psi_t \qquad 7$$

This VECM allows us to differentiate between the short- and long- run dynamic. Z_{t-1} is lagged residual and its coefficient is the error-correction term which indicates the speed of adjustments, while,

[2] Kennedy (2008) and Greene (2017) describe three possible cases of the rank: case 1 is when *r* is of full rank, *q*, indicating that the variables are given by a stationary process; case 2 is when *r* = 0, which means there is no long run equilibrium between trade and exchange rate; and case 3 is the intermediate case where $0 < r < q$, implying there are $\bar{r}$ cointegrating relations among the elements of X_t and *q - r* stochastic trends.

ε_t and ψ_t are white noise processes. In (7), the null hypothesis that TRAD does not Granger-cause EXRV is rejected if the set of estimated coefficients on the lagged values of EXRV is jointly significant using the F statistics. TRAD is Trade flow, which is a proxy for net export in the country, EXCH is exchange rate of dollar to naira, INFL is inflation rate, INTR is interest rate, OILP is Brent crude oil price, RGDP is the real gross domestic product, and EXRV is exchange rate volatility[3]. The data ranging 1980 - 2019 are obtained from the Central Bank of Nigeria, CBN (2020) Bulletin, and the International Financial Statistics, IFS published by the international monetary Fund, IMF (2020).

Results

The result of the unit root test of stationarity of all the series is presented in Table 1. As shown except for INTR, all other variables TRAD, EXCH, INFL, OILP, RGDP and EXRV were not stationary at level form at 5%. All series are stationary at first difference form; ∆TRAD, ∆EXCH, ∆INFL, ∆OILP, ∆RGDP ∆INTR and ∆EXRV are stationary, In general, the evidence suggests the presence of I(1) for most of the variables.

Table 1:
Test for Stationarity Result

Unit Root Test (Level)			
Variables	ADF Statistic	Critical Value at 5%	Remarks
TRAD	1.814017	2.951125	Non-stationary
EXRV	0.140119	2.951125	Non-stationary
INFL	2.802717	2.951125	Non-stationary
OILP	3.740581	2.951125	Non-stationary
RGDP	0.591695	2.951125	Non-stationary
INTR	4.263125	2.951125	Stationary
EXCH	4126457	2.951125	Non-stationary
Unit Root Test (First Difference)			
Variables	ADF Statistic	Critical Value at 5%	Remarks
∆TRAD	5.174354	2.954021	Stationary
∆EXRV	5.443604	2.954021	Stationary
∆INFL	5.776538	2.95711	Stationary
∆OILP	6.058128	2.95711	Stationary
∆RGDP	7.269927	2.954021	Stationary
∆INTR	7.482221	2.954021	Stationary

[3] We computed the exchange rate volatility with standard deviation of the level of exchange rate:

$$V_t = \sqrt{\sum_{t=1}^{n}\left(e_i - \bar{e}\right)^2 \Big/ (n-2)}$$

e is the logarithm of EXCH (see Hooper and Kohlhagen, 1978; Akhtar and Spence-Hilton, 1984).

∆ EXCH	5.457061	2.954021	Stationary

Source: Author computation, 2022

The result of the Johansen cointegration test over the various sample periods is presented in Table 2. This test is performed since the variables were found to be differenced stationary in the levels. For the trace test, we start with r = 0 and move upwards. We stop the first time we are unable to reject the null hypothesis. For instance, the hypothesis of *r=0* is rejected as the computed value of the test statistic is greater than the critical value. Similarly, the null hypothesis of *r* =1, *r* = 2 and *r* = 3 are also rejected. But in the next step, the null hypothesis of at most four cointegrating vectors *r* = 4 cannot be rejected at the 5 percent level of significance. This shows evidence of 4 or fewer cointegrating vector. The maximum eigenvalue test supports the existence of 4 cointegrating vectors in the system at 5% level. Since cointegration exists then (Granger-) causality also exists in at least one direction. We next present the result of the VECM equation (Table 3a) and the causality tests based on VECM\VAR (Table 3b, 4a, 4b).

Table 2:
Johansen Cointegration Test

Trace Statistic			Max-Eigen Statistic		
Hypothesized No. of CE(s)	Test Statistics	5% Critical Value	Hypothesized No. of CE(s)	Test Statistics	5 % Critical Value
*r = 0***	187.7774	124.24	*r = 0***	93.14133	45.28
r = 1 **	124.6360	94.15	*r = 1* **	89.02134	39.37
*r = 2**	74.61469	68.52	*r = 2***	56.83783	33.46
*r = 3**	47.77685	47.21	*r = 3**	28.57119	27.07
r = 4	22.20566	29.68	*r = 4*	13.71968	20.97
r = 5	8.485981	15.41	*r = 5*	7.191461	14.07
r = 6	1.294520	3.76	*r = 6*	1.294520	3.76

Source: Author computation, 2022

The VECM Equation correct the short run dynamics from the long run stable convergence established by Johansen test. Table 3a presents the short-run dynamics of the co-integrating equations. From the result in Table 3a, the error-correction term, Z_{t-1} emerges as an important influence. The result show that four of the co-integrating variables, EXCH, INFL, INTR and OILP are adjusting as seen by their respective coefficient in equation (6), which assume negative values in the Error Correction cointEq1. The result shows that in the short-run, exchange rate, inflation rate, interest rate and oil price are negatively related to trade flow. Whereas, the real gross domestic product and exchange rate volatility has a positive relationship with trade flow. The coefficient of the exchange rate volatility is as well statistically significant. This implies that exchange rate volatility improves trade for the Nigerian economy. The VECM estimate also provides evidence that in the short-run, the converging variables are mutually related.

The result of the causality tests based on VECM is presented in Table 3a, and the results based on VAR are reported in Table 3b, 4a and 4b. Since this study aims to see the join effect of exchange rate volatility, as well as interactions of other macroeconomic variables on trade, we employ the estimated results in Table 3a to perform hypothesis testing (the Wald test) on each coefficients of the VECM equations. For the test, we report the F statistics to know whether EXRV affects TRAD and vice versa. To estimate the VAR, we first determine the lag structure, using the AIC criterion and obtained an optimal lag length of 2. As a rule, for this test, we note that that low probability values indicate that the null hypothesis that the coefficient is zero is strongly rejected. As shown, the F-statistics of 6.25938 and 3.537806 indicate that the $Z_{t-1}$is significant for both equations. This implies that both TRAD and EXRV will adjust to their past disequilibrium on account of any perturbation in the system. In terms of the short run dynamics between TRAD and EXRV, it can be seen that changes in EXRV have a significant causal influence on TRAD. Analogously, in the EXRV model, TRAD have a significant causal influence on EXRV. Also, we see that exchange rate volatility, oil prices, RGDP affects TRAD, while the inflation rates and exchange rate are not significant. For the EXRV model all variables except inflation, interest rate and exchange rate are significant.

This finding is in line with theoretical postulations that exchange rate variability improves trade. The degree of such impact depends on the relative sizes of countries, variability of consumption and productivity shock (Broda & Romalis, 2008). Table 4a shows that exchange rate volatility, oil price, and real GDP have important influence on their trade. Table 4b shows that aside interest rate all other variables are important determinant of exchange rate volatility. In sum, the results suggest that (a) trade cause greater exchange rate variability. (b) a feedback relationship, that is existence of bi-directional causality emanating from trade to exchange rate and vice versa.

Table 3a:
The VECM Result

Error Correction:	CointEq1	t values	S.D.	R-squared	Log likelihood	Akaike AIC	Schwarz SC
β_j	0.284358	(0.15529)	[1.83111]	0.947462	-486.5368	31.40855	32.14142
γ_j	0.034362	(0.01522)	[2.25822]	0.891883	-412.2028	26.76267	27.49554
δ_j	-2.96E-06	(1.8E-06)	[-1.62287]	0.497116	-123.3186	8.707415	9.440283
ϕ_j	-3.86E-07	(1.4E-06)	[-0.28158]	0.558562	-114.1693	8.135581	8.868449
ω_j	1.10E-07	(1.5E-06)	[0.07342]	0.794387	-116.8676	8.304224	9.037092
τ_j	-2.67E-07	(4.3E-07)	[-0.62399]	0.444466	-76.81763	5.801102	6.533970
φ_j	-3.50E-06	(1.4E-06)	[-2.52002]	0.578489	-114.5198	8.157485	8.890353
θZ_{t-1}	-1.55E-07	(2.0E-07)	[-0.78891]	0.420057	-87.1912	5.540659	5.854910

Source: Author computation, 2022

Table 3b:
The Causality tests based on VECM

Error Correction:	TRAD	EXRV
	F-statistic	F-statistic
ΔTRAD	9.23612***	12.40855***
ΔEXRV	8.799190***	9.76267***

∆INFL	1.054432	0.707415
∆OILP	14.349676*	9.135581
∆RGDP	4.121071*	8.304224***
∆INTR	7.853408**	1.301102
∆EXCH	1.463915	8.157485***
Z_{t-1}	6.259388***	3.537806**

***, **, and * associated with the F-stat is significance at the 1%, 5% and 10% level respectively.

Source: Author computation, 2022

Table 4a:
Causality tests based on VAR (TRAD)

	TRAD (-2)	EXRV	INFL	OILP	RGDP	INTR	EXCH
F-stat.	13.2017***	15.8535***	1.029526	3.259388*	4.07217**	0.7709	4.16619**
AIC	31.38831	7.932343	8.497790	5.540659	7.547149	7.677528	26.97753

Source: Author computation, 2022

Table 4b:
Causality tests based on VAR (EXRV)

	TRAD	EXRV (-2)	INFL	OILP	RGDP	INTR	EXCH
F-stat.	53.8498***	37.4624***	32.1912***	3.3015*	4.5183	1.01845	4.4990
AIC	32.8531	7.932343	5.420057	12.923172	9.98262	5.45276	2.97753

***, **, and * associated with the F-stat is significance at the 1%, 5% and 10% level respectively.

Source: Author computation, 2022

The AIC determines the optimal lag employed for TRAD and EXRV.

The Impulse Response Functions, IRF Estimates are presented to give additional insights into the short-run transmission. The graphs reveals that the IRF analysis are in conformity with the causality tests. Table 5 shows IRF for trade flow against own shocks and innovations in EXRV, EXCH, INFL, OILP, RGDP and INTR over the 5 years period. The result indicates that previous trade flow and oil price shocks had a positive correlation from the beginning till the end of the period. The response of TRAD to innovations in EXCH showed that the relationship is positive only at the beginning and end. The response of TRAD to innovations in INFL, INTR, RGDP and EXRV are positive only at the beginning but negative from the 2nd till the end of the period. The table reflects that the response of EXRV to own shocks and the innovations in RGDP are positive at the 1st to the 3rd period but negative at the last two periods. Its response to shocks in TRAD and INTR are positive in all the period.

The table reflects that the response of inflation rate to own shocks and the innovations in TRAD and OILP are positive both at the beginning till the end of the time horizon. It was seen that INTR exhibit a negative shock to INFL but positive at other periods. The response of RGDP to shocks in EXRV was only positive at the beginning but negative at every other periods. The table indicates that the response of INTR to own shocks and the innovations in RGDP and EXRV are positive both at the beginning till the end of the time horizon. Its response to shocks in TRAD is negative at the first to third period and positive in other periods.

The Table also indicates that the response of OILP to own shocks and the innovations in EXRV, INFL and INTR are positive both at the beginning till the end of the time horizon. Its response to shocks in TRAD is negative all through the period. RGDP was found to be negative only at the second period but positive at other periods of the time horizon. However, response to shocks in EXRV was found to be positive at the beginning while it is negative at every other period till the end of the time horizon. The response of RGDP to own shocks and the innovations in INTR, OILP and EXRV are positive both at the beginning till the end of the time horizon. Its response to shocks in TRAD is negative only at the beginning of the period but positive in the other periods. In sum, the accumulated responses of each variable to shocks in itself and shocks in other variables provides information to detect the interaction among variables to attain long-run (steady-state) equilibrium in the time series forecast.

Forecast Error Variance Decomposition, FEVD examines the share of the changes in the given time series caused by the seed of own shocks and the innovations of other variables. Table 6 presents the FEVD for all the variables. The table shows that the share of variation witnessed in TRAD is largely adduced to the seed of its own shock to as high as 100% in the first period and then falls to about 13% at the end of the time horizon. The innovations in EXCH, INFL, INTR, OILP, RGDP and EXRV is between 0 to 0.87%, 0 to 3.28%, 0 to 7.71%, 0 TO 14.55 and 0 to 33.82% respectively, at the beginning and end of the period.

The innovations in EXRV are more pronounced compared to other variables in the end of the period. The FEVD in EXCH is attributed to its own variation of 93.69% at the beginning of the period and 53.71% at the end of the period. The other proportion of the variations is sourced from the variations in TRAD, INFL, INTR, OILP, RGDP and EXRV between 6.30% to 14.48%, 0 to 24.28%, 0 to 2.35% and 0 to 0.38%, 0 to 3.73% and 0 to 0.04%, respectively at the beginning and the end of the time period. The FEVD in INFR is attributed to the seed of its own shock and shock from EXCH of 40.21% and 40.99% at the beginning of period. This was adduced to innovations in EXCH by 47.23% at the period end.

Table 6 further shows that the FEVD of INTR is attributed to the seed of its own shock of 67.01% and 52.19% at the beginning and end of the period. The innovations in TRAD, EXCH, INFR, OILP, RGDP and EXRV are 2.20% to 2.42%, 18.23% to 12.60%, 12.55% to 13.12%, 0 to 5.91%, 0 to 6.00% and 0 to 7.73% at the beginning and end of the period respectively. Furthermore, it is revealed that the FEVD in OILP is attributed to the seed of its own shock and also shock from TRAD of 15.80% and 49.93% at the beginning of the period. But was grossly adduced to innovations from itself by 43.21% at the end of the period. Finally, the table also indicates that the FEVD of EXRV is attributed to its own shock of 34.21% at the beginning which marginally falls to 17.88% at the end of the time horizon. However, at the end of the period, the innovation was largely adduced to shocks in Trade Flow.

Table 5:
Generalized Impulse Responses

Accumulated Response of TF:							
Period	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	1372177.	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	3435116.	-2040874	-1146058	1032752.	-622685	-813390	-524473
3	3829828.	-4741878	-2006919	2902480.	-2288459	-1959820	-773702
4	1555807.	-7910336	-1840723	5385852.	-5353577	-2848876	-286021
5	584995.1	-1.1E+07	-2780453	6938329.	-8655281	-4896807	177400.8
Accumulated Response of EXR:							
Period	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH

1	3.079399	0.000000	0.000000	0.000000	0.000000	0.000000	11.86742
2	13.12602	-0.48731	-5.53028	1.436353	2.456515	1.231126	21.77690
3	20.12219	-0.99056	-14.2921	3.041793	5.783289	5.874064	33.37225
4	26.49824	-0.86975	-27.1943	4.194514	10.18826	8.499872	49.05715
5	32.26082	-0.43375	-38.0183	4.703106	15.05738	11.31366	65.22824

Accumulated Response of INF:

Period	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	6.996943	0.000000	10.23513	0.000000	0.000000	0.000000	-10.3347
2	14.84926	-1.3489	21.81908	1.698651	-2.58615	-1.99272	-23.2594
3	21.08533	-2.33495	23.70525	0.739494	-5.01047	1.736552	-32.8835
4	27.56245	-2.99822	21.84999	1.251429	-3.37784	4.691631	-41.1122
5	33.92073	-2.70432	23.49511	0.143025	-2.45821	5.020711	-47.5927

Accumulated Response of INT:

Period	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	-0.56046	0.000000	-1.33705	0.000000	0.000000	3.089561	-1.61162
2	-0.49541	0.601480	-1.81068	-0.25457	0.667691	4.767503	-2.89756
3	-0.06225	1.556475	-2.59666	-1.21526	1.100674	6.296205	-3.49071
4	0.602252	2.666535	-4.44643	-2.33612	2.145479	8.960136	-4.51101
5	1.156241	3.889649	-5.30992	-3.2401	3.321954	11.24615	-5.45087

Accumulated Response of OP:

Period	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	-8.5695	0.000000	5.378952	4.821779	0.000000	3.286179	3.262432
2	-9.79598	-1.14855	7.997209	7.745209	-0.30309	1.829088	7.508541
3	-9.86111	-4.57311	9.965748	14.17181	1.812351	1.130411	8.028499
4	-14.7793	-9.57498	12.24600	23.19643	2.320829	1.148626	9.858176
5	-20.2937	-14.0486	13.94547	31.85561	3.368293	0.233863	13.56240

Accumulated Response of RGDP:

Period	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	-0.60009	0.000000	-3.31241	5.798121	11.33583	0.790165	-0.02342
2	1.233460	0.630482	-4.30491	15.55820	29.66503	1.207488	0.508926
3	7.660619	1.228265	-3.54127	29.37756	55.63848	1.259751	-1.11281
4	16.30535	1.657906	-2.42394	48.05034	88.41759	3.087858	-3.84905
5	27.59664	1.590426	-2.97772	70.72441	127.9696	5.965324	-6.14801

Accumulated Response of EXRV:

Period	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	57129.76	78651.60	38432.90	-41248.8	28908.75	67278.04	9336.502
2	202277.8	55108.00	8762.584	-34286.6	52685.47	88601.66	-5180.54
3	361437.3	5130.276	-52207	-16778	51804.89	70336.15	-16873.8
4	304389.8	-88681.4	-14273.2	88947.27	-24195.5	113809.5	3927.602
5	319630.0	-166178	-18732.7	126649.1	-144067	64527.15	58459.84

Cholesky Ordering: TF EXR INF INT OP RGDP EXRV

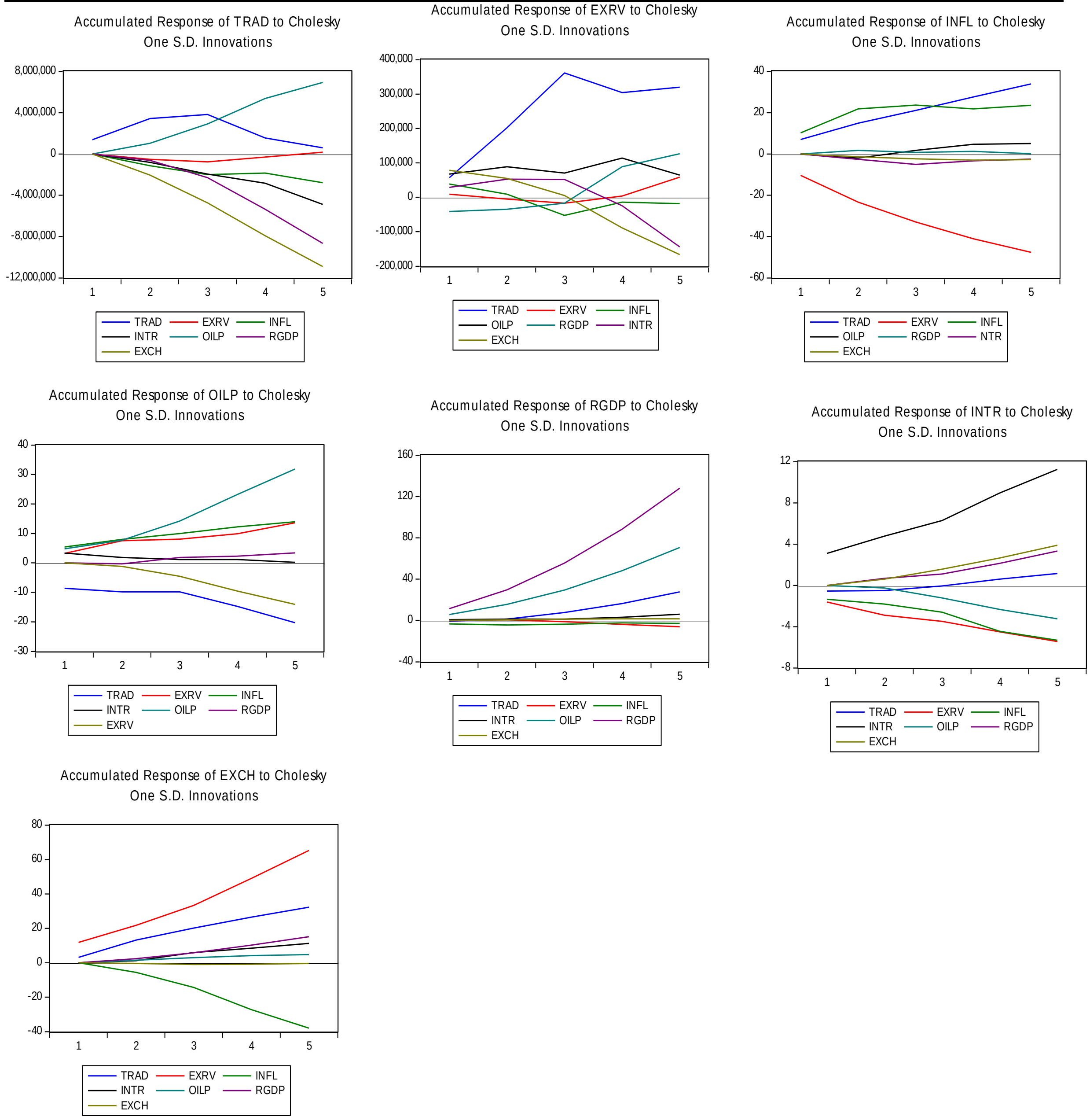


Table 6:
Generalized Forecast Error Variance Decomposition of the Variables

Variance Decomposition of TRAD

Period	S.E.	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	1.37217	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
2	3.74275	4.38214	2.97337	9.37629	7.61395	2.76792	4.72297	1.96364
3	5.46329	2.10884	3.83970	6.88340	1.52858	1.05956	6.61997	1.12969
4	7.85339	1.85900	3.48592	3.37596	1.73967	2.03604	4.48526	0.93232
5	9.49986	1.37488	3.38242	3.28568	1.45597	2.59937	7.71251	0.87512

Variance Decomposition of EXCH:

Period	S.E.	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	1.22604	6.30841	0.00000	0.00000	0.00000	0.00000	0.00000	9.36915
2	1.97455	2.83204	0.06090	7.84435	0.52915	1.54775	0.38874	6.13086
3	2.61822	2.32475	0.07158	1.56603	0.67695	2.49477	3.36576	5.44830
4	3.41509	1.71499	0.04332	2.34779	0.51182	3.13007	2.56947	5.11743
5	4.01277	1.44839	0.04318	2.42809	0.38677	3.73945	2.35275	5.71296

Variance Decomposition of INFL:

Period	S.E.	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	1.61406	1.87920	0.00000	4.02108	0.00000	0.00000	0.00000	4.09971
2	2.5274	1.73167	0.28484	3.74066	0.45170	1.04702	0.62164	4.28713
3	2.8205	1.87931	0.35093	3.04834	0.47834	1.57951	2.24736	4.60672
4	3.0343	2.07940	0.35099	2.67119	0.44176	1.65422	2.89018	4.71568
5	3.1751	2.30014	0.32913	2.46645	0.52533	1.59469	2.65036	4.72344

Variance Decomposition of INTR:

Period	S.E.	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	3.7741	2.20516	0.00000	1.25500	0.00000	0.00000	6.70109	1.82338
2	4.4513	1.60662	1.82581	1.01542	0.32706	2.24991	6.23826	2.14537
3	5.0330	1.99741	5.02856	1.03816	3.89930	2.50002	5.80226	1.81704
4	6.3962	2.31603	6.1253	1.47913	5.48507	4.21611	5.32711	1.37949
5	7.1952	2.42305	7.73025	13.1290	5.91301	6.00527	5.21916	1.26076

Variance Decomposition of OILP:

Period	S.E.	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	1.2126	4.99358	0.00000	1.96741	1.58094	0.00000	7.34316	7.23742

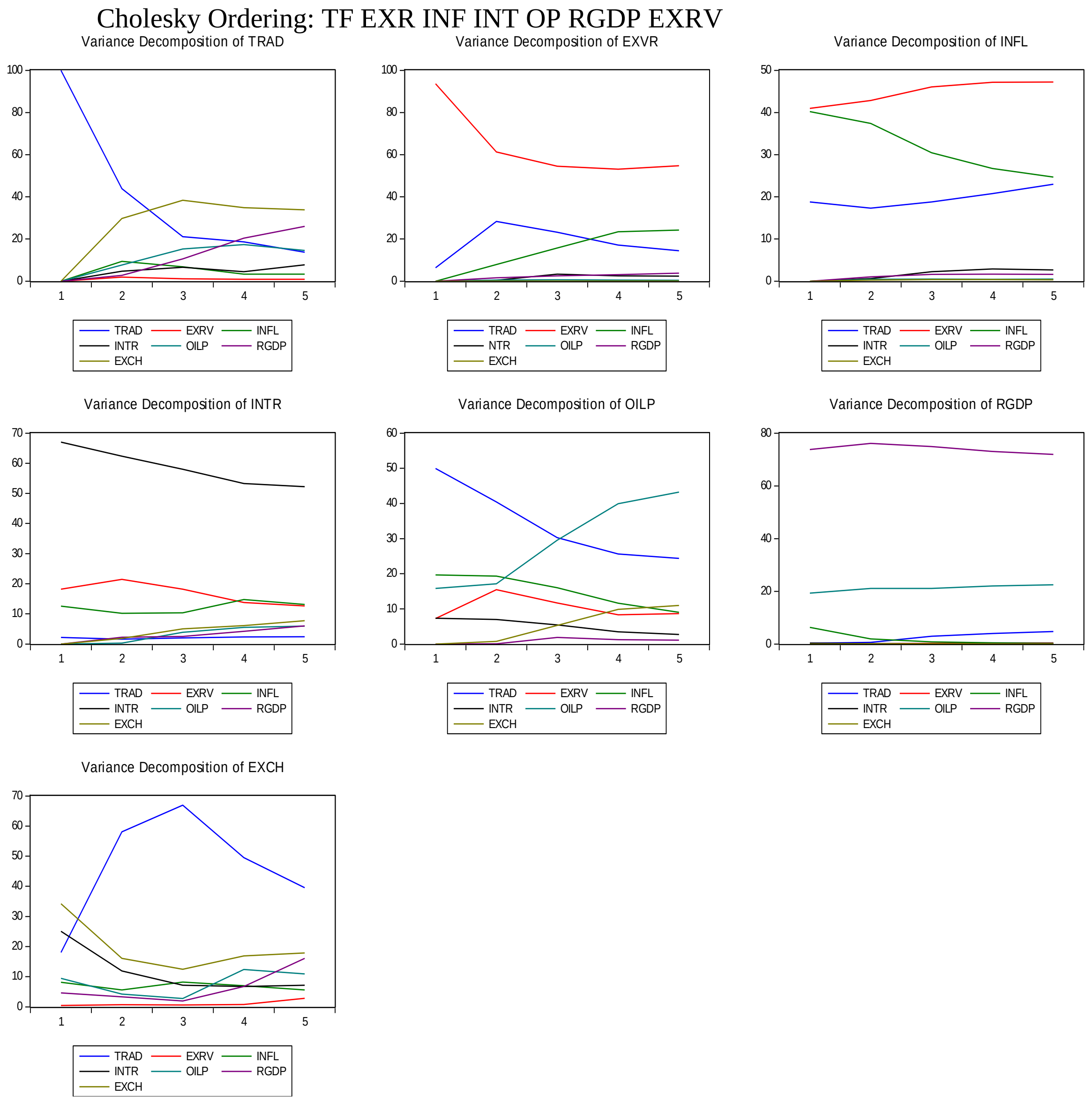
2	1.3620	4.03925	0.71102	1.92897	1.71378	0.04951	6.96492	1.54545
3	1.5737	3.02596	5.26773	1.60144	2.95136	1.84394	5.41449	1.16860
4	1.9675	2.56073	9.83272	11.5886	3.99195	1.24648	3.46409	8.34111
5	2.3045	2.43924	10.9359	8.99141	4.32182	1.11522	2.68273	8.66395

Variance Decomposition of RGDP:

Period	S.E.	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	1.3193	0.2068	0.0000	6.3030	19.312	7.38188	0.35867	0.00031
2	2.4708	0.6096	0.0651	1.9585	21.110	7.60790	0.13079	0.04650
3	3.8999	2.9606	0.0496	0.8244	21.029	7.4891	0.05268	0.19158
4	5.5055	3.9510	0.0309	0.4549	22.055	7.3027	0.13669	0.34314
5	7.2463	4.70876	0.0179	0.2684	22.522	7.1947	0.23658	0.29873

Variance Decomposition of EXRV:

Period	S.E.	TRAD	EXRV	INFL	OILP	RGDP	INTR	EXCH
1	13.445	18.0543	34.2194	8.1707	9.4119	4.6229	25.0382	0.48219
2	20.459	58.1272	16.1023	5.6317	4.1805	3.3470	11.8994	0.71170
3	27.236	66.9464	12.4530	8.1886	2.7721	1.8896	7.16416	0.58590
4	32.703	49.4770	16.8658	7.0251	12.373	6.7111	6.73612	0.81094
5	36.661	39.544	17.8895	5.6050	10.904	16.031	7.16736	2.857849



Conclusions

Since the advent of floating exchange rates in 1973, excessive volatility of exchange rate have had high implication for trade. While Verheyen (2013), Yanamandra (2015), Bahmani-Oskooee, Iqbal and Salam (2016) identify the negative impact for trade flow, Wong (2013) show that increase exchange rate volatility have positive impact on trade. As noted (Bahmani-Oskooee and Gelan, 2017), the course of exchange rate swings on trade flows is country specific. This study aims to understand the dynamics of the sporadic movements of exchange rate on trade for the Nigerian economy.

The study found that there exists a positive effect of exchange rate volatility on trade flow for Nigeria. The evidence suggests that exchange rate volatility played a significant role in improving Nigeria's trade volume. The depreciation of exchange rate improves the competitiveness of exports as much as making imports more expensive, hence, improves trade balance. However, there is need to undertake measures that will check excessive fluctuation beyond fundamentals needed for trade and growth. We suggest that policy should continue its periodic foreign exchange intervention to curtail excessive swings, in order to eliminate the detrimental effects of exchange rate volatility on trade and the overall economy.

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