

9KDeterminants of Foreign Exchange Rate Volatility and Non-Oil Export in Nigeria

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Abstract- This paper examined determinants of foreign exchange rate volatility and Non-oil Export in Nigeria.

The study used time series data covering 36years (1982-2017) collected from CBN. The method of analyses used was descriptive statistics as well as co-integration analysis (ARDL). The study also employed ARCH and GARCH model to determine the presence of volatility in the exchange rate. ADF and PPT were used to test the unit roots and determine non stationarity among the variables. Autoregressive Distributed Lag and bound test used to determine long run cointegration among the dependent and independent variables. The volatility of exchange rate was determined through Autoregressive Conditional Heteroscedasticity (ARCH) and GARCH 1(1) model on the non-oil export in Nigeria. The results show that foreign exchange rate, bank rate, inflation and foreign exchange volume has a positive relationship with non-oil export, however, GDP, M2 and Government expenditure has negative coefficient and statistically insignificant. The ARCH(1) and ARDL model indicated exchange rate and inflation has most volatility effect on non-oil export respectively. The government should pursue a rebound policy on exchange rate stability that encourages non-oil exports.

Index Terms- Exchange rate volatility, Exports, GARCH, Economic

I. INTRODUCTION

The economists have long been divided as to which exchange regime is beneficial to economy after the collapse of Bretton Wood System in 1973, Oyejide and Ogun, (2013) and as many empirical have mixed reactions, some supporting flexible while other fixed exchange rate system. The exchange rate determines the strength of any economy and its competitiveness in the world international market as exchange rate is the price at which domestic currency exchanged for another country's currency in the market, thus, it affects their international competitiveness and serves as nominal indicator for domestic prices (Shettima, 2015). The exchange rate volatility associated with uncertainty and unpredictable movements in the relative prices in an economy which denote deviation from unobservable equilibrium or benchmark. The world economy is experiencing exchange rate volatility with soaring degree of uncertainty in achieving macroeconomics and monetary policy objectives of price stability and sustainable economic growth.

Exchange rate stability promotes economic growth with positive impact on investment and export trade, however, exchange rate stability does not symbolise a static condition, but movements or changes in the market fundamentals, hence instability destroys, discourages production and foreign investments. The exchange rate is determined by market mechanism; the forces of demand and supply and flexible exchange rate produces significantly volatility and uncertainty which effects purchasing power by Oyovwi (2013) and distorts the workings of the entire system (economy) as it creates disequilibrium between the supply and demand of foreign currency. Foreign exchange rate volatility (FERV) is a reflection of the disequilibrium in the foreign exchange market (Stancik, 2007 cited in Adamu 2017).

Exchange rate determinants are fundamental, therefore the monetary authority shows concern how to manage and to preserve the value of the domestic currency and ensure favourable external reserves and price stability in the domestic economy (Olajide, 2019).

Exchange rate appreciation or depreciation has relatively effect on economy which could be positive or negative depending on the direction of the rate (Tams-Alasia, 2018). Be it of nominal or real exchange rate, volatility creates uncertainty in macroeconomic, however, empirical evidences say that exchange rate volatility produce conflicting results either positive or negative, therefore the debate on the impact of volatility is yet unresolvable, (Musibau, 2017)

Exchange rate volatility and its determinants have been challenges and of concern to macroeconomic formulators and government, therefore, the Central Bank of Nigeria intervened to control and contain the exchange rate volatility and the real shocks associated with it movements in market economy by adopting several exchange regimes: (SAP, 1986, (SFEM 1989), Dutch auction system and Wholesale Dutch auction in the time period covered (Olaleye, 2019).

Literatures on exchange rate volatility have drawn considerable attentions to its effects and directions for understanding exchange rate determinations. Exchange rate determinants depend on the exchange rate system in operation and a change in exchange rate policy will necessitate a change in exchange rate regime Kenneth and Okorie (2016) and some of the determinants are inflation rate, interest rate, and trade openness, the level of output, domestic money supply, exchange rate and exchange rate regime.

Nigerian economy is ranked high among the volatile countries in term of trade instability, hence diminishing non-oil exportations and unpredictability the international capital movements, balance of payments and domestic living standard of and Nigeria been a mono-product exporter and highly import dependent country. It has been shown that oil rich countries have more volatile economies than non oil economy, Onyeizugbe and Emmanuel, 2014.

It is empirically revealed that exchange rate volatility changes Nigeria macroeconomic fundamentals from non-oil exports country (Ajao, 2015, Musibau, 2017) to import dependent country of consumable goods.

The argument, has Nigeria achieves significant success in reducing exchange rate volatility since the adoption of the various (modifications) exchange rate regimes as the determinants prevalent? Musibau, 2017.

The objective of this paper is to determine the exchange rate volatility determinants and their relationship with non-oil exports in Nigeria.

This paper deviates from previous studies by looking at the relationship between the determinants of exchange rate volatility and non-oil export and to determine the most determinant (s) that burdened non-oil export in Nigeria from 1982 to 2017.

II. REVIEW OF RELATED LITERATURE

Exchange Rate Devaluation: Exchange rate devaluation is when a government deliberately reduces the value of currency in order to make her exportable goods to be cheaper and attractive to exporting countries. Nonetheless, the result of devaluation is perceived vulnerable as it increases future speculation of further devaluation and weakened confidence in the economy, Muhammad, 2014. The effect of exchange rate devaluation on aggregate demand on investment, production component is multifaceted and is relative to the structure of the economy.

The most salient reason of effecting currency devaluation on aggregate demand is to increase international competitiveness of exportable goods and discouraging import substitution, which increases output. However, counter-inflationary macroeconomic policies result in a reduction in exportable goods.

Exchange rate is an important macroeconomic variable in the context of general economic policy decision and two types of exchange rate are commonly identified: nominal and real exchange rate. Nominal exchange rate is a monetary theory which determines the relative price of two money or currencies, that is, Naira in relation to the dollar while the real exchange rate is a rate that determines the relative price of two goods- Tradable goods (exports and imports) in relation to non-tradable goods (goods and services) produced and consumed locally (Sakawar, 2014).

Spot exchange rate is the rate at which commodities or currencies are sold or bought immediately, it is also referred to as the rate at which foreign exchange dealers convert one currency into another on a particular day (CBN, 2016, Ojomolade, 2019).

Exchange rate volatility refers to the situation where there is deviation from the observable exchange rate equilibrium or the divergence from the target level of equilibrium exchange rate; also refers to the misalignment of exchange rate due to multiplicity

of markets parallel to the official market (Jongbo, 2016, Olaleye, 2019).

Inflation rate is the percentage increase in annual general price levels of goods and services produced, having positive or negative impact on the purchasing power of individuals in a country. Inflation is defined as “a general rising in prices for goods and services without a corresponding supply or rising wages and rent (Olalere, 2015). This happened in Nigeria where salaries and wages have been stagnant.

Theories of Exchange Rate: The theories underpin exchange determinants are:

Theory of Purchasing Power Parity (PPP)

Purchasing Power Parity originated by John Wheatley while its modern usage as theory of exchange rate determinant began with the Swedish Economist in 1918. Dogruel 2013. The theory is used to determine equality between country currencies if there is inflation. It examines the inflation differential between the affected countries economy. The exchange rate differentials reflect the variation arising from the purchasing powers of the relative currency in relation to the Base Exchange rates. This is while if inflation in Nigeria is greater, more imported goods are demanded at the expense of exports goods assume to be expensive, thereby affecting the balance of payment and value of the domestic currency.

Marshall-Lerner theory explains why a reduction in value of a nation's currency will not improve its balance of payments immediately through the use of J-Curve. Currency depreciation to have a positive impact on the trade balance according to the theory, the sum of the price elasticity of exports and imports in absolute value must be greater than one. Depreciation or devaluation of exchange rate mean reduction in the price of exports thereby increase the quantity exported and at the same time, the price of imported goods increases, reducing the quantity demanded. The net results of these two occurrences of the quantity imported or exported depend largely on import and export price elasticities. If the exports are price elastic, the quantity demanded increases more than the decrease in price and total export revenue increase. The same happened if goods imported are elastic, total import expenditure decreases.

Elasticity Approach and the Monetary Theory

Elasticity approach focuses on the relationship between the exchange rate and the trade flow of goods and services as measured by the current account balances-flows of exports from and imports to Nigeria from other countries. The export and import levels are functions of the real exchange rate, the price of imported goods relative exported goods. If the real exchange rate increases imported becomes more expensive, which not only reduces the import demand, but increases the demand for exports.

The monetary theory of exchange rate determination is the most recent. Its major thrust is that exchange rate fluctuations are largely explicable in terms of variations in the relative supplies of national currencies. Within the context of this viewpoint, the monetary approach suggests that the money supply could be used to forecast movement of exchange rates, and that there exists an observable causal relationship between exchange rates and changes in money supply and money supply is treated as

endogenous which affect exports to and imports from other nations.

Economic growth is defined as the increasing capacity of an economy to meet and satisfy the needs of the members of the society with goods and services demanded and as economic indicator which measures the persistent increase in national output or national income produced in the economy, Lawal,2016. However, exchange rate volatility would not allow this in an economy such as Nigeria.

This study adopted elasticity approach theory because it explains the casual relationship exchange rate and trade flows between trading countries.

Empirical Review

Adaramola (2017) examined the effect of exchange rate volatility on export volume in Nigeria. The study employs the Johansen (1988) Multivariate Co-integration procedure as well as the Error-Correction Mechanism (ECM). The results reveal that real exchange rate volatility on real exports reduce the activities that risk-averse exporters, switch sources of supply and demand or change prices in order to minimize their exposure to the effect of exchange risk. Adamu (2017) investigated the sources of exchange rate volatility in Nigeria using quarterly data for the period 1989Q1 to 2015Q4 using GARCH. The empirical analysis found that, net foreign asset and interest rate have positive and statistically significant impact on exchange rate volatility while fiscal balance, economic openness and oil price have positive and statistically insignificant impact on exchange rate volatility. The study however, discovered that nominal GDP has negative and statistically insignificant effect on exchange rate volatility. Musibau et al (2017) studied exchange rate volatility and non oil exports in Nigeria: An empirical investigation, using ARCH-LM and Johansen co-integration approach. The result of the study is that exchange rate is volatile and has negative significant impact on non-oil exports in Nigeria.

Gap: This study fills the gap on determinant of exchange rate volatility and non-oil export in Nigeria.

III. METHODOLOGY

The data used are secondary collected from Central Bank of Nigeria (CBN) statistical bulletin of 2018 and National Bureau of Statistics for 36 years (1982-2017) to give reliability of results. GARCH -1 is used to test for exchange rate volatility while Unit roots test was carried out using ADF and PPT to determine non stationarity among the variables, Auto regressive Distribution Lag applied to determine short and long run cointegration among the variables and descriptive statistics also adopted.

Model specification

$$NOILXP = f(GDP, BLR, INF, FXVOL, GXP, M_2, FX)$$

$NOILXP = a_0 + a_1GDP + a_2FX + a_3INF + a_4BKLR + a_5M_2 + a_6GXP + a_7FX + e_2$
 GDP = proxy for output, FX=Foreign exchange rate, INF = Inflation, BLR= Bank Lending rate, Noilxp = Non oil export, FXVOL= Foreign exchange rate volatility, M₂=money supply, GXP= government expenditure, e₂ = error term. Non-oil export as independent variable and others dependent variables

Estimating Exchange Rate Volatility

Exchange rate volatility is a variation or swing in exchange rates over time and is computed thus: $V_t = \frac{[Et - Et-1]}{Et-1} \times 100$

Where V_t is exchange rate volatility, Et is the spot exchange rate in the current year and Et-1 is the spot exchange rate in the previous year.

4. Results and Discussion of Findings

Table 1 Descriptive Statistics

	NOILXP	M2	INF	GEXP	GDP	FXVOL	FOREX	BLR
Mean	512.824	5014.84	19.406	1741.75	26010.59	16.45	88.23	18.08
Median	34.07020	878.4573	12.23000	947.6900	6897.482	7.60000	102.1052	17.58562
Maximum	9264.300	25350.80	72.84000	7102.530	104508.6	98.85000	305.7900	29.80000
Minimum	0.247400	17.68793	5.38000	9.64000	162.9998	5.77000	0.724100	9.25000
Observations	35	35	35	35	35	35	35	35

Source: Author's Computation

The study used descriptive statistics as in Table 1. The nonoil export (NOILXP) averages 512.824 and varies from a minimum of .247 to a maximum of 9264.3. Broad money supply (M2) and Inflation (INF) has a mean of 5014.84 and 19.406 and the minimum ranges from 17.687 and 5.38 to a maximum of 25350.8 and 72.84 respectively. Likewise, government expenditure and GDP have a mean of 1741.75 and 26010.59 and fluctuate from a minimum of 9.64 and 162.99 to a maximum of 7102.53 and 104508.6 correspondingly. Foreign exchange volatility and bank lending rate has mean of 88.23 and 18.08 which vary from minimum of 0.724 and 9.25 to maximum of 305.79 and 29.8

Unit Roots Test (Phillips Perrons and Augmented Dickey Fuller)
Table 2

Table 1 Variables	Phillips Perrons	ADF	Level	1 st diff	5%	Order of Integration
BLR	9.444183	3.287922		1	1.952910	1(1)
FX	3.245832	3.102363	0		1.950687	1(0)
FXVOL	3.585801	3.540131	0		1.950687	1(0)
GDP	5.442247	3.673739	0		1,951000	1(0)

INF	9.192 318	4.460 599		1	1.951 000	1(1)
NOIL XP	2.633 059	24.66 059	0		1.954 414	1(0)
M2	9.542 211	12.58 278	0		1.950 687	1(0)
GEXP	3.489 818	5.520 698	0		1.950 687	1(0)

Source: Researcher's E-view Result Computation 2020

The null hypothesis of non stationarity is rejected if the ADF test statistic is greater than critical value of 5% significance; likewise for PPT null hypothesis. The variables differenced are integrated at order one 1(1) and zero 1(0), hence we used ADRL as Least square regression was not suitable. The bounds test is to avoid spurious results, the time series have to be tested to determine their data generation process.

Autoregressive Distributed Lag (ARDL)
Table 3A
Dependent Variable: NOILXP

ARDL Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	52.670350	37.250285	1.413958	0.1828
GENRL	1298.154559	1134.713210	-1.144038	0.2749
FXVOL	35.057086	33.775501	1.037944	0.3198
FOREX	45.148057	34.598515	1.304913	0.2164
BLR	61.935170	91.976932	0.673377	0.5135
C	6411.397576	5753.642499	1.114320	0.2870

R-squared 0.910846 A R-squared 0.762256 F-statistic 6.129940 Prob(F-statistic) 0.001235 Durbin-Watson stat 3.121197

Table 3B

ARDL Bounds Test

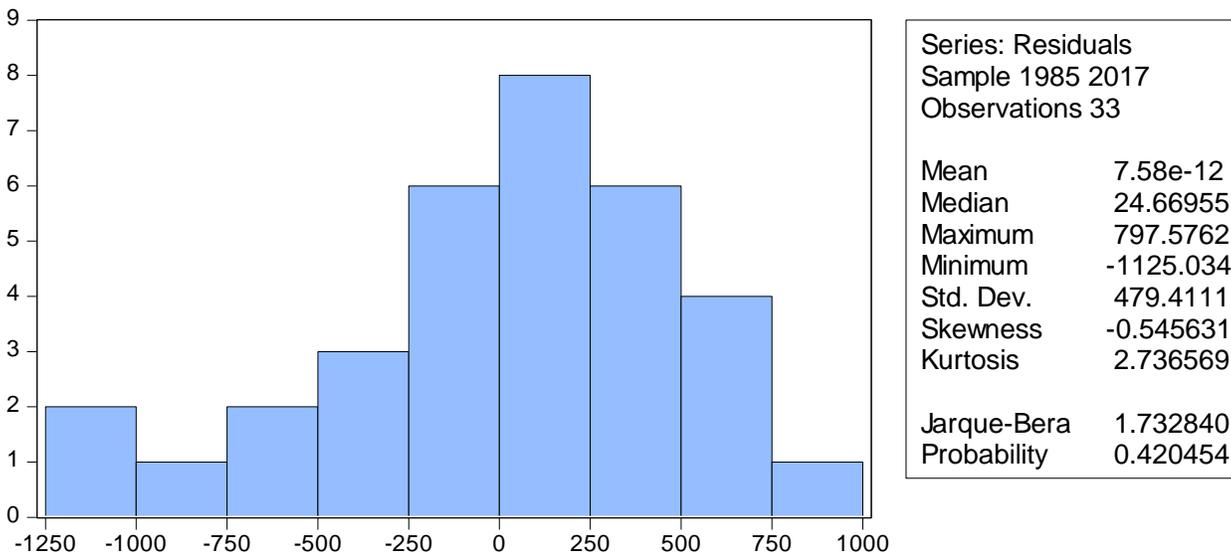
Test Statistic	Value	K
F-statistic	4.466066	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79

The null hypothesis of non stationarity is rejected if the ADF test statistic is greater than critical value of 5% significance; likewise for PPT null hypothesis. The variables differenced are integrated at order one 1(1) and zero 1(0), hence we used ADRL as Least square regression was not suitable. The bounds test is to avoid spurious results, the time series have to be tested to determine their data generation process. F-statistic of 4.466 is greater than the upper and lower bound at 5% significant level indicating long run relationship between the determinants and non-oil exports in Nigeria.

Figure 1
Test of Normal Distribution: Jarque-Bera Statistics



Test of Normal Distribution: Jarque-Bera Statistics

The “Histogram Normality Test” is employed to examining if the residuals of the estimated GARCH (1.1) model are normally distributed using the Jarque-Bera statistics. The result of the Jarque-Bera statistics has its estimated probability value to be more than 5%. This implies that we accept the null hypothesis (H0) and reject the alternative hypothesis (H1); we therefore conclude that the residuals in the GARCH (1.1) model are normally distributed.

Table 4

Heteroskedasticity Test: ARCH

F-statistic	5.603552	Prob. F(1,30)	0.0246	.
Obs*R-squared	5.036398	Prob. Chi-Square(1)	0.024	0.0248

The decision rule states that, if the p-value of the Observed R*squared is more than 5%, we accept the null hypothesis (H0), and other wise. Thus, the probability value of the observed R*squared is 0.0245 which is less than 5%, we therefore reject the null hypothesis (H0) and accept the alternative hypothesis and conclude that the model has ARCH effect.

It is evidenced from all the evaluations carried out, the residuals of the estimated GARCH (1.1) model has no serial correlation, normally distributed and has ARCH effect. However, the estimators of this model are still consistent even though there exists a serial correlation, and so; the model is useful for predicting the performance of the Nigeria’s exchange rate and its determinants supporting the work of Musibau 2017.

Table 5
Discussion of GARCH 1(1) MODE: Variance Equation.

Method: ML ARCH - Student's t distribution (BFGS / Marquardt steps)				
GARCH = C(7) + C(8)*RESID(-1)^2 + C(9)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
INF	1.282308	0.956603	1.340481	0.1801
GENRL	-637.8554	145.2611	-4.391095	0.0000
FXVOL	-1.282867	0.777221	-1.650582	0.0988
FOREX	27.51499	5.142542	5.350464	0.0000
BLR	18.50614	6.254685	2.958764	0.0031
C	3202.929	693.0388	4.621572	0.0000

	Variance Equation			
C	15.92612	104.7820	0.151993	0.8792
RESID(-1)^2	3.135934	1.234411	2.540430	0.0111
GARCH(-1)	-0.010835	0.058875	-0.184042	0.8540

From Table 5, ARCH is significant. This indicates that the preceding year's exchange rate information influences the current exchange rate volatility. The GARCH is not significant, meaning the previous year's exchange rate volatility do not influence the current year's exchange rate volatility. The result discloses that Nigeria exchange rate is influenced by its own ARCH and not GARCH factors or own shocks. Therefore, we can conclude that

the volatility in Nigeria exchange rate is largely dependent on its own shocks such as ARCH.

Test of Serial Correlation of the GARCH (1.1) Model: Correlogram Squared Residual

The "Correlogram Squared Residual" is used to check for the presence or absence of first order serial correlation in the estimated GARCH (1.1)

Table 6: Correlogram Square Residuals Results

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. ***	. ***	1	0.382	0.382	5.2736	0.022
. *	. .	2	0.183	0.043	6.5181	0.038
. *	. **	3	-0.107	-0.224	6.9630	0.073
. .	. .	4	-0.053	0.062	7.0731	0.132
. *	. *	5	0.112	0.207	7.5925	0.180
. .	. *	6	0.066	-0.094	7.7790	0.255
. *	. *	7	-0.080	-0.195	8.0661	0.327
. **	. *	8	-0.205	-0.070	10.013	0.264
. .	. **	9	-0.013	0.239	10.021	0.349
. .	. .	10	0.034	-0.052	10.080	0.433
. ***	. **	11	0.359	0.290	16.854	0.112
. *	. *	12	0.123	-0.098	17.683	0.126
. .	. *	13	-0.008	-0.117	17.687	0.170
. *	. .	14	-0.079	0.060	18.067	0.204
. .	. .	15	-0.055	0.009	18.261	0.249
. *	. .	16	0.089	-0.015	18.805	0.279

Source: Author's Computation.

The decision rule is that if the p-values are more than 5%, we accept the null hypothesis (H0) or otherwise. However, the result from the above indicates that all the probability values selected for the 16 different lags are greater than 5%, therefore, we reject the alternative hypothesis (H1) and accept the null hypothesis (H0), it is concluded that the estimated GARCH (1.1) model has no serial correlation.

residuals of the estimated GARCH 1(1) mode have serial correlation, normally distributed and ARCH effect. It is evidenced from the study that exchange rate is volatile and impacted on non-oil export, therefore, the monetary authority should try pursue stable exchange rate policy that will encourage non-oil export while the government concentrate on the macroeconomic variables that have negative influence on non-oil export.

IV. CONCLUSION AND RECOMMENDATIONS

The determinants of exchange rate volatility and non-oil export was examined in this paper using time series data collected from CBN and NBS for 36 years. ARDL analysis indicted a long run relationship of dependent with independent variables as the F-statistics value of the test statistics 4.466 which is greater than the upper and lower bound at 5% significant level. Bank rate, inflation, foreign exchange rate, foreign exchange volumes are positive and statistically insignificant impact on non-oil export. GDP, government expenditure and M2 are negative and statistically insignificant and impact on non-oil export. The

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