



Exchange Rate Volatility and International Trade in Nigeria

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Abstract: This study investigates the impact of exchange rate volatilities on international trade in Nigeria. The research is carried under the assumption that exchange rate volatilities are deemed to impact on the volume of export and import trading activities. The study made use of Secondary data from 1996 to 2018. Econometric tools were used to ascertain relationships. The paper established a mixed result between the variables under review. While some of the tests did not provide adequate and predictive information on the relationship between exports, imports and real effective exchange rate, others did. The VAR model estimates indicate an inverse relationship between Export, Import and REER in current periods. A unit increase in export and import in a particular year leads to about 0.9% and 0.4% decrease in REER respectively. Variance decomposition analysis suggests that the shocks partially explain fluctuations in REER, as well as exports and imports. The Impulse response analysis indicates a negative association between export and real effective exchange rate while it was majorly positive for imports throughout the ten periods. The causal effect reveals that import causes exports but that exports do not granger cause imports. The ARCH modelling approach suggests the existence of a first-order Arch effect and a significant GARCH term. Though the Coefficient of GARCH in a mean term is negative; it produced a singular covariance which by itself is not unique. Results show evidence of volatility of REER clustering on import and export trading activities in Nigeria. This could have serious implications for growth in Nigeria, as a reduction in the growth of exports could reduce the foreign exchange earnings available for the financing of developmental projects. At the same time, a decline in imports could affect domestic production and consumption. It could also impinge negatively on the balance of payment positions for Nigeria. In line with these observations, monetary and fiscal interventions are required to mitigate the adverse effects since financial shocks often exacerbate exchange rate volatilities.

Keywords: Export, Import, Real exchange rate, Nominal exchange rate, International trade, Exchange rate volatility

1. Introduction

According to the Encyclopedia Britannica, “International trade is the sale and purchase of consumer or capital goods and services, raw materials, securities or gold across national borders. Such transactions may be accomplished by barter or more typically through an exchange of national currencies”. Simply put, international trade is the exchange of goods and services across international borders.

Historically speaking, international trade is as old as civilization. From ancient times, authors and scholars alike deemed international trade to be a catalyst for industrial productivity and overall economic growth and development. Since no nation is a pariah state, they all depend on one another for goods and services that are produced more efficiently elsewhere (Analogbei 1987). International trade consists of import and export trades. Basically, the volume of exports in Nigeria hovers around a mono-product, i.e. crude oil. In 1996, there was a gradual but progressive increase in the volume of Nigeria’s export. The price of oil reached the historic high amounting to 115 USD per barrel by mid-2008 (IFS, 2015). This continued unabated following the adoption of a democratic dispensation in 1999 and peaked in 2012. There was a downward slide after 2012, which lasted till about 2015. After 2015, it increased again and have made consistent leaps that lasted till 2018 and beyond. The above scenarios are shown in figure 1 below:

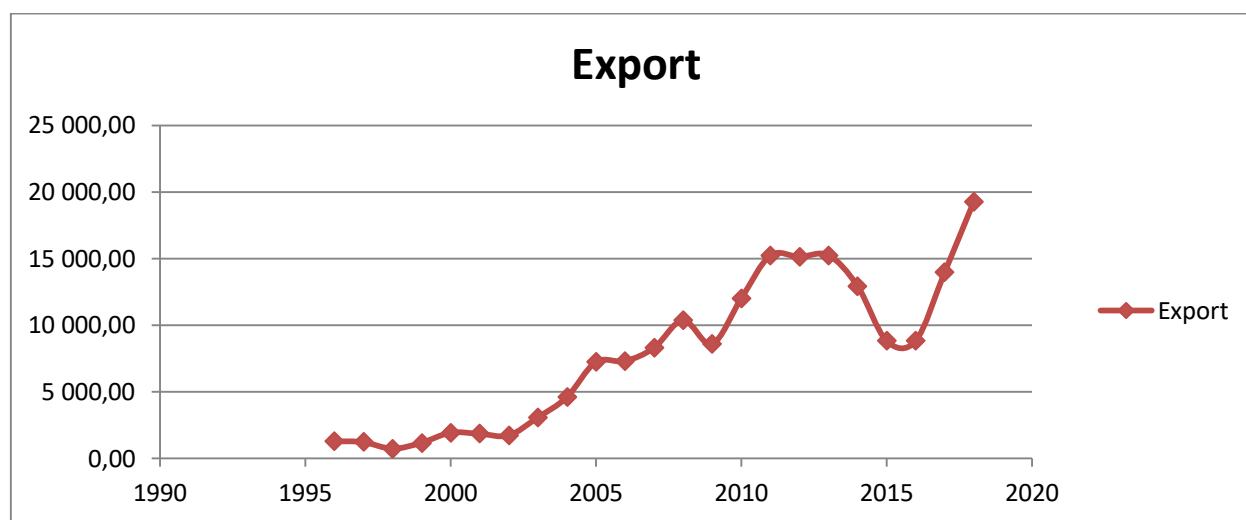


Figure 1: Export
Source: CBN Statistical bulletin (2018)

Import refers to the total amount of goods and services brought into a country at a particular time. For the period under review (1996 to 2018), the quantum of imports has exhibited an exponential increase. This trend is aptly shown in figure 2 below:

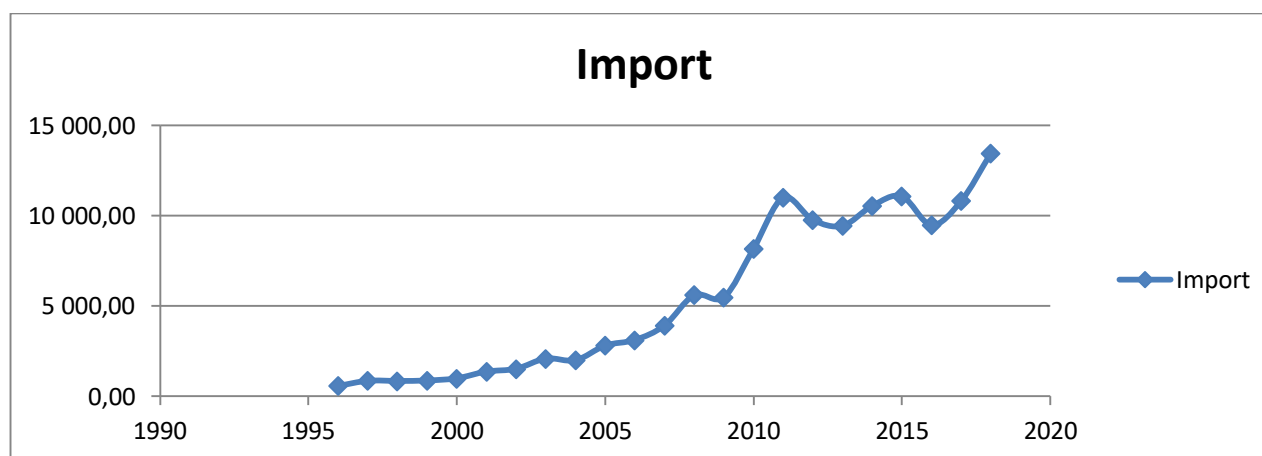


Figure 2: Import
Source: CBN Statistical bulletin (2018)

In international trade, there is a common denominator affecting the quantum of export proceeds and amount spent on total imports, i.e., the rate at which a country's currency is traded against that of the other. This refers to the exchange rate of one currency note to the other. Exchange rates are never static. The supply and demand of significant currencies fluctuate over time. Thus, exchange rate volatility refers to the tendency for foreign currencies to appreciate or depreciate in value, thus affecting the profitability of foreign exchange trades. Okechukwu et al. (2019) found high and persistent volatility in the Nigerian stock market returns. Volatility is the measurement of the number of rate changes and the frequency of such changes. There are many instances when exchange rate volatility occurs, including business dealings between parties from two different countries and international investments. Volatility in such circumstances is difficult to avoid.

Exchange rate volatility explains a fluctuation in the economy's exchange rate. In Nigeria, there has been a persistent fluctuation in the exchange rate. The major factors contributing to the exchange rate fluctuation include interest rate, inflation, the balance of payment, and government intervention. The trends of exchange rates are shown in figure 3 below:

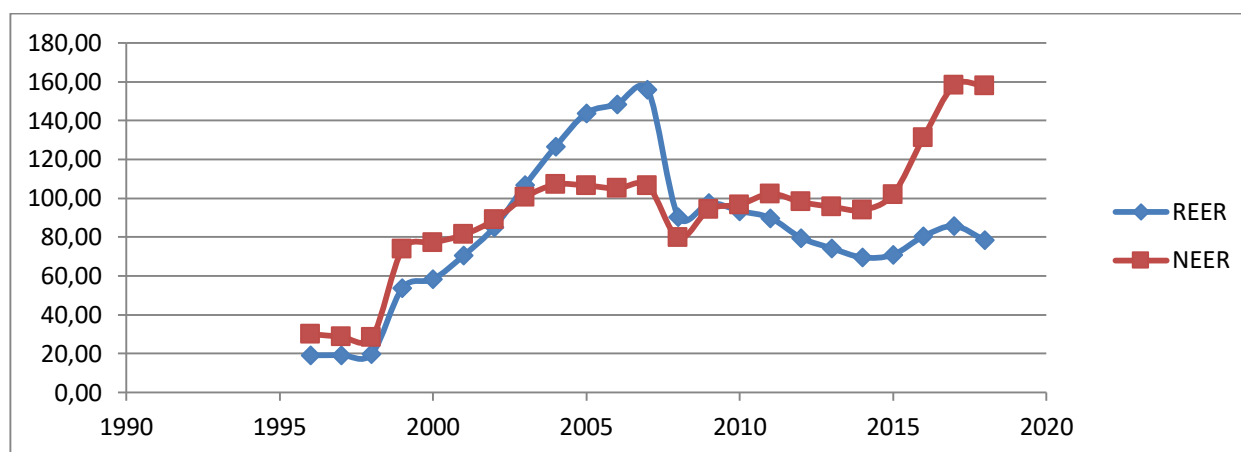


Figure 3
Source: CBN Statistical Bulletin.

The fluctuations in the exchange rate are evident: In 1998, there was a significant rise in exchange rate volatility. This could partially be attributed to returning to democracy, as there was a significant shift from the fixed exchange rate to the flexible exchange rate. Under the fluctuating exchange rate, the CBN attempted to devalue the naira, thereby stabilizing exchange rates movement. Both the Nominal and Real exchange rates increased tremendously between 2000 and 2006. Both peaked around 2007 before a decline. From 2010 to 2018, volatility rates have been quite unpredictable. Though Nigeria has been engaged in foreign trade for many decades, she has been persistently marginalized, and her level of participation and share in global trade is deficient (Osuegbu, 2013). This may not be unconnected with our low-level production, dependence on primary products and adverse exchange rate volatility. This research is, therefore, set to ascertain the impact of exchange rate volatility on international trade in Nigeria.

1.1 Problem Statement

According to Udeh (2010), one of the biggest challenges Nigeria faces as a nation is how to reduce import dependence and implement export led-growth policies. From the agricultural collapse to the current oil-led growth, the Nigerian economy has been on a crossroad and is in dire need of diversification. From the early 70s, choice of exchange rate regime was based on monetary policy target devoid of any balance of payment (BOP) considerations – how exchange rate fluctuations affect trade flows was not a regime’s concern.

According to Osuegbu (2013), Nigeria has been engaged in foreign trade for many decades, and yet it was persistently marginalized, with a significantly low degree of participation and share in global trade. Nigeria failed to exploit the full potentials of international trade for high productivity and rapid economic transformation. The issue of exchange rate volatility is partly contributing to this lopsidedness in international trading activities. Nigeria’s economy is import-dependent and operates on the float managed exchange rate system. We would expect that exchange rate volatility should be a topical issue that could help in determining the country’s balance of payment position. A prime concern today for most policymakers is how to capitalize on international trade. Recent trends in international trade and globalization prompted the policy debate over the pros and cons of different exchange rate systems. One of the issues in the discussion is the trade effect of exchange rate volatility. Proponents of fixed exchange rates have long argued that the risks associated with exchange rate volatility discourage economic agents from cross-border trading. Opponents have maintained that there are useful instruments to hedge against the exchange rate volatility, and hence the effect should be immaterial.

Several studies discuss the relationship between exchange rate volatility and international trade. The basic idea is that: if countries are risk-averse (or even risk-neutral), higher exchange rate uncertainty may lead to a reduction in the volume of trade because they may not want to risk their expected trade profits. Exchange rate volatility can affect international trade directly, through uncertainty and adjustment costs, and indirectly, through its effect on the structure of output and investment and on government policy (Brodsky, 1984). Udeh (2010), posits that different schools of thought have a diverse view of the relationship between exchange rate volatility and international trade performances. While some studies provide evidence indicating a negative relationship; others suggest there are positive effects of exchange rate volatility on international trade. This study seeks to identify the effects of exchange rate volatility on export and import

trades in Nigeria. The conceptual weakness in existing literature provides further impetus for this study.

1.2 Objectives of the Study

The study intends to investigate the extent to which exchange rate volatility impacts on the volume of international trading activities in Nigeria. The paper will examine the seeming mismatch between fluctuating exchange rates and enhanced international trading transactions between Nigeria and her trading partners. The study will also accomplish the following:

- b) Examine the effects of exchange rate volatility on exports out of Nigeria.
- c) Determine the influence of exchange rate volatility on imports into Nigeria.

1.3 Research Questions

Having stated the above objectives, the following research questions are therefore considered relevant to the study.

- 1) What is the nature of relationships between exchange rate volatility and the level of international trading activities in Nigeria?
- 2) To what extent has exchange rate volatility affected the level of exports in Nigeria?
- 3) What is the nature of relationships between exchange rate volatility and imports in Nigeria?

Succinctly put, has exchange rate volatilities affected the level of international trading activities in Nigeria? The present study will provide answers to the above questions.

1.4 Research Hypotheses

H01: There is no significant relationship between exchange rate volatility and the volume of international trading activities in Nigeria in the long run.

H02: There is no significant relationship between exchange rate volatility and export trades in Nigeria in the long run.

H03: There is no significant relationship between exchange rate volatility and trade imports in Nigeria in the long run

1.5 Significance of the Study

The study will review the effects of exchange rate volatility on international trading activities in Nigeria. The study will provide recommendations to policymakers that could assist in appraising the effectiveness of exchange rate regimes. The study will also serve as reference material for future and further works on the impact of exchange rate volatility on international trade in Nigeria and its attendant effects on the economy. It will also provide a basis for further comparative studies, in both the developed and less developed economies. The study covers the impact of exchange rate volatility on international trade in Nigeria for the period 1996 to 2018. This study is limited to the Nigerian context, and the scope of the study was determined by data availability.

2. Literature Review

The relevant literature associated with this study will be reviewed from the standpoint of a conceptual, theoretical and empirical framework.

2.1 Conceptual Framework

The conceptual framework of this study was based on the variables identified in the study.

2.1.1 The Meaning of International Trade

International trade (foreign trade) could be defined as the exchange of goods and services across international borders. In its purest form, it is the exchange of capital goods and services between countries or trade across international borders or territories (Wikipedia, 2015). Esezobor (2009) defined international trade as “trading between sovereign states”. According to the Encyclopedia Britannica, “International trade is the sale and purchase of consumer or capital goods and services, raw materials, securities or gold across national borders. Such transactions may be accomplished by barter or more typically through the exchange of national currencies”. The Encyclopedia Americana defined international trade as “commercial exchanges between residents of different sovereign political units. It becomes clearly distinguished from local or domestic trade only as nations emerge and begin to formulate national commercial policies, and then it becomes international trade”.

The Grolier Family Encyclopedia described international trade as “the exchange of goods and services among countries”. This definition implies that countries tend to specialize in the production and export of those goods and services which they can produce relatively cheaply and import things that are produced more efficiently elsewhere. Thus, the main bases of international trade are exports and imports. These are briefly reviewed below:

2.1.2 Exports

One major function of international trade is to see that goods produced in one country are shipped to another state for future sale or trade. The sale of each good adds to the producing nations gross output. Exports are therefore goods and services one country sells to others.

Exports are one of the oldest forms of economic transfer and occur on a large scale between nations that have fewer restrictions on international trade, such as tariffs or subsidy. According to Lequiller and Blades (2006) “the term export derives from the goods and services out of the port of a country. The seller of such goods and services is referred to as an exporter, whereas the overseas based buyer is referred to as an importer”. According to national accounts, exports consist of transactions in goods and services (sales, barter, gifts or grants) from residents to non-residents. Smuggled goods must be included in the export measurement”. In national accounts any direct purchases by non-residents in the country’s economic territory are recorded as service exports; therefore all expenditures by foreign tourists in the country’s economic region are considered part of the exports services of that country. Also, international flows of illegal services must be included. Exports also include the distribution of information that can be sent in the form of an e-mail, fax or can be shared during a telephone conversation (Ojukwu, 2011). Thus, in economics, an export refers to any good or commodity transported from one country to another in a legitimate fashion, typically for use in trade. Many countries engage in export trade.

2.1.3 Imports

The word “import” is derived from the word “port” since goods are often shipped via boat to foreign countries. Import is therefore derived from the conceptual meaning as transportation of products and services from one state into the port of another country. The buyer of such goods and services is referred to as an “importer” while the overseas-based seller is referred to as an “exporter”, (Mohan, 2009). Thus, an import refers to any good or service brought in from one country to another country in a legitimate fashion, typically for use in trade. It is a good that is brought in from another country for sale (Arthur et al., 2003). Imported products or services are provided to domestic consumers by foreign producers. An import in the receiving country is considered export in the sending state.

A country has demand for an import when domestic quantity demanded exceeds domestic quantity supplied or when the price of the good (or service) on the world market is less than the price on the domestic markets.

2.1.4 Exchange Rates

When people travel to foreign countries, they must change their money into foreign currencies. The same is true when goods are imported. For example, when Americans import goods from Japan, Europe or Nigeria, the dollars paid for these goods must be exchanged for Yen, Euros or Naira. In finance, an exchange rate between two currencies is the rate at which a currency will be exchanged. It is also regarded as the value of one country’s currency in terms of another currency (Sullivan et al. .2003). For example, an interbank exchange rate of 370 Nigerian Naira to the United States Dollar (US\$) means that #370 will be exchanged for each US\$1 or that US\$1 will be exchanged for #370. In the retail currency exchange market, a different buying rate and selling rate will be quoted by money dealers. The buying rate is the rate at which money dealers will buy foreign currency, and the selling rate is the rate at which they will sell the currency. The quoted rates will incorporate an allowance for a dealer’s margin (or profit) in trading or else the margin may be recovered in the form of a “commission” or in some other way. (Esezobor, 2009).

2.1.5 Exchange Rate Volatility

Exchange rate volatility refers to the tendency for foreign currencies to appreciate or depreciate, thus affecting the profitability of foreign exchange trades. Volatility is the measurement of the amount that these rate change and the frequency of such changes. There are many instances of exchange rate volatility, including business dealings between parties in two different countries and international investments. Volatility in such circumstances is difficult to avoid. Exchange rate volatility explains a fluctuation in the economy’s exchange rate. In Nigeria, there has been a persistent

fluctuation in the exchange rate. The major factors contributing to the exchange rate fluctuation include interest rate, inflation, the balance of payment, government intervention etc.

2.1.6 Nominal Exchange Rates versus Real Exchange Rates

The nominal exchange rate is the rate at which currency can be exchanged. If the nominal exchange rate between the dollar and the Naira is 370, then for one dollar one may purchase 370 Naira. Exchange rates are always represented in terms of the amount of foreign currency that can be purchased for one unit of domestic currency. Thus, we determine the nominal exchange rate by identifying the amount of foreign currency that can be purchased for one unit of domestic currency. The real exchange rate is a bit more complicated than the nominal exchange rate. While the nominal exchange rate indicates how much foreign currency can be exchanged for a unit of domestic currency, the real exchange rate indicates how much goods and services in the domestic country can be exchanged for the goods and services in a foreign country. The real exchange rate is represented by the following equation: $\text{real exchange rate} = (\text{nominal exchange rate} \times \text{domestic price}) / (\text{foreign price})$.

An example may illustrate the equation. Consider we want to determine the real exchange rate for crude oil between the US and Nigeria. We know that the nominal exchange rate between these countries is 370 Naira per dollar. Assuming that the price of crude oil in Nigeria is 150 Naira and the price of crude oil per barrel in the US is \$5. We are comparing equivalent grades of crude oil in this example. In this case, we begin with the equation for real exchange rate thus = $(\text{nominal exchange rate} \times \text{domestic price}) / (\text{foreign price})$. Substituting in the numbers from above gives real exchange rate = $(370 \times \$5/150) = 12.33$ barrel of Nigerian crude per barrel of American oil. By using both the nominal exchange rate and the real exchange rate, we can deduce valuable information about the relative cost of living in two countries. While a high nominal exchange rate may create the false impression that a unit of domestic currency will allow the purchase of many foreign goods, in reality, only a high real exchange rate justifies this assumption.

In this study, we intend to use the Real Effective Exchange Rate (REER) as the proxy for exchange rate volatility.

2.2 Theoretical Framework on International Trade

Many theories attempted to explain the reasons for international trade. This includes the Mercantilist, Absolute Advantage and Comparative Advantage Theories. Others include the Heckscher-Ohlin Theory of Factor Endowment, Country Similarity Theory, International Product Life Cycle Theory (IPLC), Porter's Theory of National Competitive Advantage and Global Strategic Rivalry Theory.

2.2.1 International trade theoretical framework

Basically, there are three schools of thought explaining the effect of exchange rate volatility on international trade. They are the traditional school, the risk-portfolio school and the political economic theory.

The theoretical frameworks may not constitute a major point of emphasis in our present study.

2.3 Empirical Review

To effectively review the empirical literature, we examined Nigerian, African and global perspectives.

2.3.1 The Nigerian Perspective

Danladi et al. (2015) conducted a study on the impact of exchange rate volatility on international trade in Nigeria. They tested stationarity of the variables by applying the Augmented Dickey-Fuller (ADF), this was followed by a co-integration test, then the granger causality and the Error Correction Model (ECM). The co-integration test indicated that the variables are co-integrated, indicating the existence of a long-run relationship between the variables. The granger causality test showed the presence of a causal relationship between international trade and exchange rate volatility. It was observed from the ECM analysis that exchange rate volatility negatively affects international trade. The study, therefore, recommends that the government should put in the place exchange rate and trade policies that will promote greater exchange rate stability and trade conditions promoting domestic production. In other to achieve this, the government should provide efficient infrastructural services like energy resources. Danmola (2013), examined the impact of exchange rate volatility on full-scale financial variables in Nigeria using the Correlation Matrix, Ordinary Least Square (OLS) and Granger Causality test. The findings of the study show that exchange rate volatility impacts on Gross Domestic Product, Foreign Direct Investment and Trade Openness, but with negative influence on the inflationary rate in the country. It was

suggested by the author; there is a need to improve the country's income base in term of an increasing number of items for export and decrease dependence on the petroleum sector. Petroleum is one of the vital inputs of almost every industry in the economy (Houng, 2020). A further recommendation was to diminish the importation of unnecessary items, so as improve the term of trade. Likewise, an increase in domestic production will lessen the issue brought about by exchange rate volatility.

Aloba and Abogan(2013), evaluated exchange rate volatility from the perspective of a parametric measure to find the trend and potential reasons for exchange rate volatility in Nigeria over the period 1986 to 2009. The study found exchange rate volatility in Nigeria given the fact that the standard deviation of the exchange rate has been curiously high and surprisingly low during that period. The parametric measure of exchange rate further confirmed a high degree of volatility, portraying a higher risk to a risk-averse economic agent. The study, therefore, recommends that the government should always track the frequent movement in the exchange rate to regulate it. The higher risks attached to a high degree of volatility may scare off both domestic and foreign investors. Udeh (2010), asserted that Nigeria's economy is import-dependent and operates on a system of float managed exchange rate. Exchange rate volatility is a major issue in determining the country's equalization of payments position. It is these issues that the study investigated. The study follows a linear specification through partial adjustment approach using Distributed Lag Scheme (DLS) - autoregressive distributed slack model (ARDLM). The research, contrary to one-way directional impact (positive or negative) on BOP recorded in various literature, shows that the dynamism of the effect of exchange rate volatility on BOP, ranging from short-run (SR) to a very long run (VLR). In the short run, it has a negative impact on BOP, while in the long run (LR) it has a positive impact, which is reversed to negative in the very long run (VLR).

2.3.2 The African Perspective

Assessment of the impact of exchange policy on disaggregated manufactured exports in sub-Saharan Africa was the major preoccupation of Sekkat and Varoudakis (2000). The study covered the period 1970-1992 and examined the effects of exchange rate volatility and misalignment on export performance of the panels of CFA and non-CFA countries. The results showed that exchange rate volatility had a significant adverse effect on textile and chemical exports of non- CFA countries but an insignificant positive effect on those of CFA countries. A limitation of the study is that it used data covering two non-homogenous periods (that is fixed and flexible exchange rate era.) Ghura and Greenes (1993) also employed panel data in their investigation on the impact of exchange rate misalignment and volatility on the trade flows of sub-Saharan African countries during the period from 1972 to 1987. Exchange rate volatility, measured by the coefficient of variation of real exchange rate was found to have significant and negative impact on trade flows. This analysis covered the fixed exchange period only, thus limiting the utility of the findings.

2.3.3 Global Perspective

Nicita (2013), in his article exchange rates, international trade and trade strategies contributed to the understanding of the relationship between the exchange rate and international trade. The author investigated the effect of exchange rate volatility and misalignment on international trade by examining whether exchange rate misalignment affects trade strategy choices. The methodological framework consisted of fixed effects relapses estimates on a detailed board data set comparing about 100 countries and covering a ten year period (from 2000 to 2009). The results indicate that exchange rate misalignment affects international trade flows in a substantial way. Cash undervaluation is found to promote exports and restrict imports, while the opposite holds for the situation of overvaluation. The investigation indicates that exchange rate volatility isn't most likely a significant concern. This is as a result of the increasing availability of financial instruments to fence against exchange rate dangers and to the increasing portion of intra-industry trade.

In their paper of the effect of exchange rate volatility on international trade flows, Elif Nuroglu and Robert Kunst (2012) conducted board data examination and applying the fuzzy methodology. The paper examined the effect of exchange rate volatility on international trade flows by using two different methods: the board data investigation and fuzzy rationale. A board with a cross-section measurement of 91 sets of EU15 countries during the period from 1964 to 2003 was utilized. An extended gravity model of trade is applied to determine the effect of exchange rate volatility on bilateral trade flows of EU15 countries. The estimated impact is unmistakably negative, indicating that exchange rate volatility affects bilateral trade flows. Chowdhury (2007) explored real and nominal foreign exchange volatility effects on exports. Using a flexible slack form of the Goldstein-Khan two-country imperfect substitute's model for bilateral trade, the study identifies the general effect into both timings just as a side impact. The result shows that the size impact of forecasted foreign exchange volatility doesn't vary according to the measure utilized in terms of magnitude and direction. Be that

as it may, there are altogether different timing effects, when contrasted with real and nominal foreign exchange rate volatility. Barrett (2007), undertook an observational audit of the effect of exchange rate volatility on international trade flows by studying the instance of Taiwan's exports to the United States from 1989-1999. In particular, they utilize sectoral level, monthly data and an innovative multivariate GARCH-M estimator with corrections for leptokurtic blunders. This estimator takes into account the possibility that traders' forward-looking contracting conduct might condition the manner by which exchange rate movement are associated.

2.4 Study Gap

The literature is awash with studies on the effect of exchange rate volatility on the trade of developed countries, but it appears to be scarce with regard to African countries, especially Nigeria. The few studies on African countries were based on panel data. There is still a need for more country-specific case studies as opposed to cross country regression analysis; that will yield more robust conclusions. Given the inadequate amount of studies in the context of Nigeria, the present study intends to fill this gap.

3. Research Methodology

To ascertain the impact of exchange rate volatility on international trade in Nigeria, an ex-post facto research design was employed using data set culled from the CBN statistical bulletin. While the Augmented Dickey-Fuller unit root is used for preliminary analysis; ordinary least square (OLS) regression analysis was used for short-run estimates. A combination of Johansen Co-integration test, Vector Auto Regression analysis, and Granger causality test, Variance Decomposition, Impulse Response tests and the ARCH / GARCH modelling techniques are used for long run estimation. All the tests helped to confirm the integrity of our model, i.e. if exchange rate volatility has a clustering effect on the proxies of international trade.

3.1 Model Specification

Components of International trade are regressed against Exchange rate volatility and other explanatory variables for the corresponding period. These are aptly captured in equation 1 below:

$$\text{TRADE VOL} = \alpha_0 + \alpha_1 \text{REER} \dots \dots \dots \text{eq.(1)}$$

Trade volume could further be decomposed into export and import trades thus:

$$\text{EXPT} = \alpha_0 + \alpha_1 \text{REER} + e_t \dots \dots \dots \text{eq.(2)}$$

$$\text{IMPT} = \alpha_0 + \alpha_1 \text{REER} + e_t \dots \dots \dots \text{eq.(3)}$$

Where

EXP = Growth rate of Export trade.

IMP = Growth rate of Import trade.

REER= Real Effective Exchange Rate.

α_0 = the intercept, while α_1 is the coefficient or parameters attached to the explanatory variable, i.e. Real exchange rate volatility.

e_t = The error term assumed to be normally and independently distributed with zero mean and constant variance. The addition of the error term or stochastic term in the model is to capture the effect of the other variables not included in the models.

3.2 Expected Results or a Priory Expectations

Exchange rate volatility is expected to have a positive relationship with exports. Reason for this expectation is based on the fact that the Naira has been devalued over time. Our export produce is expected to cost less since the value of the Naira is exchanged for a reduced amount of foreign currency. Exchange rate volatility is expected to have a negative relationship with imports and interest rates. Since the naira overtime has been devalued, interest are bound to go up, and imports are expected to cost more. Exchange rate volatility could have a negative or positive relationship with economic growth and investments depending on the quantum of trade between Nigeria and her trading partners. Conclusively, it is expected that currency undervaluation is bound to promote exports and restrict imports while the converse will hold in the case of overvaluation.

4. Data Analysis and Interpretation

A combination of preliminary analysis, short-run and long-run models were generated in this investigation.

Table 1: Unit root test

Variable	T-stat	Critical value @1%	Critical value@ 5%	Critical value @10%	Order of co-integration	Sig.
REER	-7.98	-3.80	-3.02	-2.65	2 nd Diff	Sig.
EXPT	-3.68	-3.92	-3.06	-2.67	2 nd Diff	Sig.
IMPT	-7.28	-3.83	-3.02	-2.66	2 nd Diff	Sig.

Source: E-views statistical version 7.0

This is carried out using Augmented Dickey-Fuller unit root tests to ascertain whether the data set is stationary or not and the order of integration. From the above table; all the three variables, namely real exchange rate(REER), Export(EXPT) and Import(IMPT) became stationary at the second difference.

Table 2: Descriptive statistics

	REER	IMPT	EXPT
Mean	83.32742	7877.151	5462.505
Median	80.36334	8309.758	3911.953
Maximum	155.7536	19280.04	13445.11
Minimum	19.07426	751.8567	562.6266
Std. Dev.	37.14799	5667.091	4353.046
Skewness	0.127645	0.275081	0.347268
Kurtosis	2.845073	1.887479	1.535914
Jarque-Bera	0.085460	1.476199	2.516516
Probability	0.958170	0.478022	0.284149
Sum	1916.531	181174.5	125637.6
Sum Sq. Dev.	30359.40	7.07E+08	4.17E+08
Observations	23	23	23

Source: E-views statistical package version 9.

While real effective exchange rate (REER), averages N83.32 billion, it ranges from N19.07 to N155.75 with a standard deviation of 37.15. Imports averages N7877.15billion. It ranges from N751.86 to N19280 billion with a standard deviation of 5667.09. Export trades average N5462.5 billion. It ranges from N562.63 billion to N13445.11 with a standard deviation of 4353.05.

Table 3: Correlation matrix

	EXPT	IMPT	REER
REER	0.28	0.11	1
EXPT	1.0	0.93	0.28
IMPT	0.93	1.0	0.11

Source: E-views statistical package version 9.

The correlation coefficient between the real effective exchange rate (REER) and import trades stood at 0.11. It also maintained a positive relationship of 0.28 with export trades for the period under review.

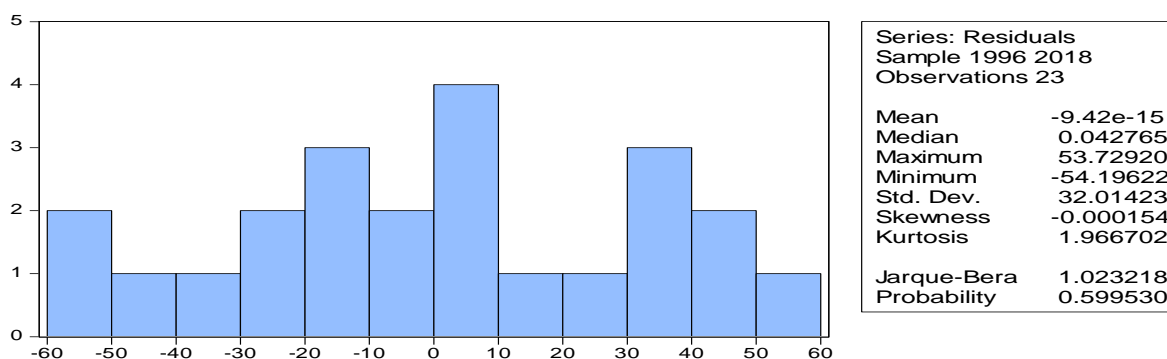


Figure 3: Normality test

The shape and pattern of the normality test above, suggests that, the series are normally distributed.

Table 3: VAR Model

Sample (adjusted): 1998 2018
Included observations: 21 after
Adjustments
Standard errors in () & t-statistics in []

	REER
REER(-1)	0.839899 (0.24468) [3.43263]
REER(-2)	-0.013413 (0.22179) [-0.06048]
C	28.42876 (11.8420) [2.40067]
EXPORT	-0.000951 (0.00233) [-0.40839]
IMPORT	-0.000428 (0.00283) [-0.15167]
<hr/>	
R-squared	0.765368
Adj. R-squared	0.706710
Sum sq. resids	5006.213
S.E. equation	17.68865
F-statistic	13.04796
Log likelihood	-87.27379
Akaike AIC	8.787980
Schwarz SC	9.036676
Mean dependent	89.43988
S.D. dependent	32.66223

The VAR model estimates imply there is an inverse relationship between Export, Import and REER in current periods. A unit increase in export and import in a particular year leads to about 0.9% and 0.4% decrease in REER respectively. Real effective exchange rate (REER) impacted in the first and second lags

Table 4: Casual Effects

Pair wise Granger Causality Tests
Sample: 1996 2018

Null Hypothesis:	Obs	F-Statistic	Prob.
EXPORT does not Granger Cause REER	21	1.43201	0.2678
REER does not Granger Cause EXPORT		1.87441	0.1856
IMPORT does not Granger Cause REER	21	0.91265	0.4214
REER does not Granger Cause IMPORT		0.78647	0.4723
IMPORT does not Granger Cause EXPORT	21	3.96698	0.0399
EXPORT does not Granger Cause IMPORT		1.66535	0.2203

The causality effect of real exchange rates on the variables of international trade in Nigeria reveals that import causes exports but that exports do not granger cause imports.

Table 5: Variance Decomposition

Period	S.E.	REER	EXPORT	IMPORT
1	20.67935	100.0000	0.000000	0.000000
2	30.16858	97.79782	1.771074	0.431107
3	39.71043	92.67825	5.031626	2.290128
4	47.99898	88.85390	7.742651	3.403451
5	54.22715	87.54024	9.124790	3.334972
6	58.95449	87.57068	9.554712	2.874606
7	63.13717	87.82934	9.654314	2.516346
8	67.40097	87.86133	9.916917	2.221748
9	71.96005	87.43064	10.62003	1.949329
10	76.63954	86.56434	11.70937	1.726289

Variance decomposition in the above table reveals that at one-year horizon, 100% of the variance in REER is explained by their shocks. Again, at a 10-year horizon, 86.56 % of the variation in REER is explained by its own shocks while the impact of EXPORT and IMPORT jointly explain the outstanding value of 13.44%. These results suggest that at the end of 10 years, fluctuations in the real effective exchange rate are partly explained by their shocks as well as that of exports and imports.

Table 6: Impulse Response Analysis

Period	REER	EXPORT	IMPORT
1	20.67935	0.000000	0.000000
	(3.19089)	(0.00000)	(0.00000)
2	21.50498	-4.014886	1.980832
	(6.33650)	(4.62479)	(5.04749)
3	23.90315	-7.951436	5.673603
	(7.19167)	(6.97543)	(6.27989)
4	24.20013	-9.951806	6.503746
	(8.95506)	(8.90496)	(7.97146)
5	22.95838	-9.483617	4.433449
	(10.0402)	(9.88490)	(8.92120)
6	21.66659	-7.985273	1.357602
	(10.6921)	(10.2367)	(8.97005)
7	21.38943	-7.263843	-0.631211
	(11.3744)	(10.7597)	(8.70890)
8	22.14277	-8.103375	-0.788952
	(12.3108)	(12.0041)	(8.83020)
9	23.15019	-9.970800	0.097602
	(13.5070)	(13.9276)	(9.64741)
10	23.60262	-11.74020	0.674175
	(14.8384)	(16.1827)	(11.0247)

From the above analysis, the response of export to the real effective exchange rate was negative throughout the ten periods. It was majorly positive for imports for the said period.

Table 7: Volatility and Modeling Approach.
Testing for ARCH Effects.

Heteroskedasticity Test: ARCH

F-statistic	9.297355	Prob. F(1,20)	0.0063
Obs*R-squared	6.981579	Prob. Chi-Square(1)	0.0082

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample (adjusted): 1997 2018
Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	387.7534	232.8634	1.665154	0.1115
RESID^2(-1)	0.508455	0.166753	3.049156	0.0063

R-squared	0.317345	Mean dependent var	891.4002
Adjusted R-squared	0.283212	S.D. dependent var	909.3548
S.E. of regression	769.8902	Akaike info criterion	16.21688
Sum squared resid	11854619	Schwarz criterion	16.31607
Log likelihood	-176.3857	Hannan-Quinn criter.	16.24025
F-statistic	9.297355	Durbin-Watson stat	1.939581
Prob(F-statistic)	0.006333		

Since the observed L M Statistics (6.9) is significant; we reject the null hypothesis that there are no first-order Arch effects. Again the T and F-statistics (6.9, .3.05) are quite substantial. This corroborates our earlier claim that there is a first-order Arch effect.

Table 8: Estimating an ARCH Model of Order 1

Dependent Variable: REER				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Sample: 1996 2018				
Coefficient covariance computed using the outer product of gradients				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(4) + C(5)*RESID(-1)^2				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	97.61930	6.596121	14.79950	0.0000
EXPORT	0.001744	0.001995	0.873921	0.3822
IMPORT	-0.003649	0.002994	-1.218753	0.2229
Variance Equation				
C	2.183205	27.60658	0.079083	0.9370
RESID(-1)^2	1.327029	0.699252	1.897785	0.0577

R-squared	-0.031649	Mean dependent var	83.32742
Adjusted R-squared	-0.134814	S.D. dependent var	37.14799
S.E. of regression	39.57287	Akaike info criterion	9.171274
Sum squared resid	31320.24	Schwarz criterion	9.418121
Log likelihood	-100.4697	Hannan-Quinn criter.	9.233355
Durbin-Watson stat	0.227699		

From the above table, the average return is 97.6. The time-varying volatility includes a constant component of 2.18 plus a component which depends on past error of 1.33. The shaded line highlights the ARCH effects. The ARCH effect is significant at the 10% alpha level. Below is a graphic representation of the conditional variance series of the variables under review. The series exhibited visible fluctuation in the '90s and early 2000. All that is gradually fizzling out.

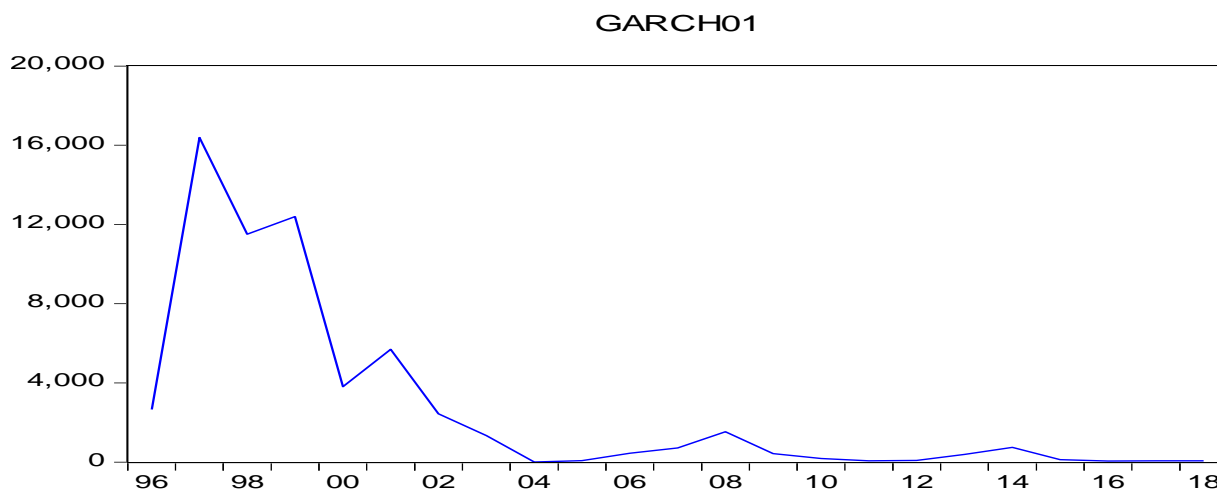


Figure 4: Arch Variance Series
Source: E-views statistical package version 9.

Table 10: GARCH TERM

Dependent Variable: REER
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Sample: 1996 2018
Included observations: 23
Presample variance: backcast (parameter = 0.7)
GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
EXPORT	0.002463	0.001834	1.343029	0.1793
IMPORT	-0.006412	0.001853	-3.460057	0.0005
C	117.1016	15.46383	7.572616	0.0000
Variance Equation				
C	-9.797872	3.709419	-2.641350	0.0083
RESID(-1)^2	0.345058	0.264516	1.304492	0.1921
GARCH(-1)	0.462716	0.233704	1.979927	0.0477
R-squared	-0.376957	Mean dependent var	83.32742	
Adjusted R-squared	-0.514653	S.D. dependent var	37.14799	
S.E. of regression	45.71848	Akaike info criterion	9.318937	
Sum squared resid	41803.60	Schwarz criterion	9.615153	
Log likelihood	-101.1678	Hannan-Quinn criter.	9.393434	
Durbin-Watson stat	0.170648			

Source: E-views statistical package version 9.

The shaded line in the above output shows the significance of the GARCH term. These results show that the volatility coefficients, the one in front of the ARCH effect (0.345058) and the one in front of the GARCH effect (0.462716) are both positive and their sums is between zero and one as required by theory. In other words, the GARCH term is quite significant.

Table 11: GARCH-IN – MEAN

Dependent Variable: REER
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Sample: 1996 2018
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*RESID(-1)^2*(RESID(-1)<0) + C(8)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
GARCH	-0.070714	NA	NA	NA
EXPORT	0.009400	NA	NA	NA
IMPORT	-0.009715	NA	NA	NA
C	135.7934			

Source: E-views statistical package version 9.

Though the Coefficient of GARCH in a mean term is negative, it produced a singular covariance which in itself is not unique.

5. Summary, Conclusion and Recommendations

5.1. Summary

The main findings of this study are itemized underneath:

- The three variables under review, namely real exchange rate (REER), Export (EXPT) and Import (IMPT) became stationary at the second difference.
- While real effective exchange rate averages N83.32 billion, it ranged from N19.07 to N155.75 with a standard deviation of 37.15. Imports averages N7877.15billion. It ranges from N751.86 to N19280 billion with a standard deviation of 5667.09. Export trades average N5462.5 billion. It ranges from N562.63 billion to N13445.11 with a standard deviation of 4353.05.
- The correlation coefficient between the real effective exchange rate (REER) and import trades stood at 0.11. It also maintained a positive relationship of 0.28 with export trades for the period under review.
- The shape and pattern of the normality test above suggest that the series are normally distributed.
- The VAR model estimates imply that there is an inverse relationship between Export, Import and REER in current periods. A unit increase in export and import in a particular year leads to about 0.9% and 0.4% decrease in REER respectively. Real effective exchange rate (REER) impacted on itself in the first and second lags
- The causality effect of real exchange rates on the variables of international trade in Nigeria reveals that import causes exports but that exports do not granger cause imports.
- Variance decomposition reveals that at one-year horizon, 100% of the variance in REER is explained by their shocks. Again, at a ten-year horizon, 86.56 % of the variance in REER is explained by their shocks while the prices of EXPORT and IMPORT jointly explain the outstanding value of 13.44%. These results suggest that at the end of 10 years, fluctuations in the real effective exchange rate are partly explained by their shocks as well as that of exports and imports.
- Impulse response analysis indicates that export to the real effective exchange rate was negative throughout the ten periods. It was majorly positive for imports during the period under review.
- Since the observed L M Statistics (6.9) is significant; we reject the null hypothesis that there are no first-order Arch effects. Again the T and F-statistics (6.9, 3.05) are quite significant. This corroborates our earlier claim that there is a first-order Arch effect.
- ARCH Model of order 1 has an average return of 97.6. The time-varying volatility includes a constant component of 2.18 plus a component which depends on past error of 1.33.

- The ARCH effect is significant.
- The GARCH term was also observed to be significant
- Though the Coefficient of GARCH in the mean term is negative, it produced a singular covariance which in itself is not unique.

5.2. Conclusion and Policy Exercises for Nigeria

The above results indicate that there is evidence of volatility clustering of real effective exchange rate (REER) on import and export trading activities in Nigeria. This could have severe implications for growth prospects for Nigeria. A reduction in the growth of exports could reduce the foreign exchange earnings available for the financing of developmental projects. At the same time, a decline in imports could affect domestic production and consumption. It could also impinge negatively on the balance of payment positions for Nigeria.

5.3 Recommendations

The effect of exchange rate volatilities on exports and imports in Nigeria require strategy mediations. There is a need to consider monetary and fiscal interventions to help mitigate its impact. This is based on the fact that financial shocks often exacerbate exchange rate volatilities.

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