

## **Exchange Rate Volatility and Trade Balance in Nigeria: An Autoregressive Distributed Lag Model Approach**

**Aderemi Timothy Ayomitunde<sup>1</sup>, Ogunleye Akin George<sup>2</sup>,  
Abalaba Bamidele Pereowei<sup>3</sup>, Owolabi Olufemi Olatunji<sup>4</sup>**

**Abstract:** The aim of this paper is to examine the effect of exchange rate volatility on trade balance in Nigeria. Data were collected from the Central Bank of Nigeria Statistical Bulletin from 1981 to 2016, and ARDL model was utilized to address the objective of this study. It was discovered from the study that exchange rate volatility has a significant negative impact on Nigerian exports. This negative impact could be attributable to the lack of competitiveness of locally made products in the world market. However, there is a positive relationship between exchange rate volatility and import, though this is not consistent with economic theory. This result could be linked with the overdependence of the country on foreign goods. Therefore, exchange rate volatility has a negative impact on trade balance in Nigeria. Based on these findings, whenever, the sustainable economic development is the goal of the policy makers in Nigeria, adequate strategic policy that has the capacity to stabilize the country's exchange rate should be embarked upon by the policy makers in the country. Similarly, the Nigerian government should possess political goodwill to embark on aggressive export promotion policies that will ensure the competitiveness of domestically produced items through value added approach.

**Keywords:** Exchange Rate; Volatility; Trade Balance; Bound Test; ARDL

**JEL Classification:** F14; F31

### **1. Introduction**

The stability of a country's exchange rate is one of the crucial variables that determines its global competitiveness. Since Nigeria's independence in 1960 till date, Nigerian government has introduced various exchange rate regimes ranging from fixed exchange regime at par with the British pound and later the American dollar. Historically, the breakdown of the Bretton Wood Agreement in 1973 sparked off the flexibility of exchange rate among the world economies. However, the emergency of the Structural Adjustment Programme (SAP) in 1986 marked the beginning of exchange rate volatility in Nigeria. Gone are those days when Nigerian currency was stronger than the American dollar. In 1985, \$US1 was equivalent to 89 Kobo (CBN, 1985), as at December 2018, an American dollar was equal to

<sup>1</sup> Department of Economics, Olabisi Onabanjo University, Nigeria, Address: Ago Iwoye, Ogun State, Nigeria, Corresponding author: aderemi.timothy@gmail.com.

<sup>2</sup> Department of Economics, Osun State University, Osogbo, Nigeria, Address: Main Campus, Oke Bale Street, Area 210001, Osogbo, Nigeria, E-mail: akin.ogunleye@uniosun.edu.ng.

<sup>3</sup> Department of Economics, Osun State University, Osogbo, Nigeria, Address: Main Campus, Oke Bale Street, Area 210001, Osogbo, Nigeria, E-mail: abalabapero@yahoo.com.

<sup>4</sup> Department of Banking and Finance, Yaba College of Technology, Nigeria, Address: Herbert Macaulay Road, Opposite WAEC office, Yaba Lagos State, Nigeria, E-mail: femmyowabi54@yahoo.com.

365 Naira. This implies that in the last 33 years the exchange rate in Nigeria has been depreciated by approximately 40,911%. Meanwhile, over the past 3 decades, the Nigerian government has made several attempts to restore the lost glory of the Nigerian currency, but reverse has always been the case. This statement is further reinforced by the submission of Aliyu (2011) and Benson and Victor (2012) who asserted that in spite of different policies embarked on by the Federal Government of Nigeria with a view to ensuring a stable exchange rate, the country's currency has been depreciating continuously from the 1980's till date. It is worth of note that the daily depreciation of the country's currency has manifested in the continuous dwindling of investment, low standard of living of the masses, and jacked up the cost of production. This scenario has been a push factor that has orchestrated some manufacturing firms to relocate their operations from Nigeria to neighboring countries in the last decade.

Consequently, it has been established in the literature that there is a connection between exchange rate fluctuation and international trade. Depreciation of currency will definitely make importation of foreign goods and services to be more expensive. As a result of this, the locally produced items will be as a matter of fact highly competitive in the domestic market. But, this situation has been argued in some quarters that there is no automatic success of country's currency depreciation in guaranteeing a healthy trade balance of the economy. The ability of the home economy to ensure a healthy trade balance is a function of these variables; the ability of the country to properly switch its direction of demand and also supply adequate goods to meet the addition demand of its population. (Guitan, 1976: Dornbusch. 1988). In the recent time, there have not been sufficient studies in the recent time focusing on exchange rate volatility and trade balance in Nigeria because the focal point of research in the literature is the investigation of the aftermath effect of exchange rate volatility on investment and economic growth. See (Aderemi et al, 2019: Adelowokan, Adesoye and Balogun, 2015, Amasoma, Nwosa and Fasoranti, 2015; Mireille, 2007: Aliyu et al, 2009, Odusola and Akinlo 2003). This has created a gap in the literature in which this study intends to fill. Against this backdrop, this paper will therefore examine the relationship between exchange rate volatility and trade balance in Nigeria. Also, the uniqueness of this study lies in the adoption of Autoregressive of Distribution Lag Model in addressing its objective in which majority of past studies have not fully explored.

In addition to introduction, the rest of the study is organized as follows, the section two addresses relevant theoretical and empirical literature review. Meanwhile, methodology, empirical results and policy recommendation are presented in section three.

## **2. Review of Literature**

### **2.1. Theoretical Literature**

In 1961, Robert Mundell laid a theoretical foundation in developing the Optimal Currency Area (OCA) theory which focused on the choice of exchange rate regime in an economy. However, Mindell developed this theory out of the quest to critically respond the Friedman's school of thought which submitted that the flexible exchange rates are optimal (McKinnon, 1963). Consequently, the theory became popularized though the revolutionary works of (Kenen, 1969, Asher, 2012). It is important to state the subject matter of this theory as it focuses on trade and business cycle stabilization. In the same

vein, this theory elucidates that, the importance of fixed exchange rate regime lies in its ability to increase volume of trade thereby leading to output growth. Through this an exchange rate uncertainty and cost of hedging are eliminated.

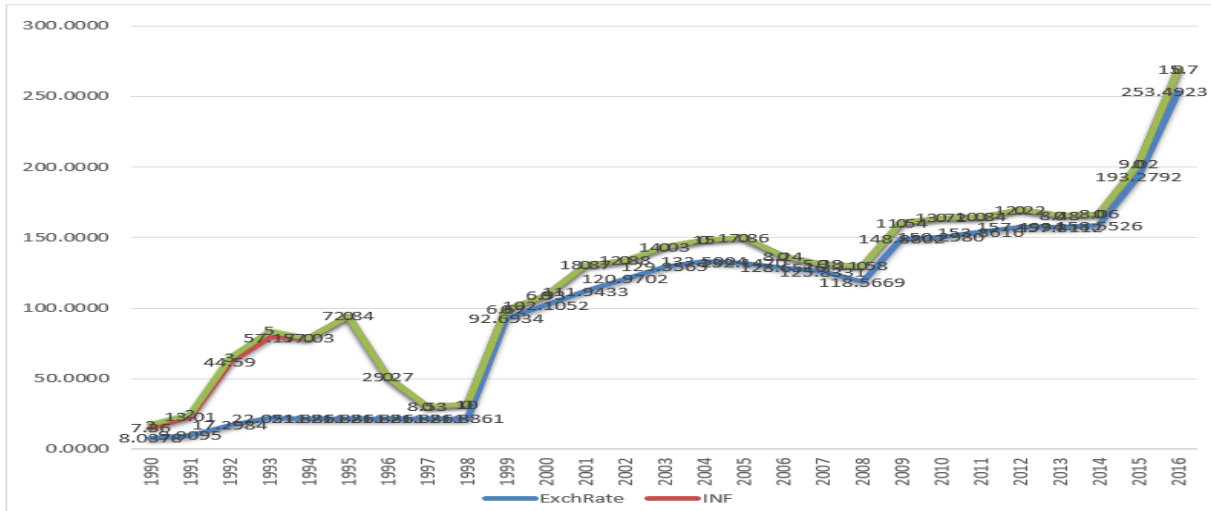
## **2.2. Empirical Literature**

In this section, an attempt has been made to present a brief review of past relevant studies on nexus between exchange rate, trade balance and economic growth in Nigeria especially.

Azeez, Kolapo and Ajayi (2012) critically examined the link between exchange rate fluctuation and economic growth in the Nigerian economy from 1980 to 2010. The finding from this study corroborated that the real exchange rate and economic growth have a direct relationship. In another study, Hossain (2012) investigated how exchange rate volatility and performance of the Nigerian macroeconomic indicators are related between the periods of 1986 to 2010. It was established from the paper that a direct link existed between exchange rate and economic growth in the country. However, Aderemi et al (2019) employed a vector error correction model to examine the relationship between exchange rate volatility and foreign capital inflows in Nigeria from 1990 to 2016. The findings from the paper submitted that 32 percent of total disequilibrium due to external shock in the previous year is corrected in the current year. Also, FDI inflows increased exchange rate volatility in the short run but the volatility dies away over time. But, remittances reduced exchange rate volatility while reverse was the case of external debt. In the same vein, Aliyu et al (2009) estimated the nexus between real exchange rate and manufacturing exports in Nigeria and the Republic of Benin. It was discovered from the study that the major obstacle to the process of economy recovery in both countries is overvaluation of exchange rates. The author recommended among others that currency devaluation, implementation of appropriate policy measures and the domestic prices of tradable products should be adjusted in way to restore exchange rate equilibrium and boost the economy performance of the countries. Furthermore, Benson and Victor (2012) concluded that depreciation of exchange rate orchestrated an increment in imports and reduction in exports in Nigeria. On the other hands, reverse is the case for depreciation of currency. Therefore, the researcher argued that in the long run there would be a shift of attention from imported commodity to items locally produced as result of exchange rate depreciation. The aftermath effect of this would be a drastic diversion of income from abroad to domestic economy through a shift in terms of trade. Eventually, a significant impact on the economic growth in exporting and importing countries will be felt concurrently in the long run.

Furthermore, it could be pinpointed from the above reviewed literature that the studies on exchange volatility in Nigeria are ongoing, and the literature is very scanty about the impact of this variable on trade balance in the country. Hence, the relevance of this study.

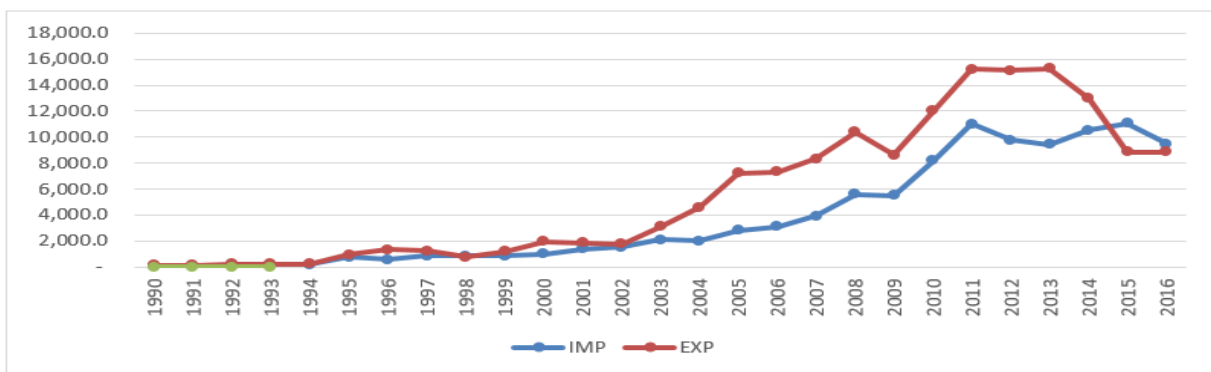
### 3. An Overview of Dynamics of Some Selected Macroeconomic Variables in Nigeria



**Figure 1. Relationship between Exchange Rate and Inflation Rate in Nigeria (1990-2016)**

*Source: Authors' Computation (2019)*

The figure above presents the inter relationship between exchange rate and inflation rate in Nigeria from 1990 to 2016. It is evident that between 1990 and 1998, exchange rate was relatively stable in the country. Meanwhile, inflation rate was rising and fluctuating during the same period. There was a sharp increase in exchange rate and inflation rate respectively in 1999, these variables continued to rise until 2006 when they slumped. However, 2010 marked another rise in these variables as they continued to rise consistently till 2016.

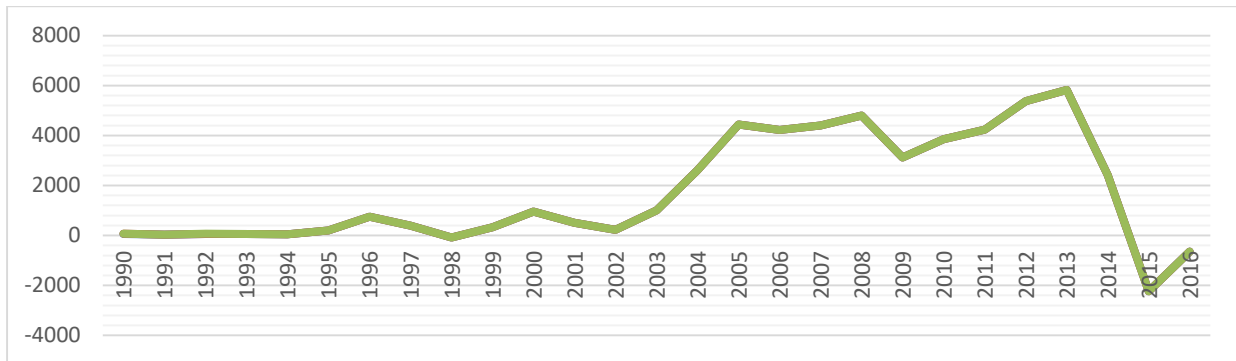


**Figure 2. Relationship between Exports and Imports in Nigeria (1990-2016)**

*Source: Authors' Computation (2019)*

From figure 2, it could be pinpointed that exports and imports follow similar patterns in Nigeria. Between 1990 and 1995, there was no significant difference between imports and exports during these years. Between 1996 and 2002, despite the fact that these variables showed a little divergence, but 1998 and 2002 were different in which these variables converged. Consequently, there was a gap between exports and imports in the country between 2003 and 2014 in which exports were leading but from 2015

to 2016, the country imported more than it exported. It worth of note to state that exports and imports are growing in the same direction in Nigeria which might have some negative consequences on trade balance in the country.



**Figure 3. Trade Balance in Nigeria (1990-2016)**

*Source: Authors' Computation (2019)*

The figure above shows the trade balance performance between 1990 and 2016. From the figure, it could be deduced that trade balance was relatively low and stable from 1990 to 1995 and thereafter started to fluctuate between 1996 and 2002. From 2003 to 2013, this variable has been rising apart from 2009 in which it declined. However, there was a sharp decline in trade balance trough out 2014, 2015 and 2016 due to recession caused by the inability of the Nigerian economy to be insulated from the recent global oil price shocks.

#### 4. Methodology

Secondary data from 1981 to 2016 was adopted for the analysis of this work. Exchange rate, inflation rate, imports, exports, trade balance data were sourced from the CBN Statistical Bulletin of 2017 edition.

##### Model Specification

The model for this study can be specified in the general form as follows:

$$EXR = F (IMP, EXP, TBAL, INFL,) \tag{1}$$

##### ARDL Model Specification

The choice of this methodology is motivated as a result of various diagnostic tests such as unit root test and Bound Test on the variables adopted for the analysis. An autoregressive lag model is considered appropriate for this study due to different orders of integration of the variables i.e. I(1) and I(0). (Peseran, Shin and Smith, 2001: Peseran and Pesaran 1997). Therefore, in a general form, ARDL model can be specified as follows:

$$ARDL (1, 1) \text{ model: } Y_t = \mu + \alpha_1 Y_{t-1} + \beta_0 X_t + \beta_1 X_{t-1} + U_t \tag{2}$$

Meanwhile,  $Y_t$  and  $X_t$  are stationary variables, and  $U_t$  is a white noise.

The application of the lag operator to each of component of the vector would make it an easy task to define the lag polynomial and the vector polynomial as well

However, in a more concise form, the estimation model for this study can be stated thus:

$$EXR_t = \alpha_0 + \alpha_1 EXR_{t-1} + \alpha_2 IMP_{t-1} + \alpha_3 EXP_{t-1} + \alpha_4 TBAL_{t-1} + \alpha_5 INF_{t-1} + \varepsilon_{1t} \dots (3)$$

$$\Delta EXR_t = \beta_0 + \sum_{i=1}^p \beta_1 \Delta EXR_{t-1} + \sum_{i=0}^p \beta_2 \Delta IMP_{t-1} + \sum_{i=0}^p \beta_3 \Delta EXP_{t-1} + \sum_{i=0}^p \beta_4 \Delta TBAL_{t-1} + \sum_{i=0}^p \beta_5 \Delta INF_{t-1} + \varepsilon_{2t} \dots (4)$$

Where EXR is used to represent exchange rate. However, Exchange Rate Volatility is computed with the aid of the Standard Deviation of the first difference of logarithms of the exchange rate. The standard deviation is calculated over one year period as an indicator of short run volatility as well as over 33 years period to capture long run variability. IMP denotes imports, EXP is used to capture exports, TBAL used to proxied trade balance, INF means inflation rate which is used to measure the economic stability Ut is error term. t=1981-2016.

$\beta_0$  is an intercept and  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$  are slope parameters to be estimated. It is expected that coefficients of the variables to have the following signs:  $\beta_3, \beta_4, \beta_5 > 0$  and  $\beta_2 < 0$

Pre-estimation analysis:

- (a) Unit root test:
- (b) Bounds test.

It is pertinent for this study to examine various diagnostic tests such as unit roots and bounds test before the estimation of ARDL. The standard augmented Dickey Fuller test, Philips Perron test and bounds test would be employed to determine the order of integration and the existence or otherwise of long run equilibrium among the variables respectively.

### 5. Result and Discussion

**Table 1. Descriptive Statistics of Annual Data Series (1981-2016)**

Descriptive Statistics	EXCHR	LEXP	LIMP	LTBAL	INF
Mean	4.194898	7.737298	7.250404	6.658862	19.66875
Median	4.785511	7.804316	7.458026	6.891544	12.55000
Maximum	5.066087	9.633122	9.305274	8.669502	72.84000
Minimum	2.084156	4.699444	3.822490	3.465736	5.380000
Std. Deviation	1.017647	1.647953	1.622778	1.785215	18.64281
Skewness	-0.829678	-0.538913	-0.528318	-0.482310	1.736902
Kurtosis	2.037406	2.020382	2.266776	1.793550	4.703962
Jargue-Bera	3.680048	2.121359	1.654098	2.386013	14.97080
Probability	0.158814	0.346220	0.437338	0.303308	0.000561
Sum	100.6776	185.6952	174.0097	159.8127	472.0500
Sum. Sq. Deviation	23.81893	62.46223	60.56840	73.30085	7993.751
Observation	34	34	34	34	34

Source: Authors' Computation (2019)

The above table presents descriptive statistics of the data employed for empirical analysis in this paper. This is important because it provides a useful information concerning how sample series are distributed. The estimated results in the table indicate that the values of mean and median of the following variables exchange rate volatility, exports, imports and trade balance are almost the same except inflation rate which shows slight deviation. This implies that the distribution of the data series is symmetrical in nature. Since the data series were normally distributed, they could be used for further econometric analysis.

**Table 2. Unit Root Test**

Variables	ADF Test			PP Test		
	Level	1 <sup>st</sup> Diff.	Remarks	Level	1 <sup>st</sup> Diff.	Remarks
EXP	-2.981***	2.987***	I (1)	-2.981***	-2.986***	I (1)
TBAL	-3.005***	-2.992***	I(1)	3.004***	-3.020***	I(1)
INFL	-2.981***	-2.986***	I(1)	2.981***	-2.986***	I(1)
EXR	2.981***	-2.986***	I(1)	-2.981***	-2.986***	I(1)
IMP	2.981***		I (0)	2.981***		I (0)

Source: Authors' Computation (2019) \*\*\* %5 level

In order to eliminate the emergence of spurious regression which is usually associated with the time series data in this paper, effort has been made to subject the data to stationarity tests with the aid of the standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Consequently, the reported results in table 2 clearly shows that the data are a mixture of I(0) and I(1). Some variables of interest like exchange rate volatility, exports, trade balance and inflation are stationary after first difference possess unit roots. This implies that these variables possess a unit root. However, the variable used to proxy import is stationary at a level. This means that this variable does not possess a unit root.

**Table 3. ARDL Bounds Test**

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	k
F-statistic	1.834255	3
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
5%	3.23	4.35

Source: Authors' Computation (2019)

From the above, it could be established from the result of Bound Test that the Null hypothesis of no long run relationship could not be rejected because the value of F-Statistic is lower than the upper and lower Critical Value Bounds at all level of significance. Therefore, there is no cointegrating relationship between the variables in the model. Since the variables of interest do not possess a long run equilibrium relationship, therefore the short run relationship is estimated in this paper.

**Table 4. Short Run Relationship**

**Dependent Variable: Exchange Rate Volatility**

Variable	Coefficient	t-statistics	P-value
LEXCHRATE(-1)	0.723735***	11.31880	0.0000
LEXP	-73.51469**	2.655176	0.0156
LIMP	0.898572	0.120753	0.9053
LTBAL	-0.045397*	1.749348	0.1080
INFL	-0.006547***	4.895809	0.0005
C	5.553630*	1.924234	0.0712

Source: Authors' Computation (2019) \*Significant at 10%, \*\*Significant at 5%, \*\*\*Significant at 1%

In the table above, the ARDL results of the short run relationship between the studied variables are presented. It is important to stress that estimated results did not conform to the a priori expectation. Exchange rate volatility has a significant negative impact on exports in the short run. Exchange rate volatility is supposed to increase exports base of Nigeria despite the fact that the coefficients of volatility measure sensitivity of exports to a shock in exchange rate. Therefore, a shock to exchange rate causes a significant decline in exports in Nigeria. This finding corroborates the assertion of Aliyu (2010). However, there is a positive relationship between exchange rate volatility and import, but the relationship is not significant. It is worth of note that this finding contradicts economic theory. Rise in exchange rate should make imported items to be very expensive, and thereby discourages their competitiveness in the domestic economy. However, these findings are in line with the proposition of Aliyu (2011) who submitted that exchange rate depreciation caused an increment in imports and reduction in exports in Nigeria despite the adoption of different methodology.

Consequently, there is a negative relationship between exchange rate volatility and trade balance, though the relationship is significant at 10% level of significance. It could be established thus that exchange rate volatility is not favorable to international trade in Nigeria because its impact on trade balance is negative. Also, inflation rate and exchange rate volatility have a significant inverse relationship in Nigeria. This means that exchange rate volatility has not been one of the factors causing a rise in inflation rate in the country. This finding contradicts the work of Lawal et al (2016).

## 6. Conclusion and Discussion

This paper has examined the relationship between exchange rate volatility and trade balance in Nigeria between the periods of 1981 and 2016 with the application of Bound Test and ARDL model. The findings that came up in this study could be summarized as follows: the variables of interest do not have a long run equilibrium relationship. Exchange rate volatility has a significant negative impact on Nigerian exports, and consequently reflecting a negative implication on trade balance. This negative impact could be attributable to the lack of global competitiveness of Nigeria's locally made products in the world market. Some of the locally made products in Nigeria lack value added qualities that can make them compete with the products of other advanced countries and some emerging countries like China, India and other Asian Tigers in the global market. However, there is a positive relationship between exchange rate volatility and import, though this is not consistent with economic theory. Rise in exchange rate should make imported items to be very expensive, and thereby discourages their



competitiveness in the domestic economy. This contradictory finding could be a result of the overdependence of the country on foreign goods. Another reason that might account for this could be as a result of value added qualities that imported goods possess, meanwhile some of the locally made products in Nigeria lack these qualities. Also, inflation rate and volatility in exchange rate show a significant negative relationship in Nigeria. This means that volatility in exchange rate is not responsible for rise in inflation rate associated with the Nigerian economy.

Moreover, owing to the findings that originated from this study, it is pertinent that the following recommendations should be offered to the appropriate Nigerian policy makers, institutions regulators, investors and future researchers. Adequate strategic policy that has the capacity to stabilize the country's exchange rate should be embarked upon by the policy makers in the country. Similarly, the Nigerian government should possess political goodwill to embark on aggressive export promotion policies that will ensure the competitiveness of domestically produced item through value added approach in the global market. In the same vein, as a matter of urgency, importation of all items that can be locally produced should be drastically discouraged if not totally banned in Nigeria.

## References

- Adelowokan, O. A.; Adesoye A. B. & Balogun O. D. (2015). Exchange Rate Volatility on Investment and Growth in Nigeria: An Empirical Analysis. *Global Journal of Management and Business Research*, Vol.15, No. 10, pp. 19-30.
- Aderemi, T. A.; Akinbode, S. O.; Omogboye, M.A. & Fagbola, L. O. (2019). Exchange Rate Volatility and Foreign Capital Inflows in Nigeria: A Vector Error Correction Model Approach. *Acta Universitatis Danubius. Œconomica*, Vol. 15, No. 5, pp. 34-43.
- Aliyu, S. R. U. (2010). Exchange rate volatility and export trade in Nigeria: An empirical investigation. *SSRN Electronic Journal*, Vol. 20, No. 13, pp. 1071-1084.
- Aliyu, S. R. U. (2011). Impact of oil price shock and exchange rate volatility on economic growth Nigeria: An empirical investigation. *Research Journal of International Studies*.
- Aliyu, S. U. R; Yakub, M. U; Sanni G. K & Duke O. O (2009). Exchange Rate Pass-through in Nigeria: Evidence from a vector Error Correction Model. *CSAE conference*. UK: Oxford University.
- Asher O. J. (2012). *The Impact of Exchange rate Fluctuation on the Nigeria Economic Growth (1980 – 2010)*. Unpublished B.SC Thesis of Caritas University Emene, Enugu State, Nigeria.
- Azeez, B. A.; Kolapo, F. T & Ajayi, L. B. (2012). Effect of Exchange rate Volatility on Macroeconomic Performance in Nigeria. *Interdisciplinary Journal of Contemporary Research in Business*, Vol. 4, No.1, pp. 149-155.
- Benson, U. O & Victor, E. O. (2012). Real Exchange Rate and Macroeconomic Performance: Testing for the Balassa-Samuelson Hypothesis in Nigeria. *International Journal of Economics and Finance*, Vol. 4, No. 2, pp. 127-134.
- CBN. (1985). *Statistical Bulletin*. Central Bank of Nigeria.
- CBN. (2017). *Statistical Bulletin*. Central Bank of Nigeria.
- Dornbusch, R. (1988). *Open macroeconomics*. 2nd Edition. New York.
- Friedman, M. (1953). The Case for Flexible Exchange Rates. *Essays in Positive Economics*. Chicago: University of Chicago Press, pp. 157-203.
- Guitan, M. (1976). The Effects of Changes in exchange Rate on Output, Prices and The balance of Payments. *Journal of International Economics*, Vol.6, pp. 65-74.



Hossain, A. (2002). Exchange rate responses to inflation in Bangladesh. Washington D.C. *IMF Working Paper*, No. WP/02/XX.

Lawal, A. I., Atunde, I. O., Ahmed, V. & Abiola A. (2016). Exchange Rate Fluctuation and the Nigeria Economic Growth. *EuroEconomica*, Vol. 35, No.2, pp. 1-14.

Mireille, L. (2007). The Impact of the Real Exchange Rate on Manufacturing Exports in Benin. *Africa Region Working Paper Series*, No. 107.

Odusola & Akinlo (2003). Assessing the impact of Nigeria's naira depreciation on output and inflation. *Policy Implication. West African Journal of Monetary and Economic Integration*, Vol. 6, No. 1.

McKinnon, R. (1963). Optimal Currency Areas. *American Economic Review*, Vol. 53, pp. 717-724.

Kenen, P. (1969). The Theory of Optimum Currency Areas: An Eclectic View. In Robert Mundell and Alexander Swoboda (eds.). *Monetary Problems of the International Economy*. Chicago: University of Chicago Press. pp. 41–60.

Pesaran, M. H.; Shin, Y. & Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, Vol.16, pp. 289-326.

Pesaran, M. & Pesaran, B. (1997). *Microfit 4.0 (windows version)*. New York: Oxford University Press Inc.