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Empirical Analysis of the Impact of Exchange Rate Fluctuation on the Nigeria Balance of Payments: 1981 – 2017

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Abstract

This study examined the impact of exchange rate fluctuation on the Nigeria balance of payment for the period of 1981– 2017. The study employed ARDL bound testing approach to cointegration to test the long run relationship among the variables after the unit root test was conducted, which revealed that some variables were stationary at first difference while one was stationary at level. The empirical results from the ARDL bounds testing procedure revealed that a long-run relationship exists between exchange rate and balance of payments in Nigeria. The elasticity of the exchange rate coefficient in the balance of payments model was negative and statistically insignificant at 5 percent level, thus balance of payment position in Nigeria responded negatively to exchange rate policies in Nigeria. Both in the long-run and short-run the estimated coefficient of exchange rate variable was not statistically significant. This implied that change in exchange rate do not influence the balance of payments position in Nigeria. Therefore, it was recommended that, Nigeria government should implement economic policies that could enhance the appreciation of the Naira-US$ exchange rate against the devaluation policy which most often results in high cost of importing raw materials and capital goods, raises the cost of production and reduces the profits of the importing firms as well as reduce the excessive balance of payments deficit by discouraging over-reliance on imported goods and the promotion of domestic export produce is very imperative.

Keywords: Exchange Rate Fluctuation, Balance of Payment, ARDL
JEL Codes: E31, F41, F43

1. Introduction

Exchange rate refers to the price of one currency (the domestic currency) in terms of another (the foreign currency). Exchange rate plays a key role in international economic transactions because no nation can remain in autarky due to varying factor endowment. Movements in the exchange rate have ripple effects on other economic variables such as interest rate, inflation rate, unemployment, money supply, etc (Oladipupo & Onotaniyohuwo, 2011). These facts underscore the importance of exchange rate to the economic well-being of every country that opens its doors to international trade in goods and services. The importance of exchange rate derives from the fact that it connects the price systems of two different countries making it possible for international trade to make direct comparison of traded goods. In other words, it links domestic prices with international prices. Through its effects on the volume of imports and exports, exchange rate exerts a powerful influence on a country's balance of payments position. Consequently, nations in the pursuit of the macroeconomic goals of healthy external balances as reflected in their balance of

payments (BOP) position, find it imperative to enunciate an exchange rate policy (Oladipupo&Onotaniyohuwo, 2011).

Exchange rate is a key determinant of the balance of payments (BOP) position of any country. If it is judiciously utilized, it can serve as nominal anchor for price stability. Changes in exchange rate have direct effect on demand and supply of goods, investment, employment as well as distribution of income and wealth. For several years, the Nigerian economy witnessed high level volatility in foreign exchange dynamics, which aggravated the nation's balance of payments. Basically, adequate foreign exchange is required in the economy for the servicing of external debts, importation of raw materials, machines and spares and upgrading of industrial infrastructure for sustainable development (Oladipupo & Onotaniyohuwo, 2011).

Against this backdrop, the concern of many scholars and economy watchers has to do with the dynamics of foreign exchange, being contingent on the market forces of demand and supply, as well as their critical linkages with balance of payments. Also of immense interest is the trend of balance of payments between trading nations, which underscore financial and real investments cooperation for economic cooperation and sustainable development. Some research works (Opaluwa, Umeh & Ameh, 2012; Owolabi & Adegbite, 2017; Oladipupo & Onotaniyohuwo, 2011) had examined changes in exchange rate over the years, with emphasis on short-run equilibrium tendency and also address the implications of foreign exchange dynamics on international finance and investment profiling (Loto, 2011; Lipsey& Chrystal, 2004). Considering Nigeria's macroeconomic context, this study examines foreign exchange dynamics in relation to balance of payments.

The implementation of Structural Adjustment Program (SAP) recommended by International Monetary Fund (IMF) for developing countries so that they could get loans with certain conditionality which lead to problems balance of payment problems due to expansionary financial policies, a deterioration in terms of trade, price distortions, high debt servicing or combination of these factors have often resorted to devaluing their currencies (Nashashibi, 1983). Therefore, Nigeria has undergone various policy and structural reforms both at micro-and macro level of the economy in the form of implementing Structural Adjustment Program (SAP), which began in 1986 and has led to high level of fluctuation in the exchange rate over the years. Therefore, the aim of this study is to investigate the impact of exchange rate fluctuation on Balance of Payment (BOP) in Nigeria. Hence, following the introduction is section II which deals with the review of empirical literature, section III involves the analytical methodology, section IV present data, analyze and interpret regression results, while section V summarizes and conclude the study.

2. Literature Review and Theoretical Framework

Empirical Review

A number of studies have been carried out on the relationship between exchange rate and balance of payment. Dutta and Ahmed (2006) using co-integration and error correction model approaches investigated the behavior of Indian aggregated import demand during the period 1971-1995. The results obtained indicated that import volume is co-integrated with relative import price and real GDP. The output of the import demand in India is largely explained by real GDP and generally less sensitive to import price changes. Rose (1990), examined the empirical relationship between the real effective exchange rate and aggregate real trade balance for major OECD countries in the post-Bretton Woods era. Using a variety of parametric and non-parametric techniques, the results suggest that there is little evidence that the exchange rate significantly affect the trade balance.

Oladipupo and Onotaniyohuwo (2011) investigated the impact of exchange rate on

the Nigerian external sector (the balance of payments position) using the ordinary least square (OLS) method for data covering the period between 1970 and 2008. The result revealed that exchange rate has a significant impact on the balance of payment position. Imoisi (2012) examined the trends in Nigerian's Balance of payments position from 1970-2010 using an econometric analysis. The study carried out a multiple regression analysis using the ordinary least square method for both linear and log linear form. The results showed that the independent variables appeared with the correct sign and thus, conform to economic theory, but the relationship between Balance of payments and inflation rate was not significant. However, the relationship between Balance of payments, Exchange rate and interest rate were significant.

Salasevicius and Vaicious (2003) used the VECM to test for Marshall-Lerner condition in the exchange rate-trade balance relationship in the Baltic States. The study found that Lithuania met the Marshall-Lerner condition, but Estonia did not, while the result of Latria was ambiguous.

Ogbonna (2011) examined the empirical relationship between the real exchange rate and aggregate trade balance in Nigeria. The study tested Marshall-Lerner conditions to see if it is satisfied for Nigeria. The result showed no co-integration for the trade balance model. The results further revealed that depreciation/devaluation improves balance of payment and Marshall-Lerner (ML) condition holds for Nigeria.

Rasaq (2013) analyzed the impact of exchange rate volatility on macroeconomic variables, using correlation matrix, ordinary least square (OLS) and Granger causality test, the findings of the study showed that exchange rate volatility has a positive influence on Gross Domestic Product, Foreign Direct Investment and Trade Openness, but with negative influence on the inflationary rate in the country.

Umoru and Odjegba (2013) analyzed the relationship between exchange rate misalignment and balance of payments (BOP) mal-adjustment in Nigeria over the sample period of 1973 to 2012 using the vector error correction econometric modeling technique and Granger Causality Tests. The study revealed that exchange rate misalignment exhibited a positive impact on the Nigeria's balance of payments position. The Granger pair-wise causality test result indicated a unidirectional causality running from exchange rate misalignment to balance of payments adjustment in Nigeria at the 1 percent level. The inconsistency in the research results of the various studies reviewed therefore motivated this study.

In recent time, a study was carried out by Okwuchukwu (2014) examined the impact of exchange rate on balance of payment in Nigeria, using annual data from 1971 to 2012. The empirical methodology employed autoregressive distributed lag (ARDL) co-integration estimation technique to detect possible long-run and short-run dynamic relationship between the variables used in the model. The study also tested the Marshall-Lerner (ML) condition to see if it is satisfied for Nigeria. The results provided evidence in favour of a positive and statistically significant relationship in the long-run and also a positive but statistically insignificant relationship in the short-run between balance of payment and exchange rate. The results further revealed that depreciation/devaluation improves balance of payment and that Marshall-Lerner (ML) condition subsists for Nigeria. The study recommends policies that will discourage excessive importation and promote incentive based export promotion programmes. It further recommends diversification of the economy and the promotion of entrepreneurial development in Nigeria.

Harley (2018) investigated the impact of exchange rate using of descriptive and ordinary least square methodology for the period of 2012 to 2016 on a panel data. The regression result shows thatthere is a positive relationship between Return on Investment and exchange rate of 145.4265. This implies

thata unit increases in exchange rate of 145.4265 will bring about a rise of 145.4265 in Return on Investment. Other variables used in the study have a positive relationship with return on investment. Hence, it can be deduced that, empirical research on the impact of exchange rate on balance of payment is still very scanty and few records available produced ambiguous result with techniques which are not only outdated but were not adopted following the rules governing the adoption of techniques of analysis of time series data. Therefore, this study will apply advance econometric technique to an updated time series data covering the period of 1981 to 2017 to fill the gap in the literature.

Theoretical Framework

This study employed as its theoretical framework the elasticity approach which focus on the trade balance and exchange rate. It studies the responsiveness of the variables in the trade and services account, constituting of imports and exports of merchandise and services relative price changes induced by devaluation. The elasticity approach to balance of payments is built on the Marshall Learner condition (Sodersten, 1980), which states that the sum of elasticity of demand for a country's export and its demand for imports has to be greater than unity for a devaluation to have a positive effect on a country's balance of payments. If the sum of these elasticities is smaller than unity, then the country can instead improves its balance of trade by devaluation. This condition can be expressed mathematically as follows:

$\Delta B = KXf(e_{1m} + e_{2m-1})$ …..…….…. 2.1

where:

ΔB= change in the trade balance

K = The devaluation in percentage

Xf = The value of exports expressed in foreign currency

e_{1m} = The first (devaluing) country's demand elasticity for imports.

e_{2m} = The second country's demand elasticity for exports from the devaluingcountry.

Thus, $e_{1m} + e_{2m} > 1$ for Marshall Learner condition to be fulfilled.

This approach essentially detects the condition under which changes in exchange rate would restore balance of payments (BOP) equilibrium. It focuses on the current account of the balance of payment and requires that the demand elasticity be calculated, specifying the conditions under which a devaluation would improve the balance of payments. Crockett (1977) sees the elasticity approach to balance of payments as the most efficient mechanism of balance of payments adjustments and suggests the computation of demand elasticity as the analytical tool by which policies in the exchange field can be chosen, so as to form the equilibrium. In contrast, Ogun (1985) is of the view that most less developed countries who are exporters of raw materials or primary products, and importers of necessities may not successfully apply devaluation as a means of correcting balance of payments disequilibrium, because of the low values for the elasticity of demand.

3. Methodology

Model Specification

This study focused on Balance of payment (BOP) as the dependent variable and exchange rate as the independent or explanatory variable. In order to test if Marshall – Lerner condition holds for Nigeria, total import and total export were included as explanatory variables. Based on the theoretical background and the model of Okwuchukwu (2014) this study will estimate the following functional relationship:

BOP =f(EXR , XM, IM) ……..3.1

Where ;

BOP is Balance of payment,

EXR is exchange rate,

XM is total export,

IM is total import.

The balance of payment model in this study draws from the same logic as the Marshall-Lerner condition, but differs only on the expression of the balance. While Marshall-

Lerner expressed balance of payment as net export (X – M), this study followed the methodology used by Boyd (2001) and salasevicius and vaicius, (2003) to take their ratio (X/M) since according to salasevicius and vaicius (2003), trade built in this way in a logarithmic model gives the Marshall-Lerner condition in an exact form rather than approximation. The Linear approximation of the functional form of the model expressed in natural logarithm is of the form.

$BOP = \alpha_0 + \alpha_1 InEXR + \alpha_2 InXm + \alpha_3 InIm + \mu_t$…..3.2

Where,
In is the natural logarithm,
BOP is the balance of payment,
EXR is the real exchange rate,
XM is total export,
IM, is total import,
μ is the stochastic error term,
α_o is the constant term and
$\alpha_1 \ldots \alpha_3$ represents the coefficients of the explanatory variables.

The coefficient of InEXR gives the Marshall-Lerner condition of NX + NM > 1. The decision rule here is that if the value of the coefficient of InEXR is positive, it implies high import/export demand elasticity, meaning that ML condition subsists and that depreciation of exchange rate improves balance of trade in Nigeria. But, if the value of the coefficient of InEXR is found to be negative, it indicates that the ML condition does not hold and thus depreciation of the domestic currency worsens the balance of trade in Nigeria.

Estimation Techniques

The model estimation technique chosen for the study is the autoregressive distributed lag (ARDL) bound testing approach to co-integration. The study first of all looked at the time series properties of the data used in the analysis since the ARDL stipulates that none of the variables should be more than I(1). This study therefore estimates the following regression equation.

Where;
ΔInBOP is the log difference of the balance of payment,
ΔIn EXR is the log difference of the exchange rate,
ΔInXM is the log difference of total export, and
ΔInIM is the log difference of total import.
α_1, α_2, α_3, α_4 represents the short-run coefficient and β_1, β_2, β_3, β_4, represents the long-run coefficient of balance of payment, exchange rate, export and import respectively.

Furthermore, Pesaran*et al*(2001), maintained that equation (3.3) can be replicate to ARDL version of the error correction model relating to the variables equation (3.3) as thus:

Where; ECM_{t-1} represents the error correction term lagged for one period, while γ is the coefficient for measuring speed of adjustment. It measures how fast errors generated in one period are corrected in the following period and μ_t is the stochastic error term.

This study basically relies on the use of secondary data. The data were sourced from the Central Bank of Nigeria (CBN, 2017) publications and World Development Indicators 2017 etc.

4. Analysis and Interpretation of Result

Unit Root Test

The results of the stationarity test conducted on each variable explained in the model using ADF and PP techniques in testing the hypothesis of unit root or no unit root as the case may be is presented in table 4.1;

Table 4.1: Unit Root Test Result

Variables	ADF TEST H_0: Variable is not Stationary	PP TEST H_0: Variable is not Stationary	Order of Integration
LBOP	-6.678550***	-9.169380***	I(0)

EXR	-0.112464	-0.112464	
D(EXR)	-5.305581***	-5.305581***	I(1)
LXM	-1.645958	-1.791143	
D(LXM)	-5.005961***	-5.013577***	I(1)
LIM	-0.527119	-1.138691	
D(LIM)	-4.631205***	-4.591967***	I(1)
Asymptotic Critical Values			
1%	-3.653730	-3.661661	
5%	-2.957110	-2.960411	
10%	-2.617434	-2.619160	

**** implies significant at 1% level, ** implies significant at 5% level and * implies significant at 10% level. Δ represents first difference*
Source: Authors' computation from E-views Output 10.0

From the results presented in table 4.1, the LBOP was stationary at level with both the ADF and PP unit root test respectively which means it is integrated of order (0), while the EXR, LXM and LIM were not stationary at level which necessitated there differencing. Hence, for these variables after the first difference, it was observed that the null hypothesis of non-stationarity were rejected at 10%, 5% and some at 1% critical value for ADF and PP respectively. This means that the variables were stationary at first difference and are integrated of order (1). Therefore, the appropriate techniques of analysis is that which can capture the characteristics of a mixture of I(0) and I(1) of the variables which according to Pesaran, *et al* (2001) is the ARDL model.

Estimation of Long Run Relationship

Equation 3.3 above is estimated to test the null hypothesis of no cointegration against the alternative hypothesis. The result obtain is presented in the table below.

Table 4.2: ARDL Long Run Relationship Result

Dependent Variable: D(LBOP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1884.040	3741.959	0.503490	0.6196
D(LBOP(-1))	0.495016	0.203863	2.428180	0.0473
D(EXR(-1))	-5.074709	228.3677	-0.022222	0.9825
D(LIM(-1))	-10.64193	6.609146	-2.064100	0.0495
D(LXM(-1))	13.72817	4.566714	3.006138	0.0052
LBOP(-1)	-1.566183	0.317846	-4.927486	0.0001
EXR(-1)	-9.662516	89.83396	-0.107560	0.9153
LIM(-1)	-12.00640	5.359600	-2.240168	0.0124
LXM(-1)	26.24289	3.634952	2.323237	0.0496
R-squared	0.641026	Mean dependent var		-185.5194
Adjusted R-squared	0.510490	S.D. dependent var		19904.05
S.E. of regression	13925.86	Akaike info criterion		22.15858
Sum squared resid	4.27E+09	Schwarz criterion		22.57490
Log likelihood	-334.4580	Hannan-Quinn criter.		22.29429
F-statistic	14.90728	Durbin-Watson stat		2.001327
Prob(F-statistic)	0.001410			

Source: Authors' Computation from E-views Output 10.0

The result presented above shows the existence of long run relationship among the variable given a negative and significant coefficient of the lag value of the balance of payment (BOP) and its depicts that all the explanatory variables in their long and short run forms are in line with the apriori expectation and significant at 5% significance expect that of exchange rate variable. Also, the coefficient of determination (R^2) explains 64% of the variations in the dependent variable which is above 50% and even after taking into consideration the degree of freedom, the adjusted coefficient of determination (adjusted R^2) still explains 51% variation in the dependent variable. The F-statistic 14.90728(0.001410) confirmed the fitness of the coefficient of determination and shows an overall significant level of the explanatory variables jointly in explaining the balance of payment. Above all, the model is free from autocorrelation as shown by the Durbin-Watson value that is approximately equal to 2. In the same vein, the outcome of this result can be tested using some diagnostic tests such as serial correlation test and stability test. These are presented and explained below respectively:

Table 4.3: Breusch-Godfrey Serial Correlation LM Test:

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.237122	Prob. F(2,33)	0.0029
Obs*R-squared	14.53242	Prob. Chi-Square(2)	0.6513

Source: Authors' Computation from E-views Output 10.0

The result of the Breusch-Godfrey Serial Correlation LM test shows that, the Null hypothesis of no serial correlation cannot be rejected given the probability value of 0.6513 and that the alternative hypothesis that there exist serial correlation in the model can be rejected. Therefore, there is a plus to the reliability of the estimated model as it is free from serial correlation problem.

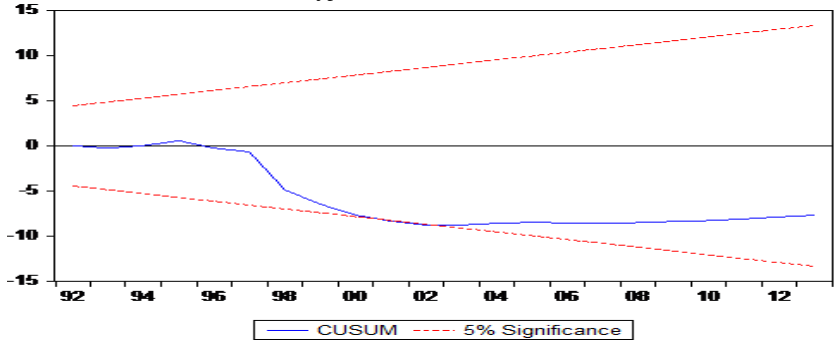

Fig. 4.1: Plot of Cumulative Sum of Recursive Residuals

For the stability test, CUSUM figure above shows that the CUSUM line is within the critical bounds of 5 percent which is an indication that the model is structurally stable.

Bound Test Approach to Cointegration

The long run relationship of the result presented above can be further affirmed by conducting a bound test. This is done by testing if the coefficients of β's are equal to zero in our estimated model or not. The F-Statistic value from the bound test as revealed by the Wald test presented in table 4.4 below will be compare with the critical value from the bound table (Pesaran et al., 2001).

Table 4.4: Wald Test

Test Statistic	Value	Df	Probability

F-statistic	6.072055	(4, 22)	0.0019
Chi-square	24.28822	4	0.0001

Source: Authors' Computation from E-views Output 10.0

Table 4.5: F-statistics for Testing the Existence of Co-integration

Test Statistic	Value	Lag	Significance Level	Bound Critical Value(Unrestricted intercept and no trend)	
F-statistic	6.072055	1	1%	I(0)	I(1)
			5%		
			10%		
				2.57	2.91
				2.86	3.22
				3.43	3.82

Source: Authors' Computation from E-views Output 10.0

We can observed from table 4.5 that estimated results of the F-statistics exceed the upper critical values at 1%, 5% and 10% significance level, and thus, inferring that there exists a co-integrating relationship among the time series in the level form, without considering whether they are I(0) or I(1).

Error Correction Representation of ARDL Model

Equation 3.4 in chapter three is estimated and the result is given in the below table.

Table 4.6: Error Correction Result of ARDL Model

Dependent Variable: D(LBOP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	269.8604	2894.304	0.093238	0.9265
D(LBOP(-1))	-0.468311	0.151422	-3.092760	0.0269
D(EXR(-1))	-40.21493	178.2546	-0.225604	0.8234
D(LIM(-1))	-18.35048	5.677854	-3.231940	0.0186
D(LXM(-1))	9.191937	3.933859	2.336621	0.0393
ECM(-1)	-0.326860	0.252711	-5.250501	0.0000
R-squared	0.648618	Mean dependent var		-155.1367
Adjusted R-squared	0.575413	S.D. dependent var		20243.59
S.E. of regression	13190.78	Akaike info criterion		21.98928
Sum squared resid	4.18E+09	Schwarz criterion		22.26952
Log likelihood	-323.8392	Hannan-Quinn criter.		22.07893
F-statistic	8.860349	Durbin-Watson stat		2.006892
Prob(F-statistic)	0.000071			

Source: Authors' Computation from E-views Output 10.0

From the above table, ECM (–1) is one period lag value of error terms that is obtained from the long-run relationship. The coefficient of ECM (–1) indicates how much of the disequilibrium in the short-run will be fixed (eliminated) in the long-run. As expected, the error correction variable ECM (–1) has been found negative and also statistically significant. Hence, the coefficient of the ECM term suggests that adjustment process is less than average as 32 percent of the previous year's disequilibrium in the explanatory variables from its equilibrium path will be corrected in the current year.

5. Conclusion and Recommendations

This study examined the impact of exchange rate fluctuation on balance of payments in Nigeria for the period of 1981 – 2017. A functional relationship was specified between the balance of payments and its explanatory variables such as exchange rate,

import and export. The study employed ARDL bound testing approach to cointegration in testing the long run relationship among the variables after the unit root test was conducted and it was revealed that some variables were stationary at first difference while one was stationary at level. The empirical results from the ARDL bounds testing procedure revealed that a long-run relationship exists between exchange rate and balance of payment in Nigeria with insignificant negative relationship between exchange rate and balance of payments at 5 percent level. This is an indication that, balance of payments in Nigeria for the period of study responded negatively to exchange rate fluctuation. The result of both short and long run revealed insignificant relationship which opposed the notion that, balance of payments position is influenced by exchange rate fluctuation. The dynamic error correction mechanism revealed that the speed of adjustment to the long run equilibrium position from the previous period to the current is moderate. The ECM coefficient was correctly signed with a negative sign. Hence, it is recommended that, Nigerian government should reduce the excessive balance of payment deficit, the need to discourage over-reliance on imported goods and the promotion of domestic export produce is very imperative. This can only be achieved if the Nigerian economy is diversified and entrepreneurial development promoted, in the presence of fiscal discipline.

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