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The Analysis of Exchange Rate Fluctuation on Nigeria's Balance of Payments

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Abstract

Exchange rate volatility is a widely discussed topic amongst economist and finance experts as it is a very important phenomenon in every economy, especially amongst developing nations. This research sets out to investigate the relationship between exchange rate volatility and Nigeria's balance of payment. The data employed was sourced from the Central Bank of Nigeria's statistical bulletin (2015) and the National Bureau of Statistics (NBS). The sample size employed for the study covered a period of 30years (1985-2015). The estimation techniques employed in this research are; the Johansen co-integration test for long-run relationships, while both ARCH and GARCH were also employed to test for volatility of the Exchange Rates. The result showed there was no long-run relationship between Exchange Rate and the Balance of Payment position of the Nigerian Economy during the period under review, while the coefficient of the ARCH effect is found to be statistically significant at 10%, the GARCH effect however was found to be statistically insignificant. Therefore it was recommended amongst other things that exchange rate liberalization should be adopted by the monetary authorities in order to promote fairness and attract foreign investment which will ultimately lead to a favorable balance of payment in the Nigerian Economy.

Keywords: Exchange Rate, Balance of payment, Interest rate, Volatility, ARCH and GARCH.
JEL Classification: E42, F31

1. Introduction

The issue of exchange rate is perhaps one of the most widely discussed topics in Nigeria today. This is not surprising given the macro-economic importance, especially in a highly import dependent economy as Nigeria. However, following the fluctuations of the Naira in 1986, a policy was induced by the structural adjustment programme (SAP).This made the subject of exchange rate, a topical issue in Nigeria. The goal of every economy is to be stable, and to have a balanced balance of payment. As result of using the floating foreign exchange determination system, the country achieved that. The country also embarked on devaluation to promote export and stabilise the rate of exchange.

In Nigeria up to the time of structural adjusted programme (SAP), it appeared that Nigerian's exchange rate policy tended to encourage overvaluation of the Naira, because in 1981, it was 0.90 cents to ₦1. This in turn encouraged imports and discourages non-oil export and over dependence of

Nigerian economy on imported input over exported output. An economy that its import exceed export will experience unfavorable balance of payment and such economy currency will be devalue against other country currencies that involve in trades i.e. the exchange rate of that economy to other currencies will be low in terms of value, for instance the Nigeria Naira to dollars is $1 to ₦197.00, pounds-sterling is £1 to ₦281.29 naira etc (CBN, 2016).

The effect of the global economic meltdown on Nigerian exchange rate was phenomenon as the Naira exchange rate to the dollar rose astronomically from about ₦120/$ to more than ₦180/$ between 2008 and 2009. This is attributable to the sharp drop in foreign earnings and national revenue of Nigeria as a result of persistent fall of crude oil price in the world crude oil market. The renewed emphasis on the production of alternatives to fossil-fuel energy, such as solar, wind and bio-energy in the advance economies has reduce the demand for crude oil and consequently caused its price to sharply drop from $110 per barrel to below $50 per barrel between mid 2014 and early 2015 and currently at $33.62 per barrel in early 2016, and further weaken and reduce Nigeria foreign earnings and revenues to finance priorities sectors that will boost the economic activities, increase per capita income, create employment and increase standard of living.

The fact that crude oil is an exhaustible asset makes it unreliable for sustainable development of the Nigerian economy (Utomi, 2004). Base on the major investigation of this paper; the study set hypothesis (HO) that there is no granger causality effect between balance of payment and exchange rate in Nigeria. Previous studies have established the impact of exchange rate on balance of payment, effect of monetary policy on balance of payment and determinant of balance of payment and exchange rate in Nigeria context but most these past never consider the evaluation of granger causality effect of balance of payment and exchange rate in Nigeria.

The foreign exchange and balance of payment are some of the key factors of a nation's Life. They are factors that look into comparing a country's relationship with other nations. The exchange rate and balance of payment of a country, such as the inflation rate of a country, foreign direct investment, inflation rate and interest rate which will directly and indirectly affect the balance of payment and the Nigerian economy at large.

In 1973 and 1979, the exchange rate was relatively stable as a result of the oil boom. Nigeria however, started recording huge balance of payment deficits and very low foreign reserve in the 1980's.

It was felt that a depreciation of naira would relieve pressures on the balance of payment. Consequently the Naira was devalued and the irony of this policy instrument is that, Nigeria's foreign trade structure did not satisfy the conditions for a successful balance of payment policy. The country's foreign structure is characterized by export of crude petroleum and agricultural produce, whose prices are predetermined in the world market with low imports and export price elasticity in demand.

Currently, the nation's exchange rate has fallen and has since been fluctuating. This so far has been due to unfavorable nature of the competing powers of the nation's currencies and the currencies of the world. The economy for a long time has been struggling to resolve the problems of external and internal imbalances. This has manifested in the disequilibrium, in her balance of payment while causing a balance of payment deficit.

Relevant literatures and opinions on this issue are of the view that exchange rate policy plays an important role, of maintaining internal and external balances. On the other hand, other writers argue that devaluation is not the best policy for the less developed country, because of many diverse results. Some economists disputed the ability of the change in real exchange rate. This other to improve the trade balance of developing countries, because of elasticity of low exports other writers said that structural policies could however, change the long term trends in the terms of trade, and the prospects of export-led growth.

The key objective of the study is to examine the impact of exchange rate volatility on Nigeria's balance of payment and also attempt to evaluate the impact of interest rate on the balance of payment in Nigeria. The remaining part of the paper is structured as follows. The next section provides a review

of literature on Exchange Rate volatility and Balance of payment, while Section 3 describes the methodology adopted in the study Section 4 presents the results and discussion of findings, the Final section 5 provides the summary and recommendations.

2. Literature Review

2.1 Conceptual Clarification

Exchange Rate

Exchange rate is the price of a nation's currency, in terms of another currency. An exchange rate thus, has two components, the domestic currency and a foreign currency, and can be quoted either directly or indirectly. In a direct quotation, the price of a unit of foreign currency is expressed in terms of the domestic.

In an indirect quotation, the price of a unit of domestic currency is expressed in terms of the foreign currency. An exchange rate that does not have the domestic currency as one of the two currency components is known as a cross currency or cross rate.

Exchange rate is also the ratio at which a unit of the currency of one country can be exchanged for that of another country.

2.2. Empirical Literature

A number of studies have been carried out on the relationship between exchange rate volatility and balance of payment. In spite of the many empirical studies, on the subject, the impact of exchange rate on balance of payment remains ambiguous.

Umoru and Odjegba (2013),analysed 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.

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.

Unaimikogbo and Enoma (2011), evaluate the effect of monetary policy instruments on balance of payments in Nigeria with a simulation equation model 1986-1997 using ordinary least square estimation technique of data analysis, the study found that both polices contribute significantly to balance of payment. They concluded that monetary variable is more effective and dependable than fiscal variable in affecting changes in economic activities.

Omankhanlen, (2011) deals with the effect of Foreign Direct Investment on the Nigerian economy over the period 1980-2009. He examined empirically if the following growth determining variables in the economy-Balance on current account (Balance of payment), Inflation and Exchange rate have any effect on Foreign Direct Investment. The study developed Econometric models to

investigate the relationships between the aforementioned variables and foreign direct investment. Based on the data analysis it was discovered that foreign direct investments have positive and significant impact on current account balance in Balance of payment. While inflation was seen not to have significant impact on foreign direct investment inflows.

Olokoyo, (2012) examined the effects of Foreign Direct Investment (FDI) on the development of Nigerian economy. The paper tried to answer the question: what are the FDI determinants in Nigeria and how do they affect the Nigerian economy? The study employed the use of Ordinary Least Square (OLS) regression technique to test the time series data from 1970 – 2007. The Cochrane-Orcutt iterative method was also used to correct for autocorrelation. The model used hypothesizes that there is a functional relationship between the economy development of Nigeria using the real gross domestic product (RGDP) and Foreign Direct Investment. The regression analysis results evidently do not provide much support for the view of a robust link between FDI and economic growth in Nigeria as suggested by extant previous literatures. Though the result does not imply that FDI is unimportant, the model analysis reduces the confidence in the belief that FDI has exerted an independent growth effect in Nigeria.

Saibu and Keke (2014) examined the impact of Foreign Private Investment on economic growth using annual time series data from Nigerian economy. The paper employed Cointegration and Error Correction Mechanism (ECM) techniques to empirically analyze the relationship between foreign private investment and economic growth and to draw policy inferences on the observed relationship. The study revealed that there was a substantial feedback of 116% and 78% from previous disequilibria between long-run economic growth and foreign private investment respectively. The findings also indicated that a substantial proportion of capital inflow were not productively invested however the relatively small proportion (22%) of net capital inflows invested, contributed significantly to economic growth in the Nigerian economy. The political environment was found to be unfavorable and overwhelmed the positive impact of foreign private investment.

2.3. Theoretical Literature

In examining the theoretical literature in this study, we have to examine the theories of exchange rate determination and it's relation to Balance of payment. The theory of exchange rate determination can be explained using different approach theories. These approaches include:-

Portfolio – Balance Theory Approach

The portfolio balance approach takes into consideration, the diversification of investor's portfolio assets. Diversification is a technique that attempts to reduce risks by investing both among various financial instruments across the borders and money.

Basically, the portfolio model views exchange rate as the result of the substitution between money and financial assets (Gbosi, 2003). The apparent shortcoming of monetary approach happens to be related to its narrow view of exchange rate, as the relative price of two monies. In addressing this shortcoming, the portfolio-balance approach posits that an exchange rate as determined in the short run by the supply and demand; will also in the market have a wide range of financial assets. The model assumes that the individual allocates a fixed point in time among alternative assets. Domestic money is domestically issued as foreign dominated in foreign currency, in a simple one-country model.

The portfolio balance theory approach to exchange rate determination is largely attributed to Branco (1972, 1976), Mc-Kinnon (1969) and Dornbusch (1975). The approach assumes the foreign domestic bonds are imperfect substitutes, especially as savers have preference in how they distribute their portfolio over different countries assets. As investors increases their allocation, of portfolio assets in a given country, their risks rises and they desire a greater risk premium to compensate. This approach also assumes that assets are imperfect substitutes internationally, because investors prefer foreign exchange risk to be attached to foreign-currency-denominated bonds. If the supply of domestic bonds rises, relative to the supply of foreign bonds, there will be an increased risk premium on the

domestic bonds that will cause the domestic currency to depreciate in the spot market. We also need to consider adjustments to international trade in financial assets. Since financial assets are traded almost continuously, exchange rates constantly adjust as changes in demand and supply of financial assets in different nations change.

If perfect capital mobility is assumed, capital will flow freely between nations. This is because there are no significant transaction costs or capital controls that act as a barrier to investment. This will lead to spot and forward exchange rates adjusting instantly to changing financial market conditions .These are relative to bond supplies and demands as well as relative market conditions, so as to determine the exchange rate. This can either have a positive or adverse effect on Balance of payment which has to do with exchange rate depreciating or appreciating.

The Balance of Payment Theory Approach

This is another approach that explains the determination of the supply and demand of a country's currency. As it is known from macroeconomics, the balance of payment is a method of recording all the international monetary transactions of a country during a specific period of time. Kiguel and Ghei (1993) opined that exchange rate affects balance of payments, using the ratio of non-gold reserve to import to study the impact of devaluation on the balance of payment. Their results show that the reserve position of the devaluating country improves as a result of devaluation.

A Balance of payment statement can show a surplus or deficit result but theoretically, the overall payments (i.e. the balance of payment as a whole) should be zero, which rarely happens. A currency price depreciation or appreciation (i.e. the change in the value of money), directly affects the volume of a country's imports and exports and consequently, likely fluctuations. This fluctuation in exchange rates can add to Balance of payment discrepancies. For example, a likely depreciation will increase the value of exports in home currency terms and so the larger the exports demand elasticity, the greater the increase. Conversely, when the import becomes "more expensive" and their value is reduced in home currency, it then means that the larger the import demand elasticity, the greater the decrease.

Consequently, Monolis Anastropoulos in the 1990's argued that unless the value of exports increase, less than the value of import the depreciation will improve the current account. More specifically, the impact of the currency's depreciation on the current account, only by considering the price sensitivity of imports and exports can finally be assessed.

Emphasizing this approach, the Marshall-Lerner condition by Alfred Marshall and Abba .P. Lerner (1995), explains the condition where an exchange rate devaluation or depreciation will only cause a balance of trade improvement if the absolute sum of the long run export and import demand elasticity is equal to or greater than one. A fall in the exchange rate, will improve the current account of Balance of payment.

Hx + Hm > 1

Where Hx: - price elasticity of exports volumes

Hm: - price elasticity of import volume

The Marshall – Lerner condition is met, when the quantity effect is greater on the balance of trade, whether the net effect on the trade balance is positive or negative depends on whether or not the quantity effect out-weighs the cost effect. The J – curve effect is under the Marshall-Lerner condition illustrates that in the short-term, a depreciation of the currency can initially worsen the current account balance before it improves its position. This is due to the low price elasticity of demand for imports and exports in the immediate outcome of an exchange rate change

3. Methodology

Theoretical Framework and Model Specification

For the purpose of this study, the balance of payment theory approach will be used. The balance of payment theory is the modern and most satisfying theory of determination of the exchange rate. It is also called the demand and supply of a country's currency. According to this theory, the rate of exchange in the foreign market is determined by the balance of payments in the sense of demand and supply of foreign exchange in the market. Here balance of payment is used in the sense of market balance, if the demand of a country's currency falls at a given rate of exchange; we can speak of a deficit and its balance of payments. Similarly, if the demand for a country's currency rises at a given rate of exchange, we can speak of surplus in its balance of payments. A deficit balance of payment leads to a fall or depreciation in the external value of the country's currency. A surplus balance of payment leads to a fall or depreciation in the external value of the country's currency.

According to Eusworth (1999), "If market forces are allowed to work unimpeded, the demand and supply of foreign exchange establish a rate of exchange that automatically clears the markets so that no actual or export payments deficit or surplus can appear". In the words of Walter, if the exchange rate is permitted to respond fully to changing supply and demand conditions, the status at the balance of payment of country tends to determine the value of its currency relative to the currencies of other nations. There is a close relationship between the balance of payments and the demand and supply of foreign exchange. Balance of payment is a record of international payment made due to various international transactions such as imports, exports, investments etc. The Balance of payment also include all payments made by foreign to nationals as well as payments include all payments made by foreigners to nationals as well as payments made by nationals to foreigners. The incoming payments are credits while the outgoing payments are debits. The credit in balance of payment of the export items constituted the supply of foreign exchange; the supply of foreign exchange is made by the exporting country. On the other hand, the debit in the balance of payments or the import vein constitutes demand for foreign exchange arises from importing country.

Any deficit or surplus in the balance of payments causes changes in the demand and supply of foreign exchange and this leads to fluctuations in the . When there is deficit in the balance of payment the debit (or the demand for foreign exchange) will exceed the credits (or the demand for foreign exchange). As a result, the rate of exchange will rise (or the domestic value of domestic currency in terms of foreign exchange), exceeding debits (or the demand for foreign exchange), which in turn, will lead to a fall in the rate of exchange (or a rise in the external value of domestic currency).

Emphasizing this approach, the Marshall-Lerner condition by Alfred Marshall and Abba P. Lerner explains the condition where an exchange rate devaluation or depreciation will only cause a balance of trade improvement if the absolute sum of the long run export and import demand elasticity is equal to or greater than 1. A fall, will improve the current account of balance of payment.

This will improve the current account of balance of payment. From this effect, in the short run, appreciation of the currency can initially worsen the current account balance, before it improves its position. This is as a result of the low price elasticity of demand for imports and exports in the immediate outcome of an exchange rate change. This is known as J-Curve effects. A J-Curve refers to the trend of a country's trade balances following the devaluation or depreciation under a certain set of assumptions. It shows where the curve falls at the outset and eventually rises to a point higher than the starting point suggesting the letter "J".

Using the Balance of payment theory approach,

Balance of payment = f [import, export, exchange rate (Devaluation and Depreciation)]

i.e. BOP = f (Imp, Exp, EXR)…… (1)

Given the Marshall-Lerner condition, this states that;

$| Hx | + | Hm| > 1$

Where Hx = price elasticity of exports volumes

Hm = price elasticity of import volumes.

Model Specification

Using the Balance of payment theory approach, from equation 1, which says that

BOP = *f* (Imp, Exp, EXR)

The model will be modified to incorporate all other variables that can affect Balance of payment. These variables include; inflation, interest rate, foreign directs investment and all other errors/variables. This study will use the Error correction mechanism for estimation.

In functional form, the model is given as;

BOP = *f* (VOLEXR, INTR)

Measure of Volatility

Different measures of volatility have been employed in the past empirical studies and these measures can be divided into those that use various versions of the ARCH and GARCH techniques. The unconditional volatility measure, that is, variants of standard deviation is only capable of capturing fluctuations not uncertatainty, Engle (1982) argued that unconditional measures of volatility ignore the information regarding the random process of the generation of exchange rate. Following the criticism of unconditional measures of volatility, it is more sacrosanct to generate estimates of exchange rate volatility based on a measure center on prediction errors. Thus, this study will employ Autoregressive Conditional Heteroscedaticity (ARCH) introduced by Engle (1982) and later modified by Bollerslev (1986) as the Generalized Autoregressive Conditional Heteroscedaticity (GARCH). This conditional measure of volatility is capable of distinguishing between predictable and unpredictable elements in the real exchange rate formation process and they are not prone to overstating volatility (Arize *et al,* 2000; and Darrat and Hakim, 2000). In addition, these measures are based on conditioning the variance by allowing changes in the lagged errors, and also have the capacity to capture both volatility clustering and unconditional return distribution with heavy tail.

ARCH (P) is stated as;

$\delta^2_t = \delta_0 + \Sigma^p_{j=I} \Upsilon_j u^2_{t-j}$

Where δ^2_t is the volatility or conditional variance and u^2_{t-j} is the previous period squared residual derived from previous period information about volatility. From the ARCH (P) equation, it can be model to GARCH (1,1) parameterization and thus, we have;

$h_t = \Upsilon_o + w_1 h_{t-1} + \Upsilon_1 u^2_{t-1}$

From the equation above, where h_t is the conditional variance, u^2_{t-1} contains information about previous volatility measured as the lagged squared residual terms and h_{t-1} is the previous forecast error variance.

Sources of Data

The data employed in this study were obtained from the publications of the Central Bank of Nigeria (CBN), particularly from the statistical bulletins, annual reports and other publications. Data was also sort from the National Bureau of Statistics. Generally, the data to be used for the study are known as secondary data, which are statistical data recorded over the years by the above mentioned authorities amongst others.

4. Presentation and Discussion of Results

Presentation of Results

The data of all the variables used for this research were tested for stationary using the Augmented Dickey-Fuller unit root test and the results are presented below;

Augmented Dickey-Fuller unit root test results

Unit Root Test at Level			
VARIABLE	**ADF Test Statistic**	**95% Critical Value**	**REMARK**
BOP	-3.288068	-2.963972	Non-Stationary
Exchange Rate	-0.271703	-2.963972	Non-Stationary
Interest Rate	-2.913809	-2.963972	Non-Stationary
Unit Root Test at First Difference			
VARIABLE	**ADF Test Statistic**	**95% Critical Value**	**REMARK**
BOP	-6.162009	-2.971853	Stationary
Exchange Rate	-5.160441	-2.967767	Stationary
Interest Rate	-5.716489	-2.971853	Stationary

Source: Eviews9.1 Output

This table presents the results of the Augmented Dickey-Fuller test in levels without taking into consideration the trend of the variables. The reason for this is that an explicit test of the trending pattern of the time series has not been carried out. In the result, the Augmented Dickey-Fuller test statistics is shown in the second column while the 95% critical value is shown in the third column. The result indicates that all the variables at levels have Augmented Dickey-Fuller values that are less than the 95% critical value. The implication of this is that the time series for these variables are non-stationary in their levels.

Moving forward, we take the first differences of the respective variables and perform the unit root test on each of the resultant time series. The result of the unit root test on the first difference of these variables shows that the Augmented Dickey-Fuller values in absolute terms is greater than the 95% critical values. This implies that the variables are actually difference stationary, attaining stationarity after first differences. Indeed the variables are integrated of order one, that is, I (1).

The Augmented Dickey-Fuller Test was done on all the variables used for this research paper and the results can be summarized as follows;

Balance of Payment: At level, the ADF test statistic is lower than the 95% critical value so I fail to reject the null hypothesis. At first difference, the ADF test statistic is higher than the 95% critical value so I reject the null hypothesis and accept the alternative hypothesis which states that there is no unit root in the data. This therefore implies stationarity at first difference, I (1).

Exchange Rate: The ADF test statistic shows that exchange rate is also stationary at first difference.

Interest Rate: The ADF test statistic shows that interest rate is also stationary at first difference.

So by way of summary, all the variables have the same order of integration, which is I (1).

Ordinary Least Square Result

Dependent Variable: BOP Method: Least Squares Date: 08/08/17 Time: 12:27 Sample (adjusted): 1986 2015 Included observations: 30 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	20087.48	10614.28	1.892495	0.0692
VOLEXR	-13462.77	10595.00	-1.270672	0.2147
INTR	-1240.835	510.2951	-2.431603	0.0219
R-squared	0.259143	Mean dependent var		-7517.807
Adjusted R-squared	0.204265	S.D. dependent var		20205.79
S.E. of regression	18024.37	Akaike info criterion		22.53148
Sum squared resid	8.77E+09	Schwarz criterion		22.67160
Log likelihood	-334.9721	Hannan-Quinn criter.		22.57630
F-statistic	4.722148	Durbin-Watson stat		1.326198
Prob(F-statistic)	0.017435			

In order to estimate the Error Correction Mechanism model for this research, the above OLS model was first estimated. This was done in order to obtain residuals and then test for stationarity using the Augmented Dickey-Fuller test for unit root.

Unit Root Test Residual

Null Hypothesis: D(RESID01) has a unit root Exogenous: Constant, Linear Trend Lag Length: 0 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic			-6.371636	0.0001
Test critical values:	1% level		-4.323979	
	5% level		-3.580623	
	10% level		-3.225334	

*MacKinnon (1996) one-sided p-values.

The residuals obtained from the OLS model earlier estimated were tested for stationarity using the Augmented Dickey-Fuller (ADF) test for unit root. From the above result, it can be seen that the ADF test statistic of -6.371636 is greater than the 1%, 5% and 10% critical values so we fail to accept the null hypothesis which says that the error term (U_t) has a unit root. This implies that the residual (or error term) is stationary at level using 1%, 5% and 10% levels of significance.

The stationary status of the residual implies a long-run equilibrium relationship between the balance of payment and exchange rate, foreign direct investment, inflation and interest rate.

Further long-run equilibrium test was done using the Johansen co-integration test;

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None	0.463171	39.56033	42.91525	0.1041
At most 1	0.408078	22.14220	25.87211	0.1359
At most 2	0.233877	7.459548	12.51798	0.2990

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None	0.463171	17.41813	25.82321	0.4231
At most 1	0.408078	14.68265	19.38704	0.2114
At most 2	0.233877	7.459548	12.51798	0.2990

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

From the above results, both the Trace test and Max-Eigen test indicates that there is no co-integrating relationship between the variables at 5% level of significance, this confirms that there is no long-run equilibrium relationship.

Since the variables do not co-integrate in the long-run, the error correction model cannot be estimated.

Test for ARCH Effect

The result of the ARCH test following the procedure of ARCH LM test proposed by Engle (1982), earlier specified in equation (1) is shown in table 1 below;

Table 1: Result of ARCH (2) test

Heteroskedasticity Test: ARCH				
F-statistic	17.82966	Prob. F(2,26)		0.0000
Obs*R-squared	16.77152	Prob. Chi-Square(2)		0.0002
Test Equation: Dependent Variable: RESID^2 Method: Least Squares Date: 08/08/17 Time: 11:56 Sample (adjusted): 1987 2015 Included observations: 29 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	91.15296	754.2569	0.120851	0.9047
RESID^2(-1)	1.155935	0.348652	3.315435	0.0027
RESID^2(-2)	-0.112814	0.347251	-0.324876	0.7479
R-squared	0.578328	Mean dependent var		3973.711
Adjusted R-squared	0.545892	S.D. dependent var		2537.149
S.E. of regression	1709.722	Akaike info criterion		17.82375
Sum squared resid	76001923	Schwarz criterion		17.96519
Log likelihood	-255.4443	Hannan-Quinn criter.		17.86805
F-statistic	17.82966	Durbin-Watson stat		1.387624
Prob(F-statistic)	0.000013			

The F-statistic shows that the model is overall significant. The adjusted R squared suggests that 55% of changes in the dependent variable is caused by the chosen independent variables.

The ARCH model, as indicated by the lag value(s) of the squared residual, was found to be significant with 2 lags. Even though the constant term and the lag 2 parameters are shown not to be statistically significant, the lag 1 is found to be statically significant. This is shown to be significant at 1%. Thus it can be concluded that the study finds significant evidence of the existence of the ARCH effect in the residual of the model.

The test for higher order lags is ignored in this paper because the lag two tests is sufficient for the estimation of volatility models considered in the paper.

Table 2: ARCH (2) model

Dependent Variable: EXR Method: ML ARCH - Normal distribution (BFGS / Marquardt steps) Date: 08/08/17 Time: 11:58 Sample: 1985 2015 Included observations: 31 Convergence achieved after 26 iterations Coefficient covariance computed using outer product of gradients Presample variance: backcast (parameter = 0.7) GARCH = C(2) + C(3)*RESID(-1)^2				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
C	131.1761	2.034153	64.48684	0.0000
	Variance Equation			
C	6.526861	17.71784	0.368378	0.7126
RESID(-1)^2	1.197415	0.597526	2.003954	0.0451
R-squared	-0.614350	Mean dependent var		80.84180
Adjusted R-squared	-0.614350	S.D. dependent var		65.27942
S.E. of regression	82.94211	Akaike info criterion		10.40823
Sum squared resid	206381.8	Schwarz criterion		10.54700

Log likelihood	-158.3275	Hannan-Quinn criter.	10.45346
Durbin-Watson stat	0.038132		

For the mean equation, the probability is significant and for the variance equation The Akaike criterion is 10.40823 and the Schwarz criterion is 10.54700.

The mean equation as observed in table 2 is shown to be statistically significant at 1%. This statistical significance is observed in the variance equation. The ARCH effect is shown to be statistically significant at 5%. From the above results, we can proceed to model the volatility of exchange rate using the GARCH methodology.

Table 3: GARCH (1, 1) model

Dependent Variable: EXR Method: ML ARCH - Normal distribution (BFGS / Marquardt steps) Date: 08/08/17 Time: 11:59 Sample: 1985 2015 Included observations: 31 Convergence achieved after 34 iterations Coefficient covariance computed using outer product of gradients Presample variance: backcast (parameter = 0.7) GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
C	131.7219	2.349682	56.05947	0.0000
	Variance Equation			
C	7.829453	29.61332	0.264390	0.7915
RESID(-1)^2	1.338712	0.786585	1.701930	0.0888
GARCH(-1)	-0.094284	0.253181	-0.372397	0.7096
R-squared	-0.627746	Mean dependent var		80.84180
Adjusted R-squared	-0.627746	S.D. dependent var		65.27942
S.E. of regression	83.28554	Akaike info criterion		10.43807
Sum squared resid	208094.4	Schwarz criterion		10.62310
Log likelihood	-157.7901	Hannan-Quinn criter.		10.49839
Durbin-Watson stat	0.037818			

For the mean equation, the probability is significant and for the variance equation The Akaike criterion is 10.43807 and the Schwarz criterion is 10.62310.

The result for the GARCH (1,1) is presented in table 3. While the intercept of the mean equation is found to be statistically significant, that of the variance equation is found otherwise. Similarly, while the coefficient of the ARCH effect is found to be statistically significant at 10%, the GARCH effect is found to be statistically insignificant.

These findings indicate that the information about exchange rate volatility in the previous periods do not significantly determine the current volatility in the variable. This suggests that the ARCH effect dominates. However, since the sum of the two effects is, a value which is close to but overall, still above unity, a shock at time will persist for many periods in the future which generally suggest a long memory.

Table 4: Arch Test for the Efficient Model

Heteroskedasticity Test: ARCH				
F-statistic	0.969227	Prob. F(2,26)		0.3927
Obs*R-squared	2.012107	Prob. Chi-Square(2)		0.3657
Test Equation: Dependent Variable: WGT_RESID^2 Method: Least Squares Date: 08/08/17 Time: 13:06 Sample (adjusted): 1987 2015 Included observations: 29 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.637598	0.338577	1.883171	0.0709
WGT_RESID^2(-1)	0.353132	0.292123	1.208843	0.2376
WGT_RESID^2(-2)	0.067278	0.292236	0.230219	0.8197
R-squared	0.069383	Mean dependent var		1.012238
Adjusted R-squared	-0.002203	S.D. dependent var		0.871146
S.E. of regression	0.872105	Akaike info criterion		2.661883
Sum squared resid	19.77473	Schwarz criterion		2.803327
Log likelihood	-35.59730	Hannan-Quinn criter.		2.706181
F-statistic	0.969227	Durbin-Watson stat		1.457850
Prob(F-statistic)	0.392666			

The probability is more than 5% so there is no Arch effect.

5. Summary and Recommendations

Summary of Findings

The results of the regression model revealed the relationships between the independent and the dependent variables revealed that exchange rate volatility was found to have a negative impact on Nigeria's balance of payment and this relationship between exchange rate and balance of payment is statistically significant.

The Johansen co-integration test which was conducted to show long run equilibrium or long run relationships revealed that there is no long run equilibrium relationship between balance of payment and exchange rate.

Policy Recommendations

Based on the findings of the study, the study hereby recommends as follows:

1. The government should encourage export promotion strategies in order to maintain a surplus balance of trade which will help make the domestic currency strong and also prevent further depreciation of the Nigeria naira.
2. Exchange rate liberalization is also critical in facilitating trade in any economy, we therefore advise the policy makers to ensure that exchange rate should be determined by the forces of demand and supply and multiple exchange rates and
3. There is need for a sound monetary policy which will complement the existing exchange rate policy which will help counter the negative consequences of inflation rate, since inflation rate has a negative relationship with balance of payment.

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