DOI: https://dx.doi.org/10.4314/gjss.v23i1.3

GLOBAL JOURNAL OF SOCIAL SCIENCES VOL 23, 2024: 25-42
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EXCHANGE RATE AND NATIONAL OUTPUT PERFORMANCES: THE IMPLICATION ON NIGERIA'S ECONOMY

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(Received 18 September 2023, Revision Accepted 30 January 2024)

ABSTRACT

The study investigated the effect of exchange rate on economic growth in Nigeria using annual time series data from 1970 to 2021. The data were obtained from Statistical Bulletin published by the Central Bank of Nigeria 2021. The empirical studies reviewed had divergent views on the impact of exchange rate on economic growth in Nigeria. The study began with the test of unit root using Augmented Dickey-Fuller (ADF) and Philip-Peron (PP) unit root tests, followed by Johansen cointegration test, vector error correction model (VECM). The VECM indicated that exchange rate appreciation contracts output. The granger causality tests revealed that exchange rate and economic growth reinforce one another. However, based on these findings, it becomes imperative to build adequate foreign reserve to cushion-off trade shocks, promote import substitute industries, diversification of economy and enhance export oriented industries and reduction in cost of borrowing to enable domestic firms to benefit from the theoretical advantages of exchange rate variation. These measures promote the performances of macroeconomic variables in Nigeria.

KEYWORDS: exchange rate, economic growth, VECM, Nigeria

1.0 INTRODUCTION

With the collapse of Breton Wood system of exchange rate in 1973, emphasis of the monetary authorities shifted from fixed exchange regime to market driven exchange system. The policy of free float advocated by market system led credence to exchange rate variation, with its attendant effects on economic growth (Ajibola, Udoette, Omotosho & Muhammad, 2015).

Exchange rate is the number of basket of a country's currency trade in another currency. The strength of the country's currency is determined by how much it is exchanged. Therefore, it becomes pertinent to any economy desirous in achieving sustainable economic growth and development (Ahmed & Zarma, 1997).

Exchange rate appreciation or depreciation mainly occur due to changes in demand and supply of currencies between countries, level of economic

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growth, prevailing trade balances, magnitude of country's foreign reserve, inflation levels, public debt profile, unemployment. Appreciation of exchange rate undermines the behaviour of these macroeconomic variables. The appreciation of exchange rate over time makes country's products in the international market less competitive, leading to large scale importation, export decimal, decrease in the foreign reserves and economic growth, fall in investment and rise in unemployment. However, exchange rate depreciation invariably leads to improvement on macroeconomic variables. If exchange rate depreciates, it increases competitiveness of country's product in the international market, leading to increased exportation and economic growth, reduced importation and increased foreign reserves, increase in foreign capital inflow and rise in inflation. The increase in exports due to depreciation will boost domestic investment and production which will invariably lead to rise in employment creation.

The influence of exchange rate on economic growth has generated divergent views between the traditional and structural schools especially in emerging economies (Dada & Oyeranti, 2012). The traditional school asserted that it renders external risks benign through adequate systematic hedge that leaves trade flows unaffected. Furthermore, Tornell & Velasco (2000) opine that exchange rate depreciation actually induce fiscal discipline by allowing the effects of unsound fiscal policies to immediately manifest via movements in exchange rate and price level. While Yaqub (2010) inferred that exchange rate is the prerequisite endogenous variable for effective stimulation of macroeconomic variables.

The success of exchange rate is hinged on its ability to switch expenditure from foreign goods to domestically produced goods. This assertion is largely based on the notion that exchange rate depreciation increases global competitiveness of domestic industries as prices of domestic goods decline in relation to the prices of foreign counterpart. This will switch expenditure from foreign made goods with relatively high price to locally made ones. Moreover, depreciation enhances exports, restores current account deficits, accelerating foreign direct investment (FDI) inflow and hence used as a policy tool in international trade. Also, depreciation of domestic currency holds an attraction for foreign investors as generally foreign investors are often willing to buy the assets of countries whose currency is relatively weak (Bahamani-Oskooee& Kara, 2003). Depreciation stimulates the production of tradable items (Ahmed, Xianming, Rehman & Ahmed, 2015).

However, structural school believed that exchange rate variation may allow too much flexibility and discretion to policy makers and may be unable to provide relatively sufficient nominal anchor (Calvo, 2001). This may increase trade uncertainty and may in fact reduce trade volumes as it exposes the economy to greater risks on account of fluctuations (Alagidede& Ibrahim, 2016). The structurists are of the view that depreciation has transmission effects on inflation (Choudhri &Hakura, 2006). Depreciation of exchange rate may directly or indirectly affect prices of imported good (Volkan, Saatcioglu& Korap,2007). On the one side, depreciation of domestic currency against the foreign currencies directly results in higher prices of imported goods. On the other hand, rise in the cost of production due to increase in price of imported inputs translate to increase in price of domestic goods. Whereas, increased foreign demand for net exports may also increase the domestic prices, causing higher inflation.

In an effort to stabilize and find appropriate exchange rate for Naira, exchange rate was completely deregulated in 1995 through the introduction of Autonomous Foreign Exchange Market, reintroduction of Interbank Foreign Exchange Market in 1999, Retail and Wholesale Dutch Auction System in 2002 and 2006 respectively. The Retail Dutch Auction System and Interbank Foreign Exchange Market were later reintroduced in 2013 and 2015 to allow for full floating of exchange rate which was presumed to ensure stability of exchange rate and promote trade balances. These policies resulted in continuous deterioration of naira as it depreciated from ₦3.1828 in 1986 to ₦8.7071 in 1990, ₦106.7111 in 2000, ₦150.4799 in 2010, ₦196.9 in 2015 and ₦365 in 2021 against American dollar (CBN, 2021). Meanwhile, this problem persists today as the country is yet to identify the appropriate mechanism to diversify the productive capacity of the country and enhance the performances of trade balance.

Though, economic growth has witnessed impressive improvement over the years as the economy grew at the average of 6 to 7 percent per annum between the period of 2000 and 2014 but

sharply contracted to 2.1 percent in 2015 to -0.36 percent in first quarter of 2016 but declined further to -1.79. Thus it appears as if the growth rate has not trickled down to the real sectors of the economy. The productive capacity still remain low reflecting low level of standard of living, poor capital income, high unemployment and inflation rate and fluctuation of trade balance, and low manufacturing output. These issues have provoked unending questions on whether exchange rate has been responsible for the abysmal performances of macroeconomic variables over the years in Nigeria.

2.0 LITERATURE REVIEW

2.1 Theoretical Review

The elasticity of demand is the degree or rate at which import and export demand of a country responds to depreciation or appreciation of her currency against foreign currencies. The success of depreciation in promoting trade depends on the price elasticity of export and import. In the short run, depreciation is perceived to have negative impact on balance of trade but promotes it in the long run. As the currency depreciates, the demand for export and import will change with increase in elasticity of exports and imports. However, depreciation of exchange rate will bring about more than proportionate effect on trade balance if demand for imports and exports are elastic (Daniels & VanHoose, 2005). The elasticity approach also known as Marshall-Lerner condition is the extension of Bickerdike-Robinson-Metzler (BRM) condition. The condition shows that currency depreciation promotes trade. However, if country's currency is devalued or depreciated, the import price tends to rise in the home country while export price falls. This will increase exports demands while lowering import demand thus improving balance of trade of the country. The theory concluded that currency depreciation will only enhance trade balance provided the sum of import and export elasticity is greater than one. However, the effect of exchange rate depreciation on domestic prices and on imports and exports times time before people will adjust to new normal. Therefore, the Marshall-Lerner condition is not satisfy in the short run indicating that exchange rate depreciation worsen growth in the short run but improves in the long run. This gives rise to what is referred to J-curve. The J-curve illustrates how a devaluation of a country's exchange rate affects its trade balance overtime. Niehans (1984) viewed this as the dynamic of Marshall-Lerner Condition or, more generally, the elasticities approach. In the short-run, soon after currency devaluation, domestic importers are confronted with overblown import prices as reflected in local currency; hence; the net exports decline. On the other hand, the domestic exporters in the depreciating nation experience lower export prices since the demand for exports and imports in the short-run is reasonably inelastic. The inelasticity of demand is as a result of slow pace of changes in consumers' behaviour as well as the interval between renegotiating deals. Put differently, in the short-run when prices are relatively constant the balance of trade faces a decline as a result of the tendency of prices to remain the same as well as the slow pace of change in demand. Price stickiness occurs when goods and services remain in the same prices despite depreciation (Mackintosh, Brown Costello, Dawson, Tompson & Trigg, 1996). The trade balance worsens if the imported goods maintain the same price levels before depreciation especially where contracts were made at fixed prices and volumes prior to depreciation. This short-run time effect is commonly known as "exchange rate pass through period."

Afterwards, domestic demand begins to change from imported goods to domestic production of substitution goods as a response to the higher prices of foreign goods, resulting in trade balance improvement. Furthermore, the markets in home country enjoy increased exports as a result of lower export prices. The period between these two long-run phenomena is referred to as the "volume adjustment period" and they have a favourable effect on trade balances (Gartner, 1993). Nevertheless, the J-Curve phenomenon predicts that trade balances can be advanced on the long-run when compared to its state prior to depreciation. The dynamic response of trade balances in both the short-run and long-run recovery occurs in the form of flattened J letter, thus, the J-Curve phenomenon.

The approach of elasticity is mainly criticized for being a partial equilibrium approach which is responsible for the macroeconomic impacts owing to price changes as well as production fluctuations in reaction to currency depreciation (Kim, 2009). In fact, it only accounts for how value and volume effects respond to price dynamics. Conversely, absorption approach relates depreciation to macroeconomic variables which mostly lead to

unfavourable effect of exchange rate depreciation on balance of trade of a country. The absorption approach combines the elasticities approach with the Keynesian macroeconomics. It is based on Keynesian national income relationship and measures the income effect of depreciation against price effect of elasticity approach. This approach identified two major points; firstly, in a similar way to that of the elasticity approach, the current account is introduced to the trade balance and the countries are regarded as "large" countries. Secondly, contrary to elasticity approach, income and money are introduced, although the latter is scarcely discussed. With regards to trade balance, it is important to clarify some points. The absorption approach which is similar to the Keynesian income-expenditure assumption assumes that export volumes are independent (autonomous) of national income, and that imports have direct positive impact on national income.

The absorption approach to balance of trade started in early 1950s by Meade (1951), Alexander (1952), and Johnson (1967) which was made famous by Miles (1979). They were of the view that the depreciation of a nation's currency could lead to the deterioration of terms of trade, switching expenditure away from imported goods to locally produced goods, which enhances trade balances of that nation – expenditure switching effect. The theory posited that deficit balance of trade is an indication that the economy absorbs more goods than what is produced within the country. In this case, national income of the country will be less than her domestic investment and consumption expenditure. However, a country enjoys favourable balance of trade if the economy absorbs less than can be produced. This indicates that national income will be greater than investment and consumption expenditure. Nonetheless, absorption approach regarded balance of trade as the difference between country's national income and her domestic expenditure (Jhingan, 2007). The approach summarized the hypothesis that depreciation will ordinarily exerts positive influence on the balance of trade provided that the propensity to absorb is less than the rate at which depreciation could bring about improvement in the output of country's goods and services. Consequently, the theory suggests that deliberate policy to reduce absorption capacity should be followed when there is depreciation of currency. The fundamental principle of this approach is that strong price elasticity may not sufficiently generate a balance of payment effect resulting from depreciation, if depreciation fails to reduce domestic expenditure.

2.2 Empirical review

Many scholars have made series of efforts to analyze the influence of exchange rate on output across the world. However, their findings seem to reveal lack of consensus among the scholars as their studies yielded mixed results. Some of the researchers were of the view that exchange rate depreciation leads to growth while others were of view that it discourages growth. For instance, Naseer (2013) empirically analyzed the nexus between trade, FDI, exchange rate and economic growth of Pakistan from 1980 – 2012 using Johansen cointegration approach. It further identified that trade, FDI, and exchange rate led to output growth of Pakistan. Pakistan, Muhammad, Anwer, Salman and Muhammad (2014) used a pooled data from 1952 to 2010 to examine the relevance of exchange rate instability on imports, exports, trade balances, foreign exchange reserves and GDP using granger causality test. They found that depreciation of exchange rate led to export growth, but sudden fluctuation in exchange rates can distort economic growth. However, using granger method for the period of 1980 to 2009, Khan, Sattar and Rehman (2012) discovered that exchange rate leads to economic growth of Pakistan.

In a similar study of South Africa, Sibanda, Ncwadi and Mlambo (2013) using cointegration approach and vector error correction mechanism (VECM) on time series from 1994 to 2010 found that rising exchange rate only has short term impact on economic growth. Using a different approach such as Ordinary Least Square techniques in their study of Ghana from 1980 to 2012, Attah-Obeng, Enu, Osei-Gyimah and Opoku (2013) confirmed that output respond positively to depreciation of currency in the short run while Mewadi (2013) discovered that exchange rate is negatively related to economic growth between 1994 and 2010 in South Africa.In Kenya, Musyoki (2010) who employed Generalized Method of Moment (GMM) on annual data from 1993 and 2009 revealed that output performances inversely related to exchange rate changes. However, Kennedy (2010) using OLS approach on annual series from 1970 to 2009 showed that both variables are positively related in Kenya. This

finding is contradicted by Brown (2012) who used Vector Auto-regression (VAR) technique between 1993 and 2009 and asserted that exchange rate changes inversely relate to output in Kenya. However, Alhayky (2011) in his study of Togo from 1980 to 2004 using Fully Modified Ordinary Least Square (FMOLS) technique corroborated with Musyoki (2010) who earlier revealed that fluctuation of exchange rate negatively affect output.

In Nigeria there are plethora of empirical studies on the implications of exchange rate variation and economic growth. Some of the studies yielded divergent result on the possible effect of exchange rate variation on the economy. The divergent views of several studies may be attributed to the different approaches employed in the respective studies. For instance, following the Ordinary Least Square (OLS) techniques, it was discovered that exchange rate variation is crucial to improvement in national output of Nigeria (Opaluwa, Umeh & Abu, 2010; Adeniran, 2012; Asher, 2012; Enekwe, Ordu, & Nwoha, 2013 and Jongbo, 2014). In a related study in Nigeria, using the same approach, Onuoha (2014) and Nwogo andOwo (2017) found that exchange rate is significant and inversely related to GDP growth but positively relate to inflation while Momodu (2015) discovered that exchange rate do not impact on economic growth within these exchange rate regimes. Using Vector Error Correction approach, Imoisi, Uzomba and Olatunji (2010) reported that for the period of 1975 to 2008 exchange rate depreciation decreases economic growth of Nigeria. In the later studies which covered the period of 1986 and 2012, Ismaila (2016) established that exchange rate failed to impact output indicating that exchange rate variation failed to reflect on Nigerian economic growth during SAP era While, Akinlo and Lawal (2015) concluded that depreciation of exchange rate does not have the tendency to influence short run industrial output but can accelerate output in the long run.

In their study of effect of exchange rate management on the output of Nigeria, Fapetu and Oloyede (2014) employed error correction model to analyze the time series data within the period of 1970 and 2012. The ECM indicated that exchange rate and inflation rate are statistically insignificant while export and FDI have significant impact on growth of Nigeria. Danmola (2013) applied correlation matrix, OLS and granger causality techniques to explore the effect of volatility of exchange rate on selected macroeconomic indicators. The study established that volatility of exchange rate directly influence economic growth, FDI and trade openness but inversely related to inflation. In a similar study on Nigeria using the same approach, Rasaq (2012) discovered that volatility of exchange rate is positively related to economic growth. Analyzing the impact of exchange rate volatility on the output growth in Nigeria using VECM approach, Okwuchukwu (2015) employed annual data from 1971 to 2012. The result posited that exchange rate influenced both import and export in the short and long run. It further revealed that causality run from export to exchange rate volatility and from exchange rate to import. Similarly, examining the influence of exchange rate volatility in Nigerian manufacturing sector from 1986 to 2010, King-George (2013) adopted Ordinary Least Square techniques. It discovered that exchange rate does not impact on output growth in Nigeria. Also exchange rate fluctuation does not exhibit significant effect on the manufacturing sector output.

Amassoma and Odeniyi (2016) analyzed the relationship between exchange rate and Nigerian output employing cointegration approach on data between 1970 and 2013. The study discovered that exchange rate fluctuation positively relate to output though insignificant in Nigeria. In a similar study in Nigeria, Jerumeh, Akinribido, Popoola, Oke, Ogunnubi and Okoruwa (2016) employed cointegration approach despite the fact that the series were of different order to investigate exchange rate fluctuation on output growth between 1970 and 2012. They indicated that the variables are cointegrated. Also, the study revealed that exchange rate exhibited negative relationship with output both in the short and long run. However, the findings of some of the reviewed empirical literature were cross country studies and as such may not be applicable to Nigeria since some of those countries may not have the same economic characteristics with Nigeria, thus, the need to carry out a country specific study of Nigeria.

Some other studies employed Ordinary Least Square (OLS) techniques without considering the issues of unit root and interdependence among the economic data (see Opaluwu, Umeh & Abu, 2010; Jongbo, 2014 and Momodu, 2015). Such studies may have committed spurious regression (Adeleke, 2013 and Uwazie, Igwemma & Nnabu, 2015). Some of the other studies used a simple

two-variable or three-variable model to analyze the relationship between exchange rate variation and some of the macroeconomic variables in Nigeria. Such studies may have committed specification error as the study would have excluded some of the important variables. Another problem is that some of these studies conducted without determining the stationarity of the employed variables. Therefore, any attempt to regress non-stationary variables may lead to spurious regression (Granger & Newbold, 1974). However, this study considered some of the identified issues in the previous studies by first subjecting all the variables to unit root test using Augmented Dickey-Fuller and Phillips-Peron tests. It also applied cointegration approach to accommodate the interdependence that might exist among the variables.

3.0 METHODOLOGY

3.1 Model Specification

To estimate the effect of exchange rate variation on the national output growth in Nigeria, the study is based on structural macroeconomic model formulated by Khan and Knight (1981) which is specified as:

$\Delta logy_t = \gamma_1[logm_{t-1} - logm_t^d] + \gamma_2[logy_t^* - logy_{t-1}] + \lambda$ 1

where, $\Delta logy$ represent real income growth, y^* represent nominal output, m_t is stock of real money balances, that is, the nominal stock of money, M, deflated by the domestic price level while λ is constant. This model was later extended by Edwards (1985) and Ismaila (2016). Dada and Oyeranti (2012) added open economy indicators such as exchange rate and import to the original Khan-Knight model and specified it as:

$lnYr_t = \beta_0 + \beta_1 lnMs_t + \beta_2 lnexr_t + \beta_3 lnexr_{t-1} + \beta_4 lninf_t + \beta_5 lnyr_{t-1} + \varepsilon_t$ 2

where, Yr is output, Ms is money supply, exr is exchange rate, inf is inflation and yr_{t-1} lagged output. Similarly, Fapetu and Oloyede (2014) incorporated export, import and foreign direct investment into the model as.

$LnYr_t = \beta_0 + \beta_1 LnEXCR_t + \beta_2 LnEXPT_t + \beta_3 LnINF_t + \beta_4 LIMP_t + \beta_5 LFDI_t + \mu_t$ 3

where, Y is output, EXCR is exchange rate EXPT is export, INF is inflation, IMP is import and FDI is foreign direct investment.

Also, Chaudhry and Abdul (2014) modified Edwards (1985) by replacing unexpected money growth with broad money supply and added additional variables such as government consumption expenditure; terms of trade and net foreign aid. However, this study modified Khan-Knight (1981), Dada and Oyeranti (2012), Fapetu and Oloyede (2014) and Chaudhry and Abdul (2014) and integrated foreign reserve (FVN) in order to effectively investigate the impact of exchange rate variation on economic growth in Nigeria. The model one is specified in its functional form as:

GDP = f (EXR, GE, FDI, FVN, MS) 4

The equation 4 is further specified in a log linear form as:

$logGDP_t = \alpha_0 + \alpha_1 logEXR_t + \alpha_2 logTGE_t + \alpha_3 logFDI_t + \alpha_4 logFVN_t + \alpha_5 logMS_t + e_t$ 5

a priori expectation $\alpha_1 > 0$, while α_2, α_3, α_4, and $\alpha_5 > 0$

where, GDP is gross domestic product. It is the nominal gross domestic product of Nigeria at current basic prices (naira) expressed in log form.GDP is assumed to be indirectly related to economic growth. EXR is exchange rate. It is the nominal exchange rate of Naira to United States of American dollar. The exchange rate is expressed in logarithm form. The essence of expressing exchange rate in logarithm form is to avoid the problems of outliers in a regression equation. Exchange rate is expected to exhibits negative sign with economic growth. TGE is total government expenditure expressed in logarithm form. It is expected to show positive relationship with GDP. FVN is foreign reserve. Foreign reserve is the asset of Nigeria reserved in form of United State of America dollars by monetary authorities. It is calculated as foreign reserve in United States of America dollar multiplied by exchange rate (FVN*EXR). It is further expressed in logarithm form. Foreign reserve is expected to show positive relationship with gross domestic product (GDP). FDI is inflow of foreign direct investment. It is the Greenfield foreign capital inflows into Nigeria. It is expressed in logarithm form. It is expected to show positive relationship with trade balance. The inflow of FDI is expected to improve economic growth.TGE is total government expenditure. TGE is the total government expenditure which is calculated as total recurrent expenditure plus total capital expenditure. It is expected to show positive relationship with economic growth (GDP). MS is broad money supply. It is denoted by broad money supply (M_2) which is expressed as addition of currencies circulating outside banks, those in savings, current account and time deposit.

It is expressed in a logarithm form. It is expected to have direct relationship with economic growth.log represent logarithm, $\alpha_0, \ldots, \alpha_5$ are coefficient, e_t is the error term and t denotes time. The data were obtained from Central Bank of Nigeria Statistical Bulletin 2009 and 2015.

3.2 Estimation Procedures

Econometric modeling is undertaken to establish the influence of exchange rate on economic growth in Nigeria. To achieve the intention of this study, necessary measures are taken into account to determine the time series properties, nature and size of the variables used for the analysis. Ignoring the non-stationarity of the economic variables may lead to spurious analysis and may negate the tenets of standard econometric techniques. Also, using Ordinary Least Square (OLS) techniques may not be applicable since it does not consider the possible endogeneity of regressors. The tenets of OLS hold when the series are stationary,

$$\Delta Y_t = \alpha_0 + Y_{t-1} + \sum_{i=1}^{n} \alpha_1 \Delta Y_{t-1} + \delta_t + \epsilon_t \qquad 6$$

where, Y represent each variable, Y_{t-1} represent each lagged variable, Δ is the difference operator, δ_t is trend term, n is lag length and ε_t represent pure white noise error term with zero value of mean and constant variance, α_0 is a constant and n is the optimum number of lags in the dependent variable. If each variable has unit root at level and integrated then it becomes important indication of co-integration within the model.

The major challenge in the application of this approach is due to the inability of the test to determine false hypothesis. This most time lead to rejection of null hypothesis that suppose to be accepted. However, the use of Monte Carlo Simulation has proved the power of ADF to be weak. To overcome these identified challenges of relying solely on ADF, the study therefore specified Phillip-Peron test as follows:

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \varepsilon_t \qquad 7$$

where Y is the series, Y_{t-1} is the lag of each series, Δ represent difference indicator, ε_t is the pure noise error term and β_0 is a constant. The maximum lag length is empirically determined using Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC). The ADF and PP equations are specified to determine whether the variable Y_t represent each variable at time t. The null hypothesis of the ADF and PP tests is that Y_t is non-stationary, that is, has a unit root (H_0: $\beta = 0$) and is rejected if β is significantly negative (H_a: $\beta < 0$).

The null hypothesis of no unit root is rejected if the computed ADF/PP statistic is higher or much more in negative than their respective critical values. In this case, the time series is said to be stationary. However, the null hypothesis is accepted if the computed ADF/PP statistic is lower or much less in negative than the McKinnon critical value. In this case, the variable is concluded to have unit root. The application of both ADF and PP approach is to ensure the determination of robust order of integration of each variable. Meanwhile, despite the fact that both tests do not have the same normal distribution even where the sample is asymptotic, they still produce similar results (Adeniyi, 2010).

3.2.1 Unit Root Test

The estimation began with unit root test to determine if the each series is stationary. The study applied the Augmented Dickey – Fuller (ADF) of 1979 and Phillips – Peron (PP) derived from Phillips and Peron (1988). The choice of these tests is due to the fact that ADF considers the possibility of autocorrelation that may arise as a result of differencing each variable while Phillip-Peron test is appropriate when the sample size is small, variables serially correlated, and heteroscedastic (Gujarati & Porter, 2009). Meanwhile, due to possibility of structural changes that might have occurred within the period under study, Obioma and Ozughalu (2010) posited that the use of ADF only might be biased in discovering variables that are integrated. Therefore, it is imperative to employ Phillip-Peron (PP) to accommodate the inadequacies of ADF test.

Therefore, to test the stationary of each time series, the ADF test is generally specified as

3.2.2 Cointegration Test

The Ordinary Least Square is the commonly used approach in the test of cointegration. The analysis is said to be cointegration if the linear combination of the residuals is stationary at level or integrated I(0). Therefore, the estimation procedures are analyzed as follows:

to order zero [I(0)]. The use of OLS test of cointegration is judged to be simple but it could be biased if the sample size is small and there is a dynamic effect in the model. Also, if the regressors are more than one, it is difficult to apply OLS since the cointegrating vectors will be more than one which makes it difficult to analyze the result. Finally, the application of OLS approach negates the endogeneity that may exist among the variables which may result to simultaneity errors.

However, these identified inadequacies of OLS approach made the application of Johansen approach imperative. This approach is an improvement over the OLS approach (Johansen, 1991). Unlike OLS approach, Johansen techniques does not assume that there must be more than one cointegrating vectors rather it examine the presence of cointegrating equations. Also, it takes care of the endogeneity issues in each model. Finally, it gives insight to the number of cointegrating equation.

Johansen and Juselius (1990) noted that this maximum likelihood approach is effective in identifying the numbers of cointegrating equations among the variables that are integrated of order one [I (1)]. Specifically, this approach which consists of trace and maximum eigenvalue is applied to determine the number of cointegrating vectors. The techniques test the null hypothesis that each of the cointegrating equation is smaller or equal to 'r' cointegrating relationship. To determine the number of cointegrating equation, the model is specifies by Johansen (1988) and Johansen and Juselius (1990) as:

$$\lambda_{\text{trace}} = \mathrm{T} \sum_{\mathrm{j=r+1}}^{\mathrm{p}} (1 - \lambda_{\mathrm{j}}) \qquad 8$$

where T represents the available observations, r is cointegrating vector, λ_j is calculated eigenvalue obtained from the matrix, p is lag length. The equation 29 tests the null hypothesis (r) against its alternative hypothesis (r+1). The null hypothesis is rejected if the p-value is less than 0.05 ($r \leq 0.05$) and accepted if otherwise. Also, the maximum eginvalue test is specified as:

$$\lambda_{\max} = \mathrm{r}, \mathrm{r}+1 = -\mathrm{T}(1 - \lambda_{\mathrm{r+1}}) \qquad 9$$

The Johansen andJuselius (1990) argued that likelihood test does not care about the standard distribution of the variables but only provide the required critical value as determined by Monte Carlo techniques.The rejection of null hypothesis is an indication of long relationship among the variables. Therefore, the linear combination cancels out the stochastic trends in the series. In this case the model is cointegrated. However, the acceptance of the null hypothesis depicts absence of long run relationship. If the variables have no cintegration, they can arbitrarily depart from one another (Dickey & Fuller, 1981).Meanwhile, the test of cointegration is necessary especially when dealing with non-stationary variables.

Therefore, conducting analysis without checking of possible cointegration may lead to specification bias and this will have negative consequences on the results (Engle & Granger, 1987). To avoid issue of spurious regression it becomes imperative to conduct cointegration as a pretest to ensure robustness of regression results (Granger 1986).

3.3.3 Error Correction Model

The equation 11 does not explain the interdependence between dependent and explanatory variables. To effectively analyze the objectives of this study, it became imperative to employ vector error correction model (VECM) to take care of the interdependence that may have exist between the dependent and independent variables (Uwazie, Igwemma &Nnabu, 2015). The error correct model technique is used to examine the short run dynamics between exchange rate and economic growth in Nigeria. The error correction model (ECM) is applicable when the series are cointegrated. If the variables are not cointegrated, it is advisable to employ vector autoregressive (VAR) techniques but if cointegrated the use of Unrestricted Error Correction Model (UECM) will become more appropriate to analyze the long run effect of explanatory variables on the dependent. If cointegrated.

When cointegrated, VECM will provide the opportunity to analyze both the short and long run behaviour of the variables in the model. However, the lag variables measure the short run effect while error correction term (ECT) represent short run adjustment to the long run equilibrium. Theoretically, the coefficient of ECT is expected to be negative and significant in order to adjust to long run equilibrium. The general of VECM is specified as

$$\Delta \text{loggdp}_t = \alpha_0 + \sum_{i=1}^{m} \beta_i \Delta \text{loggdp}_{t-i} + \sum_{i=1}^{m} \delta_i \Delta \text{logexr}_{t-i} + \sum_{i=1}^{m} \gamma_i \Delta \text{logge}_{t-i} + \sum_{i=1}^{m} \vartheta_i \Delta \text{logfdi}_{t-i} + \sum_{i=1}^{m} \lambda_i \Delta \log \text{fr}_{t-i} + \sum_{i=1}^{m} \pi_i \Delta \log \text{ms}_{t-i} + \theta_1 \text{ect}_{t-1} + \epsilon_t \ldots\ldots\ldots 10$$

where Δ is the first order time difference and ect_{t-1} is error correction term (ECT), e_t is while noise error and m is the lag length. The coefficient of ect_{t-1} shows the speed at which the short run disequilibrium adjusts to long run equilibrium. The VECM is sensitive to the number of lags used for the analysis. Therefore, inclusion of few lags may result in specification error while inclusion of many lags may degenerate to multicolinearity as addition of one more parameters inform of lags consumes the degree of freedom (Brooks, 2008). Nevertheless, to avoid these problems, it important that the required lag length is empirically ascertained using Akaike information criterion (AIC) and Schwarz information criterion (SIC).

3.3 Post Result Tests

The study conducted diagnostic tests to find out whether the results of the analyses conform to some of the assumptions of the classical regression models. The diagnostic tests determine the reliability and acceptance of the regression results or how it fits each model. It includes: Breusch-Godfrey test which test the presence of autocorrelation. This test is preferred to Durbin-Watson test in that it does not lose its powers in the presence of lagged dependent variables. The Ramsey RESETS (regression equation specification error tests) is used to test for functional form of the equation while autoregressive conditional heteroscedasticity (ARCH) employed to determine if the errors are homoscedastic. The insignificance of these tests indicates acceptance of the null hypotheses of no autocorrelation, no functional form problem and that the residuals are homoscedastic.

4.0 RESULTS

4.1 Unit Root Test Results

The results of various unit root test are presented to avoid the problem of spurious regression and to determine the appropriate analytical tools for the study. Each series which is expressed in logarithm form is tested for unit root using Augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) unit root test. The results are presented as follows.

Table 1: Augmented Dickey-Fuller (ADF) Unit Root Test Results

Variables	ADF Test	PP Test	Order of integration
log(GDP)	-5.982837***	-5.965537***	I(1)
log(EXR)	-5.327846***	-5.349421***	I(1)
log(FVR)	-6.466399***	-6.470855***	I(1)
log(FDI)	-11.66963***	-11.57599***	I(1)
log(TGE)	-6.997965***	-7.026209***	I(1)
log(MS)	-6.693329***	-6.711037***	I(1)

Note: ADF is Augmented Dickey-Fuller and PP is Phillip-Peron, *** indicates significant at 1 percent, 5 percent and 10 percent

Source: Researcher's Calculation, 2022

The ADF results indicated that economic growth (GDP), exchange rate (EXR) foreign reserve (FVN), foreign direct investment (FDI), government expenditure (TGE) and money supply (MS) have unit t-statistic of -5.982837, -5.327846, -6.466399, -11.66963, -6.997965 and -6.693329 which are much more in negative than the critical value of -4.180911, -3.515523 and -3.188259 respectively. Since the t-statistics are much more in negative than the critical value, the study rejected the null hypothesis and concluded that the series were stationary. It indicated that all the series employed for the analysis had unit root but were stationary after differencing it once. It revealed that all the variables are integrated to order one [i.e., I (1)].

Furthermore, Phillip-Peron (PP) equally affirmed that the variables were integrated of the same order. This is as the t-statistics of -5.965537, -5.349421, -6.470855, -11.57599, -7.026209 and -6.711037 for GDP, EXR, FVR, FDI, TGE and MS are much more in negative than the critical values -4.180911, -3.515523 and -3.188259 respectively at 5 percent levels. This suggested that the employed series became stationary after differencing them once. The Phillip-Peron (PP) unit root test results is in tandem with the findings of ADF. Both affirmed that the series contained unit root stationary at first difference which indicated integration to order one. Thus this justified the application of Johansen cointegration test to examine long term influence of exchange rate on economic growth in Nigeria.

4.2 Results of Cointegration Tests

Johansen cointegration test was used to analyze long term implications of exchange rate on Nigerian macroeconomic variables. The choice of this approach is motivated by the fact that the ADF and PP unit roots confirmed that the series are of order one. The test analyzed the results using trace test and maximum-eigenvalue. The results are as follows:

Table 2: Results of Johansen Cointegration Test

Null Hypothesis	Trace Statistic	5% Critical value	p-value	Null Hypothesis	Max-Eigen Statistic	5% Critical Value	p-value
r = 0*	216.3281	95.75366	0.0000	r = 0*	82.92974	40.07757	0.0000
r ≤ 1*	133.3984	69.81889	0.0000	r ≤ 1*	64.18880	33.87687	0.0000
r ≤ 2*	69.20955	47.85613	0.0002	r ≤ 2*	48.23059	27.58434	0.0000
r ≤ 3	20.97896	29.79707	0.3589	r ≤ 3	13.73306	21.13162	0.3874
r ≤ 4	7.245900	15.49471	0.5492	r ≤ 4	6.322446	14.26460	0.5722
r ≤ 5	0.923454	3.841466	0.3366	r ≤ 5	0.923454	3.841466	0.3366

Note: * denotes 3 cointegrating eqn(s) at 5% level of significance
Source: Researcher's Calculation, 2022

This due to the fact that trace statistics (216.3281, 133.3984 and 69.20955) is greater than critical values (95.75366, 69.81889 and 47.85613) respectively at 0.05 levels. These findings are supported by their respective probability (p-values < 0.05). It concluded that the model is cointegrated. This shows evidence of at least three (3) cointegrating vectors. The maximum-eigen statistic also denoted presence of cointegration. The null hypothesis is rejected since the maximum-eigen statistic (82.92974, 64.18880 and 48.23059) is greater than the critical value (40.07757, 33.87687 and 27.58434) respectively at 0.05 levels. It is indicative of long term stability between EXR and GDP, exchange rate (EXR), total government expenditure (TGE), FDI, foreign reserve (FVN) and MS.

4.3 Lag Length Selection

Table 3: Lag length Selection Result

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-106.7548	NA	4.31e-05	6.963651	8.468250	7.511543
2	-74.51092	45.61335	5.69e-05	7.146874	10.15607	8.242659
3	-31.54138	48.20973*	5.35e-05*	6.806896*	11.32070*	8.450573
4	10.99999	35.27821	7.36e-05	6.487805	12.50620	8.679374*
5	115.9082	56.29223	1.02e-05	3.126427	10.64943	5.865889

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Researcher's Calculation, 2022

These criteria suggested 3 lag length accept Hannan-Quinn information criterion HQ) which indicated 4 lag length. In light this, the study chose 3 lag length as suggested by popular criteria.

4.4 Results of Short Run and Long Run Results

The vector error correction technique was applied after the Johansen test revealed evidence of cointegration among the variables. The results show both the short run and long run influence of exchange rate on economic growth in Nigeria. The results are presented as follows:

Table 4: Results of Vector error Correction Techniques

Dependent variable: GDP

Variables	Coefficient	t-Statistic	Prob.
Short Run			
log(EXR(-1))	-0.500450	-8.54607*	
log(TGE(-1))	-0.814912	-11.4964*	
log(FDI(-1))	-0.045289	-2.20740*	
log(FVN(-1))	0.187682	5.03970*	
log(MS(-1))	0.175627	9.85315*	
C	-11.62692		
Long Run			
ECT(-1)	-0.438579	-5.708030*	0.0000
D(log((GDP(-1)))	-0.294836	-2.050960	0.0524
D(log((GDP(-2)))	-0.365367	-2.557534*	0.0180
D(log((GDP(-3)))	-0.219125	-1.500168	0.1478
D(log((EXR(-1)))	-0.435451	-3.571717*	0.0017
D(log((EXR(-2)))	-0.340529	-3.029043*	0.0062
D(log((EXR(-3))	0.022663	0.212957	0.8333
D(log((TGE(-1)))	2.57E-07	4.465348*	0.0002
D(log((TGE(-2)))	-2.04E-08	-0.358134	0.7237
D(log((TGE(-3)))	1.43E-07	2.274422*	0.0330
D(log((FDI(-1)))	-0.245487	-4.496734*	0.0002
D(log((FDI(-2)))	-0.139418	-3.068324*	0.0056
D(log((FDI(-3)))	-0.011737	-0.361113	0.7215
D(log((FVN(-1)))	0.061261	1.789149	0.0874
D(log((FVN(-2)))	0.074449	2.264389*	0.0337
D(log((FVN(-3)))	0.084991	2.257497*	0.0342
D(log((MS(-1))))	-0.168647	-3.815854*	0.0009
D(log((MS(-2)))	-0.029591	-0.804085	0.4300
D(log((MS(-3)))	-0.073905	-1.998402	0.0582
C	0.551313	6.013593*	0.0000
R-Square	0.759592	F-Stat.	3.658485
Adjusted R-Square	0.551968	Prob(F-statistic)	0.002162
Durbin-Watson	1.613299		

Note: * denotes significant at 0.05 levels

Source: Extract from Researcher's Calculation, 2022

The implications of exchange rate variation on output in Nigeria were analyzed with the help of VECM and results presented in Table 4. The VEC result indicated that previous years economic growth (GDP-1 and GDP-2) have the p-values (0.0524 and 0.0180) which fall within pre-defined p-value which indicated that it has influence on the current output in Nigeria. This implies that rise in previous years economic growth lead to current increase in economic growth in the short run.

Exchange rate (EXR-1 and EXR-2) which have the p-values (0.0017 and 0.0062) respectively are statistically significant. It has coefficients (-0.435451 and -0.340529) which exhibited negative relationship with economic growth. This entails that a depreciation of exchange rate resulted in rise in economic growth in short period to the tune of 0.44% and 0.34% in the first and second lag. This finding is in line with the theoretical postulations which suggested that exchange rate must be negative to effectively discourage import and boost exports. In the short run, exchange rate has debilitating effects on the economy. It increases price of imports as well as decreases volume of exports as export and import prices tend to be perfectly inelastic. The price inelasticity of import and export is due to price stickiness and sluggishness of consumers' to respond to changes in price associated to exchange rate variation. In short run, consumers

or firms will continue to demand foreign made goods despite rise in price. The increase in import price increases the cost of production which invariably translates to general increase in price level. Therefore, the rise in inflation in Nigeria is attributable to recent depreciation of exchange rate. The result of this study is in support of J-curve which postulates that exchange rate has short run negative impact on the economy. This assertion is in consonance with earlier studies such as Nwogo & Owo (2017) in Nigeria, Ferrando (2011) in China, Allayky (2011) in Togo, Brown (2012) in Kenya, Mamun et al (2013) in Bangladesh, Ayinde (2014), Alagidede and Muazu (2016), and Danladi and Uba (2016) in Nigeria. They pointed that exchange rate depreciation worsen economic growth within a short period which is indicated that it leads to output contraction.

However, the significance of error correction term (ECT-1) showed that short run negative effect of exchange rate on Nigerian economy will easily adjust to improve the economy over a long period. ECT measures the speed of adjustment to the long run equilibrium. Its p-value (0.0000) is an indication that it is statistically significant. The coefficient shows that short run debilitating effect of exchange rate will adjust by 43.86 percent per annum for equilibrium to be corrected in the long run. Similarly, Johansen cointegration test also revealed that exchange rate variation promotes economic growth in the long run. The coefficient of exchange rate of -0.500450 and t-statistic of -8.54607 indicated that it is statistically significant in the long run. The negative sign is in tandem with the theoretical expectation which shows that exchange rate depreciation resulted in 0.5% rise in economic growth in the long run. Theoretically, depreciation of naira reduces the price of locally made goods and as well lead to rise in price of imports. This made imports expensive within the economy and export cheaper outside the country. In the long run, the exports and imports prices of Nigeria tend to be elastic which will influence her citizens to shift their preference from foreign made goods and inputs whose prices become high to locally made goods or inputs with relative cheap prices. Preference for domestic goods will stimulate aggregate demand in the economy which invariably leads to output expansion, increase in investment with antecedent rise in employment opportunities. Thus, this promotes production capacity of Nigeria, which will have direct bearing in enhancing macroeconomic variables.

On the other hand, fall in exports price invariably makes the domestic industries more competitive in global market. This points to the fact that exports become cheaper in foreign countries leading to increase in demand for locally made goods from Nigeria in the long run. The increase in demand for Nigerian export will stimulate production which subsequently leads to rise in employment creation and output expansion. This finding is in tandem with studies performed in various countries by Ferrando (2011) in China, Joan (2012) in South Africa, Naseer (2013) and Anweret al (2014) in Pakistan, and Khairul (2015) in Bangladesh. These studies showed that exchange rate variation played vital role in enhancing economic growth in long run. However, in Nigeria, some earlier studies recognized the effectiveness of exchange rate variation in enhancing the growth of the economy (see Opuluwaet al, 2010, Aderinan 2012, Asher, 2012 and Enekwe, Ordu andNwoha, 2013).

Government expenditure (TGE) and foreign direct investment (FDI) exhibited negative and significant relationship with economic growth in the long run. The findings indicated that government intervention in the economy is inimical to the growth of Nigeria's economy. in the same vein, the reliance on inflow of foreign direct investment to boost economic growth in Nigeria has been found to retard growth. This assertion is in line with the dependency theory which posited that foreign direct investment inflow strangulates domestic investment which makes a developing economy to perpetually depend on the developed economies. On the other hand, foreign reserve (FVR) and money supply (MS) indicated that they positive impact on economic growth in the long. Therefore, rise in Nigeria's foreign reserve will strengthen the value of the country's currency against foreign currencies while rise in money supply will stimulate aggregated demand which will translate to increase in economic growth. The R^2 (0.759592) is quite high which indicated that 75.96 percent variation on economic growth is due to exchange rate variation and other explanatory variables. The f-statistic (3.658485) with the p-value of 0.002162 affirmed that the regressors jointly lead to rise in output in Nigeria.

The Durbin-Watson (DW) statistic of 1.613299 indicated that there is little presence of autocorrelation. The Durbin-Watson entails that the result is reliable since it is close to two (2).

4.5. Results of Post Estimation Test

The Table 4 shows the results of the post estimation tests performed to determine reliability of estimates of vector error correction model result. The null hypothesis of normal distribution, no autocorrelation, homoskedasticity, no functional form problem are rejected if their respective probability value is lower than 0.05 and accepted if otherwise.

Table 5: Results of Post Estimation Tests

Test Method	Obs	F-statistic	Prob.
Jarque-Bera	42	0.050455	0.767031
Breusch-Godfrey serial correlation LM test	42	0.894222	0.4876
Autoregressive Conditional Heteroskedasticity (ARCH)	41	1.272614	0.2662
Ramsey RESETS test	20	3.090189	0.0677

Note: * denotes significant at 0.05 levels
Source: Extract from Researcher's Calculation, 2022

However, the probability values 0.767031 of Jarque-Bera, 0.4876 of LM test, 0.2662 of ARCH and 0.0677 for functional form problem are higher than 0.05. The post estimation resulted indicated that the residuals are normally distributed, no presence of autocorrelation, the residuals is homoskedastic and that the model is well specified respectively.

5.1 CONCLUSION

The study indicated that exchange rate has debilitating implication on the economy. It contracts output and trade balance within a short period which supported postulations of structurist theory (exchange rate-pass-through). This implies that exchange rate has transmission effects on the economy. This assertion is an indication that the traditional theories such as Marshall-Lerner condition, J-curve and absorption theories hold for Nigeria in the long run. Therefore, exchange rate variation worsens macroeconomic variables within a short term but improves them as it moves on toward long term equilibrium in Nigeria.

5.2 RECOMMENDATIONS

The following recommendations were made to proffer solution to the problem of exchange rate variation on macroeconomic variables in Nigeria.

1. Exchange rate has been identified as being capable of stimulating economic growth in the long run; it is advisable the monetary authorities should fully liberalize the naira. This will all the market forces to actually determine its value which will discourage imports and encourages exports.
2. The depletion of foreign reserve has been identified as responsible for the deterioration of exchange rate in Nigeria. Therefore, emphasis should focus on building adequate foreign reserve that will serve as buffer whenever the country is exposed to global trade uncertainty. This will go a long way to stabilize the value of Naira and cushion-off trade shocks.
3. Government should endeavour to correct the narrative by embarking on import substitution strategy. This will put the country on the path of trade surplus.

4. Government should de-emphasis on attracting foreign direct investment that is crowding-out domestic investment. Less emphasis on FDI will stimulate domestic investment capable of boosting economic growth.
5. Since money supply exhibited positive impact on economic growth, it is imperative to maintain the current money supply level. this will stimulate growth in the long run.

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