

Exchange Rate Dynamics and Economic Growth in Nigeria

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Abstract

The study examined the impact of exchange rate dynamics on economic growth in Nigeria using annual time series data from 1987 to 2020. The variables used in the study include real GDP, realexchange rate, consumer price index, interest rate, public debt, trade openness, gross capital formation. The study adopted ordinary least square techniques for the regression analysis. The empirical analysis showed that exchange rate, consumer price index, interest rate and public debt have negative and significant impact on economic growth. The results of the analysis show that gross capital formation has no significant impact on economic growth. Also, the result showed that trade openness has positive and significant impact on economic growth in Nigeria. The study recommended that the Nigeriangovernment and Central Bank of Nigeria should foster indigenous production of goods and services in order to reduce the impact of exchange rate dynamics on the aggregate economy.

Keywords: Exchange rate, economic growth, interest rate, ordinary least square, Nigeria.

Jel Classification: C18, C24, C20, G12

Introduction

Economic growth is the increase in the real per capita income of a country over a long period of time. It is the rise in the total productivity of a country within a specified period of time (Jhinghan, 2012). The progress and development of an economy is being measured with Gross Domestic Product (GDP). The GDP can be nominal GDP or real GDP, the nominal GDP does not take account the devastating effect of inflation, but the latter is adjusted to capture the likely impact of inflation. Economic growth also has to do with a rise in income level. It is an increase in the aggregate production of an economy (Agu, 2014).

Exchange rate can be defined as the as the amount of domestic currency that is required to purchase one unit of foreign currency (Oladipo, 2016). Volatility in exchange rate occurs when there is unsteadiness in the value of one country's currency in relation to others. It is a natural outcome of the floating exchange system that is common with most major economies of the world (Galadima, 2015). Exchange rate volatility in Nigeria shows how fickle the currency of the country has become (Ukemenam, 2016). According to Chowdhury (2004), exchange rate has been found to play a valuable role in predicting currency crises, which affects the emerging

market economies recently. This currency crisis increases or declines the RGDP. The exchange rate of a country plays an important role as it affect all the macroeconomic variables which states the reason why the monetary authorities and private sectors aims to stabilize these variables (Ajakaiye, 2012). Exchange rate fluctuation is the foundation for all worldwide economic activities, showing exchange rate operation as a major factor that decides many countries economic policies (Todaro, 2004). Aliyu (2011) maintained that exchange rate appreciation will result in increased imports and declined export while depreciation would expand export and discourage import. Also, depreciation of exchange rate tends to cause a shift from foreign goods to domestic goods. Hence, it leads to diversion of income from importing countries to countries exporting through a shift in terms of trade, and this tends to have impact on the exporting and importing countries' economic growth.

Exchange rate fluctuations in Nigeria have led to an unstable environment which can be attributed to the reason why the country finds it difficult to boost its economic performance. As such, despite the vast opportunities in agriculture, industry, oil and gas, commerce and infrastructure, Nigeria has achieved a very minimal growth as a result of depreciating exchange rate which affects the standard of living of its citizens. To address this problem government have adopted a viable strategy and policy to solve the problem of weak exchange rate while boosting its economic growth. This policy is the Nigerian Autonomous Foreign Exchange Rate Fixing Methodology (NAFEX) adopted in 2007 in response to the currency crisis in 2007. However, despite these macroeconomic policy measures, the performance of the Nigerian exchange rate and economic growth has been depressing. The major questions here are, regardless of government's effort to stabilize the exchange rate, why is there still a change in the rate and how does this change affect economic growth?

Two opposing views exist on the impact of exchange rate on economic growth in Nigeria. The view of Akingunola (2011), which argues that exchange rate, has an impact on the growth of Nigerian economy because increase in price of exchange rate will have a robust impact on economic performance like increase in price of commodities. While Akims (2007) argues that exchange rate has little impact on the economic performance of Nigeria. The conflict between exchange rate dynamic and economic growth is of interest to researchers and policy analyst. This inspired this study to investigate the variations in the exchange rate and its effect on

economic growth. Therefore, following this background, the study aims to examine the impact of exchange rate dynamic on economic growth in Nigeria and also to determine if there is a long run relationship between exchange rate dynamics and economic growth in Nigeria. The findings of this study would be of practical relevance to government and policy makers in Nigeria in determining how best to channel exchange rate to boast economic performance in Nigeria. The rest of the paper is structured as follows: Section two is centered on the literature review; Section three concentrates on the methodology; Section four presents the results and Section five is the conclusion.

Literature Review

This section examines theories that deal with exchange rates. The theories discussed in this section include the purchasing power parity and the solow-swan growth model.

The Purchasing Power Parity

This theory is credited to Gustav Cassel, a Swedish economist, who developed and popularized its empirical version in the 1920s. The nominal exchange rate considers the buying power of one currency relative to another and that an exchange of purchasing power occurs between any two countries which are measured by the equivalent of one country's price level against another (Cassel, 1916). The terms of free trade are that the nominal exchange rate between two countries should be equal to the ratio of the price levels in the two countries (Taylor, 1988). This approach assumes that real equilibrium exchange rates remain constant over time and therefore, the nominal exchange rate movement tends to offset relative price movements. The purchasing power parity defines two equilibrium rate systems. The first is the short run equilibrium exchange rate which is defined as the rate that would exist under a purely floating exchange rate balance. Second is the long-run equilibrium that would yield balance of payment equilibrium over a time period in cooperative and cyclical swings in the balance of payments (including those of prevailing exchange rate by the relative purchasing power in a currency are generally attributed to the problem of arbitrage and expectations in the commodity market. The Purchasing Power Parity has been criticized by some economists as defective for the following reasons: Defects of index numbers, the PPP theory presumes a direct linkage between the price level of the two legal tender and the exchange rate. However, there are many other factors such as tariff speculation, capital flows which can influence the exchange rate. Based on this theory, the exchange rate should reflect the prices of all goods and services in an economy. However

only some goods and services enter international trade. Goods traded internally have no influence on the exchange rate, the PPP theory assumes that a change in price level results in a change in the exchange rate. But empirical evidence has shown that exchange rate governs prices and not vice versa.

Solow-Swan growth theory

This growth theory was developed and introduced by Robert Solow and Trevor Swan in the 1950s. The theory is based on a supply-side, economic theory, which postulates long-run economic growth that outlines how a sustained rate of economic growth results from the combination of three driving forces: labour, capital and technology. The model initially considered exogenous population increase to determine the growth rate but, in 1957, Solow incorporated technological change into the model. The theory states that short-run equilibrium results from varying amounts of labor and capital in the production function. The theory also holds that technological change has a great influence on an economy and that economic growth cannot continue without technological advancements. While an economy has limited resources in terms of capital and labor, the contribution of technology to growth is unlimited. Thus, even though capital is very important, its increase has only a temporary and limited impact on increasing economic growth. As capital increases, the economy maintains its steady-state rate of growth, that is, because of diminishing returns to capital, economies will eventually reach a point at which any increase in capital will no longer create economic growth. Therefore, to increase the rate of economic growth in the Solow-swan model, there is need for; firstly, an increase in the proportion of GDP that is invested. However, this is limited because a higher percentage of investment leads to diminishing returns and steady-state growth convergence. Secondly, technological progress which increases productivity of capital/labour can help countries overcome the steady state. The model assumes that the process by which countries continue to grow despite the diminishing returns is exogenous and represents a new technology that allows production with fewer resources. This is because technology is thought to augment capital and labour increases. Thus the Solow-swan theory suggests poor countries who invest more should see their economic growth converge with richer countries. This will encourage the inflow of resources and more technological improvement in the poorer countries. The influence of technology in this theory is such that increasing any one of the inputs shows the effect on GDP and, therefore, the equilibrium of an economy. However, if the three Solow-

swan factors are not all equal, the returns to unskilled labor and capital to an economy decline. These diminishing returns imply that increases in these two inputs have exponentially diminishing returns while technology is boundless in its contribution to growth and the resulting output it produces. The Solow-swan model has a continuous production function used to measure the growth and equilibrium of an economy.

The function is $Y = AF(K, L)$.

Where, Y denotes an economy's gross domestic product (GDP), K represents its share of capital, L describes the amount of unskilled labor in an economy and A represents a determinant level of technology. However, due to the relationship between labor and technology, the production function of an economy is often re-written as

$$Y = F(K, AL)$$

showing that technology augments labour, thereby increasing labour productivity. The Solow-swan model predicts that capital depreciates at a constant rate, in the absence of technology growth per worker would cease and the growth rate of output in steady state is exogenous and is independent of savings rate and technical progress.

Empirical Literature

Several researches have been carried out on the impact of exchange rate dynamic on economic growth with conflicting outcomes. A good number of empirical studies show that real exchange rate fluctuation can affect growth outcomes. Some other economic scholars are of the view that no significant relationship exist between exchange rate and economic growth.

Akpan and Atan (2012) examined the effect of exchange rate movements on real output growth in Nigeria based on quarterly series for the period 1986 to 2010. A Generalized Method of Moments (GMM) technique was used and the result of the estimation states that there is no evidence of a strong direct relationship between exchange rate changes and output growth. Rather, Nigeria's economic growth has been directly affected by monetary variables.

Uddin, Rahman and Quaosar (2014) investigated the relationship between exchange rate and economic growth proxied by real gross domestic product (RGDP) in Bangladesh for a period

of 41 years ranges from 1973 to 2013 by using time series econometric technique. The empirical results show that there is a significant positive correlation between exchange rate and economic growth. The results also advocate the presence of long-run equilibrium relationship between the two variables. Oleka, Eyisi and Mgbodile (2014) analyzed the impact of foreign exchange rate on the growth of Nigerian economy for the periods 2000 to 2014. The GDP is used as dependent variable indicating economic growth of Nigeria. While independent variables like money supply, inflation rate, employment rate and foreign exchange rates were used as economic (performance) indicators. The result revealed that there is variation on money supply and naira exchange rate; hence the monetary policy instruments were not efficacious in the attainment of price and exchange rate stability in Nigeria.

Azu and Nasiri (2015) determined the relationship between real exchange rate and economic growth applying those variables that adjudged to make up equilibrium exchange rate thereby defining how interrelated they are RER, GDP, EXP, IMP, FER and FDI. Analyzing the data using VAR technique, based on the prevailing situation in Nigerian economy within these periods, one can envisage that RER fluctuation was significantly controlled by its positive relation with real import as well as its negative relation to real GDP and foreign direct investment. Similarly, GDP are positively controlled by depreciating exchange rate, increasing previous GDP, FER and FDI. Nigerian economic growth within this period was characterized by sustainable growth enhanced by sustainable increase in these factors. Adelowokan, Adesoye and Balogun (2015) assessed the effect of exchange rate volatility on investment and growth in Nigeria over the period of 1986 to 2014. The vector error correction method, impulse responses function, co-integration and Augmented Dickey Fuller (ADF) test for stationarity were employed to capture the interactions between the variables. The results confirm the existence of long run relationship between exchange rate, investment, interest rate, inflation and growth. Finally the results show that exchange rate volatility has a negative effect with investment and growth while exchange rate volatility has a positive relationship with inflation and interest rate in Nigeria.

Danladi and Uba (2016) determined whether the volatility of exchange rate has implications for the economic performance of the countries in the West African Monetary Zone. Nigeria and Ghana were chosen as case studies for the period from 1980 to 2013. Exchange rate

variability was measured using the GARCH approach. The empirical results confirm that exchange rate volatility have a significant negative effect on economic growth. Ismaila (2016) ascertained exchange rate depreciation and Nigeria economic growth during the SAP and post SAP period: 1986–2012. Using the Johansen co-integration test and error correction model analyses after conducting the stationary test, the results show that broad money supply, net export and total government expenditure have significant impact on real output performance in the long run while exchange rate has direct and insignificant effect on Nigeria economic growth in both short and long run.

Ogbonna (2017) investigated the effect of exchange rate volatility on economic growth in Nigeria, adopting monthly time series data relating to exchange rate volatility, external reserves, domestic interest rate, RGDP growth rate and trade openness for the period of 1986-2016. The exchange rate volatility series was estimated using the generalized autoregressive conditional heteroscedasticity (GARCH) technique. The findings of the study indicated that exchange rate volatility has a negative but significant effect on Nigeria's economic growth. The study recommends the government should encourage domestic production and consumption of goods and services in order to curtail the effects of exchange rate fluctuation on other macroeconomic variables. Osinubi (2019) investigated the effect of exchange rate volatility on economic growth in Nigeria time series data from 1970 to 2016. The variables used in the study are exchange rate, inflation rate, gross domestic product. The study utilized the error correction model as well as OLS. The study reveals a significant positive relationship between real GDP and exchange rate. This implies that, devaluation of the Naira increases economic performance in terms of exporting countries. The study recommended that government should encourage export by adopting various exporting strategies that enable the growth of the economy.

Empirical Gap

The empirical works reviewed shows that from the findings that exchange rate has a significant positive relationship with economic growth while other studies have a negative relationship

with economic growth. This mixed finding is as a result of techniques used in estimating the model of the study. The works of Akpan and Atan (2012), Danladi and uba (2016), Azu and Nasiri (2015), Ogbonna (2017) made use of GMM, GARCH and VAR estimation techniques which are not adequate in generating consistent and robust coefficient estimates about the study variables, thereby providing a gap in the methodology used. This study adopted the more advanced OLS method, which allows for a more robust co-integration that plays well with small sample sizes. Through this method, it becomes methodologically possible to deal with model selection, estimation, inference and to determine the long run and short run effects of exchange rate on economic growth in Nigeria. Similarly, most empirical works have chosen their control variables at random to model the relationship between exchange rate and economic growth thereby showing their shortcoming by not using most of the important variables stated in the literature. This study incorporated more macroeconomic variables and growth-related variables in its empirical model to overcome variable omission bias and guide against the identified gap in variables used from previous studies.

Research Methods and Procedure

Sources of Data

This study employed annual time series data spanning from 1987 to 2020. The data were collected from Central Bank of Nigeria (CBN) Statistical Bulletin and National Bureau of Statistics (NBS) statistical database. The macroeconomic data include; real gross domestic product, exchange rate, consumer price index, interest rate, public debt, trade openness and gross capital formation.

Theoretical Framework

To set out the economic procedure for this work, we start with the theoretical framework. Following the neoclassical framework of Solow (1956) and Swan (1956), we assume that the economy is perfectly competitive with constant returns to scale production function. Perfect competition implies that there are numerous identical firms producing homogenous commodity, Y_j (with the assumption of single-product economy, the aggregate output is indicated as Y). The Solow-swan model has a continuous production function used to measure the growth and equilibrium of an economy.

The function is $Y = AF(K, L)$.

Where, Y denotes an economy's gross domestic product (GDP), K represents its share of capital, L describes the amount of unskilled labor in an economy and A represents a determinant level of technology. However, due to the relationship between labor and technology, the production function of an economy is often re-written as

$$Y = F(K, AL)$$

Model specification

The model is specified based on the theoretical framework. It is expressed as follows:

$$RGDP = f(EXR, CPI, INT, PD, TOPN, GCF) \quad (1)$$

Where: EXR =Exchange rate, CPI =Consumer price index, INT = Interest rate, PD = Public debt, TOPN = Trade openness, GCF = Gross capital formation.

The econometric form of the model is specified as:

$$RGDP = \beta_0 + \beta_1 EXR_t + \beta_2 CPI_t + \beta_3 INT_t + \beta_4 PD_t + \beta_5 TOPN_t + \beta_6 GCF_t + \mu_t \quad (2)$$

A priori Expectation: EXR (-), CPI (-), INT (-), PD (-), TOPN (+), GCF (+)

Taking the natural logarithmic form:

$$\ln RGDP_t = \beta_0 + \beta_1 \ln EXR_t + \beta_2 \ln CPI_t + \beta_3 \ln INT_t + \beta_4 \ln PD_t + \beta_5 \ln TOPN_t + \beta_6 \ln GCF_t + \mu_t \quad (3)$$

Estimation Technique

The study employed OLS technique to determine the impact of exchange rate dynamic on economic growth in Nigeria. The Augmented Dickey-Fuller (ADF) unit root test, which is used to test for stationarity of the time series data in the study, Johansen co-integration test is used to test the long run relationship between the dependent and independent variables.

Presentation and Interpretation of Result

Test for Stationarity

Table 1. Summary of ADF Unit Root Test Result

Variable	ADF Statistic	Level of Significant	Critical Values	Order of integration
RGDP	-5.817484	5%	-2.943427	I(1)
EXR	-5.585034	5%	-2.945842	I(1)
CPI	-5.667561	5%	-2.943427	I(1)
INT	-6.307561	5%	-2.945842	I(1)
PD	-8.977294	5%	-2.943427	I(1)
TOPN	-6.443922	5%	-2.945842	I(1)
GCF	-5.759011	5%	-2.943427	I(1)

Source: Authors' computation using *EVIEW* version 10

The first step to analyze time series data is to ensure the variables are stationary so as to avoid misleading result. To do this, ADF unit root test was conducted and the result is shown in table 1. From the result, the variables are stationary at order one since their ADF statistics are greater than the critical values at 5 per cent level of significance.

Summary of Johansen Cointegration Test

The Johansen test for co-integration was used to determine the possibility of a long run relationship among the variables. The result of cointegration test is shown in table 2 below.

Table 2. Summary of Johansen cointegration test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.999789	495.1451	69.81889	0.0001
At most 1 *	0.983310	181.9913	47.85613	0.0000
At most 2 *	0.410292	30.55145	29.79707	0.0409
At most 3	0.256418	11.01071	15.49471	0.2108
At most 4	0.001310	0.048513	3.841466	0.8256

Source: Authors estimation using *E-views 10.0*.

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level. *denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values.

From table above, the result of the test conducted reveals that the model has three (3) cointegration equations at 5% level of significance. This means that there is a long run relationship between exchange rate dynamics and economic growth in Nigeria.

Summary of Regression Result

The result of the Ordinary Least Squares regression for our model is presented in table 3 below:

Table 3: Summary of model 1 Regression Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.643208	0.855680	7.763659	0.0025
LNEXR	-4.108428	0.935789	-4.390335	0.0001
LNCPI	-11.31540	0.703609	-16.08195	0.0000
LNINT	-3.860552	0.856001	-4.509987	0.0001
LNPD	-6.543411	0.945330	-6.921827	0.0022
LNTOPN	5.882206	0.741142	7.936678	0.0000
LNGCF	1.157972	0.590443	1.961191	0.0527
R-squared	0.795380	Mean dependent var	12.55086	
Adjusted R-squared	0.694836	S.D. dependent var	11.95322	
S.E. of regression	0.858977	Akaike info criterion	2.653060	
Sum squared resid	25.08662	Schwarz criterion	2.866337	
Log likelihood	-46.73467	Hannan-Quinn criter.	2.729582	
F-statistic	1831.130	Durbin-Watson stat	1.752066	
Prob(F-statistic)	0.000000			

Source: Authors estimation using E-views 10.0

Interpretation of Results

The result shows that exchange rate, consumer price index, interest rate and public debt entered the model with negative logs which conforms to the a priori expectations. Exchange rate has negative impact on economic growth; these imply that a percentage increase in exchange rate will bring about 4.11% declines in economic growth of Nigeria. This is in line with the findings of Ogbonna (2017). Also, consumer price index, interest rate and public debt have a negative impact on economic growth. A percentage increase in consumer price index will lead to a

decrease in economic growth by 11.32%. Equally, a percentage increase in interest rate and public debt will lead to 3.86% and 6.54% reduction in economic growth.

Furthermore, trade openness and gross capital formation have a positive impact on economic growth. This shows that a percentage increase in trade openness and gross capital formation will lead to 5.88% and 1.16% increase in economic growth. The R-squared measures the “goodness of fit” of a model. The result of the ordinary least square (OLS) shows that the adjusted coefficient of determination (R^2) is 0.695380. This implies that the independent variables of our model explained about 69% of the variations noticed in the dependent variable while 31% are explained from other factors outside the model. Therefore, the independent variables have good explanatory power for the dependent variable. In testing for the overall significance of the sample regression model, the f-test was applied. The probability of the f-statistic as presented above is significant warranting the acceptance of the overall significance of the model. **Autocorrelation Test (Durbin Watson)**

The Durbin Watson test was used to check for the presence of autocorrelation between successive values of the error term. From the regression results, it is observed that Durbin Watson statistic is 1.752066, which is approximately equal to 2, thereby indicating that there is no autocorrelation in the model and the model is reliable for prediction.

Heteroscedasticity Test: White Test

F-statistic	43.27807	Prob. F(6,27)	0.0000
Obs*R-squared	37.51403	Prob. Chi-Square(6)	0.0006
Scaled explained SS	29.44648	Prob. Chi-Square(6)	0.0091

From the above, the prob F (statistics) is 0.0000 which is less than 0.05. Therefore, we accept the null hypotheses that there is no presence of heteroscedasticity in the model.

Summary of T- test

Variable	t-calculated	t-tabulated	Conclusion
LNEXR	-4.390335	2.052	Significant
LNCPI	-16.08195	2.052	Significant
LNINT	-4.509987	2.052	Significant
LNPD	-6.921827	2.052	Significant

LNTOPN	7.936678	2.052	Significant
LNGCF	1.961191	2.052	Not significant

Source: Authors' computation using EVIEW 10 version

Here, we are interested in determining the statistical reliability and significance of the individual parameters of the model. We shall do this by comparing the absolute t-value of each parameter with the critical t-value of 2.052 and if the absolute t-value is greater than 2.052, such variable possessing the coefficient is accepted as statistically significant and fit to be used for statistical inference and possibly for forecasting. From the table, exchange rate, consumer price index, interest rate, public debt and trade openness are all statistically significant.

Discussion of Findings

The main aim of this paper is to examine the impact of exchange rate dynamics on economic growth in Nigeria within the period 1987 to 2020. The paper adopted the ordinary least squares approach for its empirical analysis. The study finds that exchange rate has negative and significant impact on economic growth. This shows that an inverse relationship exist between exchange rate and economic growth. This is in line with the findings of ogbonna (2017) and Adelowan et al (2015) who found that exchange rate has a negative impact on economic growth. More so, from our findings, consumer price index has both short and long run impact on economic growth while public debt has negative and significant impact on economic growth. In addition, the study finds that trade openness has positive and significant impact on economic growth.

Conclusions and Policy Recommendations

Achieving economic growth is one of the fundamental objectives of every economy. In line with the findings of this study, the paper concludes that exchange rate, consumer price index, interest rate and public debt have negative and long-run significant relationship on economic growth while trade openness has a positive significant relationship with economic growth. The major constraint encountered in this study is time factor. The authors had limited timing to carry out this research paper. The paper contributes to existing knowledge by examining the impact of exchange rate dynamics on economic growth in Nigeria. In line with the findings of this research, the following recommendations are offered.

- I. One of the key findings of this research paper is that there is a negative significant impact of exchange rate dynamics on economic growth. To this end, we recommend that the government and Central Bank of Nigeria should foster indigenous production of goods and services in order to reduce the impact of exchange rate dynamics on the aggregate economy.
- II. Again, the paper also found that trade openness has a positive significant relationship with economic growth. We therefore recommend that the Central Bank of Nigeria is advised to drive the adoption of single digit interest lending among all the financial institutions in Nigeria to reduce cost of capital and increase the ease of doing businesses in the country.

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