

Exchange Rate and Inflationary Rate: Do They Interact? Evidence from Nigeria

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Abstract

The research paper examines the level, nature of association as well as the impact of exchange rate fluctuations on inflationary pressure and other selected macroeconomic indices in Nigeria between 1979 and 2010. Ordinary least squares method in the form of multiple regressions was applied to evaluate their association and impact and Granger Causality technique to evaluate their causality. Co integration procedure was also applied to assess whether their relationships will stand the test of time. A Stationary test was conducted using the Augmented Dickey- Fuller (ADF) tests. The result reveals that exchange rate and inflationary rate are positively related, though not to a very significant extent. This signifies that fluctuations in exchange rate can as well result in a proportionate response in the prevailing inflationary rate. The study reveals that there is no causality in any direction between exchange rate and inflationary rate. Unidirectional causality runs from interest rate to inflation. Interest rate and real GDP have no significant impact on exchange rate in Nigeria as revealed by the study. However, they both have negative relationship with exchange rate. Consequently, the paper recommends that monetary and fiscal policy setters should fashion out strategies to efficiently regulate and effectively manipulate the highly volatile macroeconomic indices in Nigeria in order to grow the economy faster and sustain it, even at the long run.

Keywords: exchange rate, inflation rate, interest rate, GDP, granger, co-integration

1. Introduction

Exchange rate is a macroeconomic indicator which defines the price of Nigeria's naira expressed in terms of one unit of the United States dollar. Macroeconomic policies in developing African nations are often causing argument as a result of the kind of structural changes needed, such as reducing imports or expanding non-oil exports, which invariably imply a fall in the nominal exchange rate (Akpan & Atan, 2012). They also added that following the failures of the variants of the flexible exchange rate mechanism (the AFEM introduced in 1995 and the IFEM in 1999) to ensure exchange rate stability, the Dutch Auction System (DAS) was re-introduced on July 22, 2002. The DAS was to serve the triple purposes of reducing the parallel market premium, conserve the dwindling external reserves and achieve a realistic exchange rate for the naira. However, In order to further liberalize the market, narrow the arbitrage premium between the official interbank and bureau de change segments of the markets and achieve convergence, the CBN introduces the Wholesale Dutch Auction System (WDAS) on February 20, 2006. This was meant to consolidate the gains of the retail Dutch Auction System as well as deepen the foreign exchange market in order to evolve a realistic exchange rate of the naira (Akpan & Atan, 2012). The historical origin of the current inflation in Nigeria dates back to the early 1970s when oil revenue rose sharply resulting in an increase in government spending and aggregate demand without a corresponding increase in domestic output production (Oriavwote & Eshenake, 2012).

Akinbobola (2012) explained the various aspects of inflation to include fiscal, monetary and balance of payments. The monetary aspect is caused by an increase in money supply while the fiscal aspect is occasioned by budget deficits though they closely associate. Exchange rate is the main issue for consideration under balance of payment aspect. In a paper presented by Mordi (acting director of research and statistics, Central Bank of Nigeria, CBN) recently, he observed that exchange rate experiences greater shock in the era of galloping inflation.

Mordi said other determinants of exchange rate include economic fundamentals like Gross Domestic Products

(GDP) growth rate, balance of payments position, external reserves, interest rate movements, external debt position, productivity, market psychology and expectations, socio-political factors, macroeconomic shocks and speculative contagion.

Monetary policy as posited by Enoma (2012) was so enlarged to include creation of credits locally to finance the deficit emanating from the annual budget as a result of the turbulence in financial sector. At this critical moment, the economy witnessed a consistent annual increase of about 29.9% in domestic credit between 1980 and 1984. Shortage of services and goods sourced from foreign countries pushed inflation up in 1984 to about 40%. During the same period, there was a total collapse in oil revenue leading to remarkable drop in budgeted foreign exchange revenue.

The relationship between government spending on public infrastructure and exchange rate tend to be an important analysis as opined by Zakaree (2012). He argued that the performance of the economy has been largely influenced by fiscal and monetary (exchange rate) policies and these policies in turn determine the growth of public and private sector in the economy and subsequent investment pattern. The risk of a budget deficit resulting from unstable foreign exchange rate poses a serious challenge to investment portfolio management and international business generally. When exchange rates are allowed to float, it fluctuates frequently and makes planning and predictions more difficult. This is why some countries opt for fixed foreign exchange rate to minimise the abrupt fluctuations (Englama, Duke, Ogunleye, & Isma'il, 2010).

From the foregoing analysis, the study seeks to evaluate the level of interaction between rate of foreign exchange and rate of inflation as they fluctuate in Nigeria economy. The remaining part of this study is arranged in four sections. Section 2, focuses on literature review, the methodology for data analysis is discussed in Section 3, results and discussion of findings is tackled in Section 4. The conclusion and recommendations are exposed in section 5.

2. Review of Related Literature

Dynamics of exchange and inflationary rate and money supply in Nigeria was examined by Akinbobola (2012) using quarterly data from 1986:01 to 2008:04. The model was estimated using VEC Model. It confirms that in the long run, there is a negative and significant association between inflationary rate and foreign exchange rate as well money supply. He argued that possible justification for the inverse effect of money supply on price level is that inflation may not be due to aggregate demand pressure but rather due to hiccups in the supply chain of goods both from the domestic and foreign supply outlets. The study emphasised that empirical deductions also signify the presence of significant feedback from the long run to short run disequilibrium. However, there exists a causal linkage between inflation, money supply and exchange rate in Nigeria.

Imimole and Enoma (2011) looked into the possible effects of drop in rate of exchange on rate of inflation in Nigeria between 1986 and 2008. It was found that inflation is influenced by real gross domestic product, depreciation in foreign exchange rate and also the supply of money with depreciation sustaining its short run effect in the long run and in a positive relationship

The determinant of rate of foreign exchange in Nigeria using purchasing power parity option was conducted by Bakare and Olubokun (2011). This study tested the validity of the purchasing power parity (PPP) either as a compliment or an option to the present floating exchange rate system. The study used ordinary least square multiple regression method in analyzing the secondary data obtained from CBN and Federal Office of Statistics from 1986 to 2010. The model is estimated on the yearly data of naira per U.S. dollar rate for the period 1970–2008. The justifiability of purchasing power parity (ppp) as better choice for determination of rate of exchange the realistic value of naira was confirmed by the result. The study suggested the need for the Central Bank of Nigeria to opt for this new system of exchange rate determination.

The effect of exchange rate volatility on macroeconomic performance in Nigeria from 1986 to 2010 was studied by Azeez, Kolapo and Ajayi (2012). The model formulated depicts Real GDP as the dependent variable while Exchange Rate (EXR), Balance of Payment (BOP) and Oil Revenue (OREV) are proxied as independent variables. It employs the Ordinary Least Squared (OLS) and Johansen co-integration estimation techniques to test for the short and long runs effects respectively. The ADF test reveals that all variables are stationary. OLS results show that OREV and EXR are positively related while BOP is negatively related to GDP. Further findings reveal that oil revenue and balance of payment exert negative effects while exchange rate volatility contributes positively to GDP in the long run. It recommends that graft should be tackled frontally in the oil sector to ensure better utilization of oil revenue, more attention be paid to Agriculture and Solid mineral sectors and that the monetary authorities should pursue policies that would curb inflation and ensure stability of exchange rate.

An assessment of the relationship between the real exchange rate and inflation in Nigeria was made by Oriavwote and Eshenake (2012) between 1970 and 2010. Co-integration test result shows that the short run relationship between exchange rate and inflationary rate is sustainable in the long run. The satisfactory speed of adjustment indicated by the error correction model further supports this long run relationship. The result showed that both domestic and imported inflation appreciated. ARCH result indicates that volatility is persistence between the real exchange rate and rate of inflation. There was indication that rate of exchange in Nigeria has been susceptible to fluctuations in the rate of inflation. Policy makers should thus, not rely only on policies to stabilize real exchange rate by targeting inflation, but should employ domestic policies to increase export and production of previously imported inputs to reduce the problem of imported inflation.

The related literature reviewed studied the relationship between exchange rate and inflation vis-à-vis other macroeconomic variables. Most of the studies applied co-integration, ordinary least square and vector error correction model. However, this study is aimed at examining both the relationship and their causality among the macroeconomic variables using the Granger Causality Model, after testing the data for stationarity.

3. Methodology

In a bivariate causality framework using times series data from 1980 to 2010, the paper examines causal relationship among rate of exchange and some macroeconomic indicators in Nigeria. Usable data availability was considered in selecting 1980 as the cut off year. Data for exchange rate and other key macroeconomic variables were collected from Central Bank Statistical bulletin for several years and in particular from the CBN Statistical Bulletin, 50 years special Anniversary edition.

The Model

To examine whether there is a prediction between exchange rate and macroeconomic indicators (inflation, interest rate and real GDP) this study adopts the Granger causality. The study also evaluates the level of association between exchange rate and the selected macroeconomic variables. The Granger causality test determines the usefulness of a particular time series in predicting a different time series.

Causality under the Granger model is normally tested in the context of linear regression models and specified as follows in our bivariate linear autoregressive model of two variables X_1 and X_2 based on lagged values as applied by Pasquale (2006):

$$X_1(t) = \sum_{j=1}^p A_{11,j} X_1(t-j) + \sum_{j=1}^p A_{12,j} X_2(t-j) + E_1(t) \quad (1)$$

$$X_2(t) = \sum_{j=1}^p A_{21,j} X_1(t-j) + \sum_{j=1}^p A_{22,j} X_2(t-j) + E_2(t) \quad (2)$$

Where p is the maximum number of lagged observations included in the equation; A is an arrangement of mathematical elements i.e. the numerical part of the algebraic term.

X_1 is the exchange rate which is constant while X_2 takes the form of various macroeconomic indices identified above and the errors originating from predictions of the time series data are represented by E_1, E_2 .

Empirical findings reported in the research presented in this paper tested whether “exchange rate in Nigeria Granger-cause” macroeconomic indices and vice versa. The association between rate of exchange and rate of inflation on the one hand and among other explanatory variables, was examined using multiple regression equation estimated and specified thus:

$$EXRT_t = K + \beta_1 INF_t + \beta_2 IR_t + \beta_4 GDP_t + \mu_t$$

Where

$EXRT_t$ = Exchange rate in time t ;

GDP_t = Gross domestic product in time, t ;

IR_t = Interest rate in time t ;

INF_t = Inflation rate in time t .

4. Discussion of Findings

Granger test requires that the data involved should be stationary; accordingly the data was tested for stationarity by the application of Augmented Dicker- Fuller (ADF) test.

The series were checked for stationarity. However, the original time series data were plotted as shown in Figure 1 to have an initial idea as to the stationarity of the data representing the variables and the outcome actually reveals non stationarity.

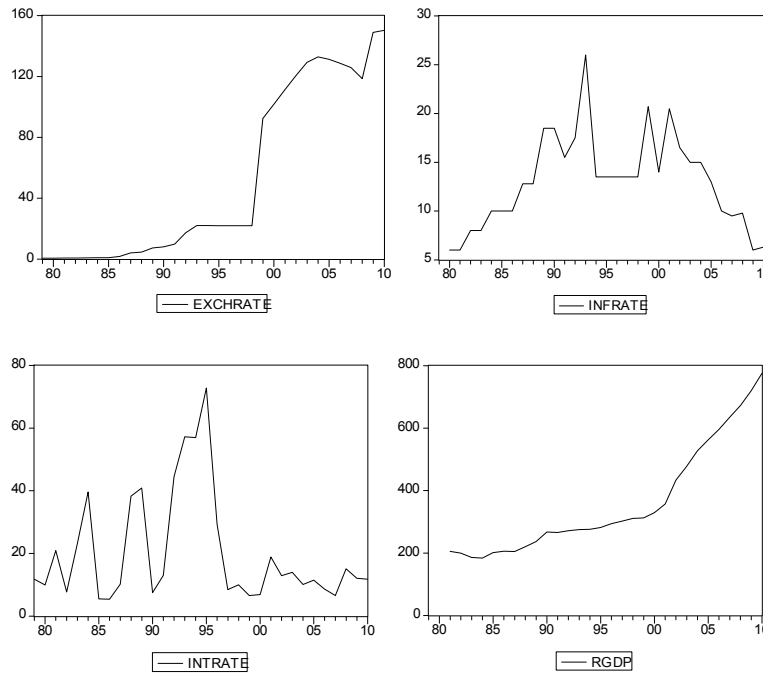


Figure 1. The original time series data

Source: Authors' Eview Output.

In the above graphical representation, all the series show evidence of unit root as the line graph failed to cross several times the zero-line with large departure from it. Augmented Dicker- Fuller (ADF) tests carried out on the series reveals the number of times the non-stationary time series are to be differenced to achieve stationarity. The results are presented in Table 1.

Table 1. ADF unit ROOT test result

Variable	Test Critical values			ADF	Status
	1%	5%	10%		
Exchange rate	-2.6453	-1.9530	-1.6218	-2.880163	1(1)
Inflation rate	-3.6852	-2.9705	-2.6242	-4.976846	1(1)
Interest rate	-3.6752	-2.9665	-2.6220	-5.240623	1(1)
Real GDP	-3.7076	-2.9798	-2.6290	-3.860900	1(2)

Source: Author's Eview output.

In the above, $H_0: a = 0$ is the null hypothesis versus the alternative: $H_1: a < 0$. The ADF unit root test result presented above confirms that stationarity was achieved for real GDP at the second difference. Other variables achieved stationarity at first difference. Exchange rate, inflation rate and interest rate were differentiated at first difference while real GDP was differentiated at second difference. The graphs for the differenced time series to confirm their new state of stationarity are as presented in Figure 2 below.

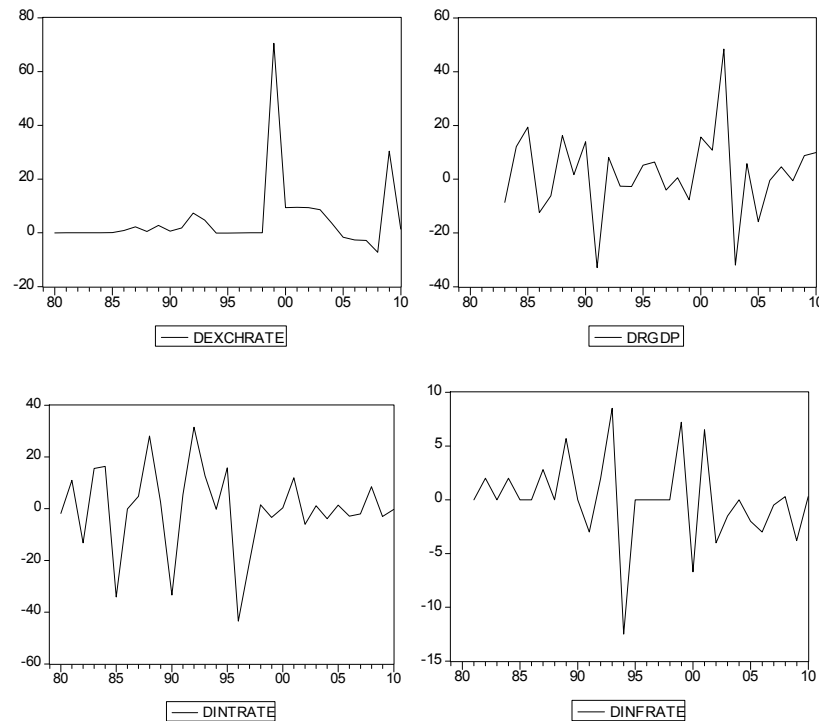


Figure 2. The differenced time series

Source: Author's Eview output.

Past empirical studies have not clearly defined the direction of the association or the causality between exchange rate and other selected macroeconomic variables. To examine this, the research reported in this paper employs Granger causality test (Granger, 1969) and the result presented thus.

Table 2. Granger causality technique

Null Hypothesis:	Obs	F-Statistic	Probability
DINFRATE does not Granger Cause DEXCHRATE	28	0.02660	0.97378
DEXCHRATE does not Granger Cause DINFRATE		0.58718	0.56401
DINTRATE does not Granger Cause DEXCHRATE	29	0.93197	0.40757
DEXCHRATE does not Granger Cause DINTRATE		0.39142	0.68034
DRGDP does not Granger Cause DEXCHRATE	26	0.00050	0.99950
DEXCHRATE does not Granger Cause DRGDP		0.72850	0.49443
DINTRATE does not Granger Cause DINFRATE	28	2.01257	0.15651
DINFRATE does not Granger Cause DINTRATE		5.28203	0.01295
DRGDP does not Granger Cause DINFRATE	26	0.81533	0.45602
DINFRATE does not Granger Cause DRGDP		1.73982	0.19992
DRGDP does not Granger Cause DINTRATE	26	0.62547	0.54469
DINTRATE does not Granger Cause DRGDP		2.87410	0.07883

Source: Authors' Eviews output.

The lagged values of exchange rates regressed on the lagged values of inflation rates used as explanatory variable in the pairwise Granger causality test in 28 observations presented above reveals no causal relationship between exchange rate and level of inflation in Nigeria. Given an F-statistics of 0.02660 and 0.58718 and

probability of 0.97378 and $0.56401 > 0.1$, the null hypothesis of independence between exchange rate and inflationary rate as well as other macroeconomic indices under consideration is accepted. In this case there is no Granger-causality in any direction between exchange rate and inflationary rate. This result corroborates the findings of Imimole and Enoma (2011). Their study reveals a positive relationship between exchange rate and inflationary pressure in Nigeria. Therefore, depreciation in exchange rate results in an increase in inflationary pressure.

Generally, the pairwise Granger causality also reveals independence between exchange rate and other macroeconomic indices applied in this study. However, among the causality between our explanatory variables in general, the test reveals a unidirectional causality running from inflation rate to interest rate.

The impact of exchange rate on the selected macroeconomic indices was examined using the least squares method. The findings are as presented in Table 3 below.

Table 3. Regression result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DINFRATE	0.948685	0.687462	1.379983	0.1803
DINTRATE	-0.045170	0.171673	-0.263116	0.7947
DRGDP	-0.014151	0.182455	-0.077556	0.9388
C	5.439525	2.809498	1.936120	0.0647
R-squared	0.074034	Mean dependent vary		5.343929
Adjusted R-squared	-0.041712	S.D. dependent vary		14.40985
S.E. of regression	14.70731	Akaike info criterion		8.346130
Sum squared resid	5191.318	Schwarz criterion		8.536445
Log likelihood	-112.8458	F-statistic		0.639624
Durbin-Watson stat	1.895716	Probe(F-statistic)		0.596918

Source: Authors' Eviews Output.

The result indicates that inflation rate has positive coefficient but not statistically significant. This result suggests that a direct relationship exist between exchange rate and inflationary rate in Nigeria. It further indicates that 1 percentage increase in exchange rate will cause inflationary rate to appreciate by 9.49 percent. Least squares depict an interest rate and real GDP with no significant impact on exchange rate in Nigeria. However, they both have a negative relationship with exchange rate. This is in line with the findings of Akinbobola (2012). The variable, interest rate has an inverse relationship with exchange rate.

The above results portray a short run relationship. Consequently a test for co-integration was performed using the Johansen trace test estimation approach. To achieve this, the trace test statistic approach was used in testing the sustainability of the existing relationship in the long run. At least a co integration vector which exists among the variables confirms this scenario. Result is presented in Table 4.

Table 4. The co-integration test result

Eigenvalue	LikelihoodRatio	5 Percent	1 Percent	Hypothesized
		Critical Value	Critical Value	No. of CE(s)
0.659313	70.68138	47.21	54.46	None **
0.524927	42.68485	29.68	35.65	At most 1 **
0.470049	23.33341	15.41	20.04	At most 2 **
0.230849	6.824183	3.76	6.65	At most 3 **

Table 4, above for the trace test indicates that there are three co-integrating equations at the 1 per cent significance level among the variables, exchange rate, inflation rate, interest rate and real GDP implying that the

short run association between exchange rate and inflationary rate is sustainable.

5. Conclusions

The importance of monetary and fiscal policies to the growth and development of the Nigerian economy cannot be over emphasized. The regulatory agencies in Nigeria such as Financial Reporting Council(FRC), Central Bank of Nigeria (CBN), Securities and Exchange Commission(SEC), Nigeria Stock Exchange(NSE), The Budget Office, Ministries of Finance and Planning, Bankers Committee and the Nigeria Deposit Insurance Corporation(NDIC) etc. The inter relationship and interactions of the variables of this study can redefine the growth and development equation of Nigerian economy. It is widely believed that these macroeconomic variables contribute a great deal in determining the general output of the economy. It is also an a priori expectation that inflation rate rises as the exchange rate is rising and in the same direction just as other macroeconomic indices deepens. The variables under study are also key to economic planning, budgeting and predictions. The above claims could be confirmed from the results generated from the analysis. The causal relationships among the variables were also examined with Nigeria as the test case. A positive but insignificant relationship exists between exchange rate and inflationary rate. However, no causal relationship exists between exchange rate and other selected macroeconomic variables of the study. Findings of this study through co integration trace test approach reveals that these short run relationships can also be sustained at the very long run as reported. Hence, monetary and fiscal policy setters should take a clue from this to fashion out strategies for the efficient regulation of these macroeconomic indices in order to grow the economy faster and sustain it even at the long run.

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