EFFECT OF EXCHANGE RATE VOLATILITY ON MACROECONOMIC PERFORMANCE IN NIGERIA

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Abstract
This study examines the effect of exchange rate volatility on macroeconomic performance in Nigeria from 1986 to 2010. 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 utilisation 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.

Keywords: Exchange Rate, Balance of Payment (BOP), Gross Domestic Product (GDP), Oil Revenue (OREV), Macroeconomic Performance.

1 INTRODUCTION
Exchange rate management has been a topical issue among academics and policy makers for a very long time. This started predominantly when the Gold standard collapsed in the 1930’s and subsequent emergence of the Bretton wood system of adjustment peg from the 1940’s, through the espousal of flexible exchange rate given by the developing nation in 1970 and those carrying out structure reforms in the 1980’s as well as in the wake of the currency crises in developing economies in the 1990’s.

Flexible exchange rate is accompanied by the fluctuation of exchange rate making it the major focus in the debate due to its impact on business outcome as nations’ business partners would prefer a stable exchange rate to a volatile one. It has been recognised in previous studies that maintaining a relatively stable exchange rate is important in boosting economic growth.
Volatility of exchange rate induces uncertainty and risk in investment decision with destabilizing impact on the macroeconomic performance (Mahmood and Ali, 2011). Mordi (2006) noted that operators in the private sector are concerned about volatility of exchange rate because of its effects on their investment which may be capital gains or losses. Exchange rate volatility has asymmetric effects on macro-economic variables.

Aliyu (2011) cited that appreciation of exchange rate results in increased imports and reduced 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 depreciation has a negative effect on developing countries (Razazadehkarsalari, Haghiri and Behrooznia, 2011).

Exchange rate is the price of one country’s currency in relation to another country. It is the required amount of units of a currency that can buy another amount of units of another currency. In Nigeria, the management of the exchange rate is carried out by the Central Bank of Nigeria. Following the adoption of Structural Adjustment Policy (SAP) in 1986, the country has moved from a peg regime to a flexible exchange rate regime. In practise, no exchange rate is clean or pure float, that is, a situation where it is left completely to be determined by market forces but rather the prevailing system is the managed float whereby monetary authorities intervene periodically in the foreign exchange market in order to attain some strategic objectives (Mordi, 2006).

Despite various efforts by the government to maintain a stable exchange rate, the naira has depreciated throughout the 80’s (Benson and Victor, 2012). It depreciated from N0.61 in 1981 to N2.02 in 1986 and further to N7.901 in 1990, all against the US dollar. The policy of guided or managed deregulation pegged the Naira at N21.886 against the US dollar in 1994. Further deregulation pushed it to N86.322=S1.00 in 1999 (Aliyu, 2011). It depreciated further to N120.97 in 2002 and N135.5 in 2004. Thereafter, the exchange rate appreciated to N132.15 in 2005 and later N118.57 in 2008. Towards the end of 2008 when the Global Financial Crisis took its toll, the naira depreciated to N150.0124 at the end of 2009.

Against this background, this research seeks to examine the effect of volatility of exchange rate on macro-economic performance in Nigeria over a period of 25 years (1986-2010).

Apart from this the introduction, the rest of this paper is organised as follows: section two focuses on the literature and empirical review while Section three relates to the methodology employed. Section four dwells extensively on analysis and discussion of findings. The last section presents the summary, conclusion and recommendations.

2. LITERATURE AND EMPIRICAL REVIEW

The effect of exchange rate volatility on macroeconomic performance has gained considerable importance in literature since 1970’s, when many developing countries shifted towards floating exchange rate from fixed exchange rate regime through adoption of the Structural Adjustment Policy. Apart from being an important macroeconomic variable, it is also a very important variable in international trade.

Exchange rate has been defined as the price of one currency in terms of another (Mordi, 2006). The increase or decrease of real exchange rate indicates strength and weakness of currency in relation to foreign currency and it is a standard for illustrating the competitiveness of domestic industries in the world market (Razazadehkarsalari, Haghiri and Behrooznia, 2011). When there is deviation of this rate over a period of time from the benchmark or equilibrium, exchange rate is called exchange rate volatility. It also indicates that misalignment of exchange rate as occurred where there is multiplicity of markets parallel with the official market.

It is a general believe that appreciation of currency expand imports and reduce export while depreciation increase cost of importation thereby discouraging import and encouraging export. However, empirical evidence on the effect of exchange rate volatility on economic performance has produced mixed pattern of results providing positive and negative effects. Empirical evidence carried out on the negative effect of exchange rate volatility on trade in open developing economies has remained mixed (European commission, 1990). Arize (1998) has found that there is a negative effect of exchange rate volatility on imports as well as exports and this effect is significant in the long and short run. The idea of risk transfer from highly
volatile investment to less risky ones by risk averse investors led many researchers to suggest that there exists a negative effect of exchange rate volatility on volume of trade because of increase in this risk level (De Grauwe, 1988). Risk averse investors invest in export so as to have less worry about the changes in exchange rate and prevent sudden loss of revenue (Mahmood and Ali, 2011).

Barkoulas et al (2002) examined the impact of exchange rate fluctuation on the volume and variability of trade flows. They concluded that, exchange rate volatility discourages expansion of the volume of trade thereby reducing its benefits. Eichengreen and Leblang (2003) carried out their research in 12 countries over a period of 120 years and found strong inverse relationship between exchange rate stability and growth. They concluded that the results of such estimations strongly depend on the time period and the sample.

Schnabl (2007) identified robust evidence through panel estimation that exchange rate stability is associated with more growth in the European Monetary Unit (EMU) periphery. The evidence, according to him, is strong for Emerging Europe which has moved to more stable environment. David, Umeh and Ameh (2010) examined the effect of exchange rate fluctuations on Nigerian manufacturing industry. They employed multiple regression econometric tools which revealed a negative relationship between exchange rate volatility and manufacturing sector performance.

Jin (2008) carried out a comparative study and found that appreciation of exchange rate increases GDP in Russia while it reduces GDP in Japan and China. Razazadehkarsalari, Haghiri and Behrooznia (2011) identified in Iran that during stagnation and low price period, depreciation of currency have positive and significant effects on real GDP while depreciation have insignificant effects on real GDP in high price period. Aliyu (2011) found that appreciation of exchange rate exert positive impact on real economic growth in Nigeria.

3. RESEARCH METHOD

There are a large number of macroeconomic variables which affect macro-economic performance beside exchange rate. They include; investment, consumption and government spending, trade, foreign direct investment, inflation, balance of payment, among others (Aliyu, 2011), since Nigeria is an oil producing Nation, oil revenue is also included. The study will cover a period of 25 years (1986-2010), 1986 being the year the monetary authority shifted from fixed exchange rate regime to flexible exchange rate regime. Data used are sourced from the Central Bank of Nigeria Bulletin various issues. The volatility of exchange rate was represented by the Nominal Effective Exchange Rate. The Johansen co-integrating estimation technique is employed to examine the long and short run effect of exchange rate volatility on economic performance.

In this study, the model adopted is based on the modification made on the model adopted by Razazadehkarsalari, Haghiri and Behrooznia (2011) and the improvement suggested by Aliyu (2011). The model is specified as follows:

\[ \text{GDP} = f(\text{EXR, BOP, OREV, INF}) \] (1)

The econometric model is expressed below:

\[ \text{GDP} = \beta_0 + \beta_1 \text{EXR} + \beta_2 \text{BOP} + \beta_3 \text{OREV} + \beta_4 \text{INF} + \mu \] (2)

Where:

- GDP = Gross Domestic Product
- EXR = Nominal Effective Exchange rate
- BOP = Balance of Payment
- OREV = Oil revenue
- INF = Inflation rate
- \( \mu = \) Stochastic Disturbance (Error Term)
- \( f = \) Functional Relationship
- Bo = Intercept of relationship in the model/constant

\( B_1 - B_3 = \) coefficients of each of the independent variables

By log linearizing, the model becomes;

\[ \log (\text{GDP}) = \beta_0 + \beta_1 \log (\text{EXR}) + \beta_2 \log (\text{BOP}) + \beta_3 \log (\text{OREV}) + \beta_4 \log (\text{INF}) + \mu \] (3)
Where:

Log = Natural log

From Equation 3, the model can be specified in a time series form as;

\[ \text{Log (GDP)}_t = \beta_0 + \beta_1 \text{log (EXR)}_t + \beta_2 \text{log (BOP)}_t + \beta_3 \text{log (OREV)}_t + \beta_4 \text{log (INF)}_t + \mu \ldots \ldots (4) \]

3.1 DEFINITION OF VARIABLES

**Gross Domestic Product (GDP):** It is the money value of goods and services produced in an economy during a period of time irrespective of the nationality of the people who produced the goods and services.

**Nominal Effective Exchange Rate (EXR):** It is the index that measures the average change of the Naira’s exchange rate against all other currencies.

**Balance of Payment (BOP):** It is defined as a systematic record of economic and financial transactions for a given period between residents of the economy and non-residents. These transactions involve the provision and receipts of real resources and changes in claims on, and liabilities to the rest of the world.

**Inflation Rate (INF):** It is the percentage change in general price level of goods and services in an economy over a period of time.

**Oil Revenue (OREV):** It is the total oil revenue received by the government.

4 DATA ANALYSIS AND DISCUSSION

Unit Root Test

It has often been argued that macroeconomic data is characterized by a stochastic trend, and if untreated, the statistical behaviour of the estimators is influenced by such trend (Aliyu, 2001). The treatment, which involves differencing the data to determine the level of co-integration, is carried out in this section using the Augmented Dickey Fuller (ADF). In order to apply co-integration, all non-stationary variables should have same level of integrating factor. The result shows that all the variables are stationary at same order, that is, second difference as summarized below:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Level</th>
<th>1st difference</th>
<th>2nd difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGDP</td>
<td>1.696*</td>
<td>-1.006</td>
<td>-3.049***</td>
</tr>
<tr>
<td>LEXR</td>
<td>-0.563</td>
<td>-3.500**</td>
<td>-7.132*</td>
</tr>
<tr>
<td>LBOP</td>
<td>-5.436*</td>
<td>-7.261*</td>
<td>-7.452*</td>
</tr>
<tr>
<td>LOREV</td>
<td>-0.699</td>
<td>-4.738*</td>
<td>-6.714*</td>
</tr>
<tr>
<td>LINF</td>
<td>-2.969***</td>
<td>-5.820*</td>
<td>-6.368*</td>
</tr>
</tbody>
</table>

Source: authors’ computation

(***)* denotes rejection of null hypothesis at the 5% (1%)

4.1 CO-INTEGRATION TEST

Having established the order of integration of this series, the next task is to determine the number of long run equilibrium relationships or co-integrating vectors among the variables. Note that when series are found to be integrated of the same order, it implies that an equilibrium relationship exists among the variables. Co-integration among these variables is tested through the Johansen test. The result is presented in Table 2. The
result reveals that there exists one co-integrating equation or long run equilibrium relationship at 1% significance level.

Table 2: Trace test

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>LR Statistic</th>
<th>1% critical value</th>
<th>Hypothesized No. of CE(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.898</td>
<td>108.68</td>
<td>68.52</td>
<td>None*</td>
</tr>
<tr>
<td>0.700</td>
<td>56.26</td>
<td>47.21</td>
<td>At most 1*</td>
</tr>
<tr>
<td>0.573</td>
<td>28.53</td>
<td>29.68</td>
<td>At most 2</td>
</tr>
<tr>
<td>0.275</td>
<td>8.96</td>
<td>15.41</td>
<td>At most 3</td>
</tr>
</tbody>
</table>

Source: authors’ computation
Max-Eigen and Trace Statistic tests indicate 2 co-integrating equation(s) at 5% level.
* denotes rejection of the hypothesis at the 1% level.

The table below summarized the long run coefficients of the model.

Table 3: Normalized Co-integrating Equation

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXR</td>
<td>1818.332*</td>
<td>634.357</td>
</tr>
<tr>
<td>BOP</td>
<td>-0.324*</td>
<td>0.0701</td>
</tr>
<tr>
<td>OREV</td>
<td>-0.0934*</td>
<td>0.0079</td>
</tr>
<tr>
<td>INF</td>
<td>-2346.228*</td>
<td>565.557</td>
</tr>
</tbody>
</table>

Source: Author’s computation
Log likelihood=-1088.348
* indicate significance of parameter employing standard error test

From the result above, there exists a positive and statistically significant relationship between EXR and GDP. That is, a unit increase in exchange rate adds 1818.332 units to GDP. However, the expectation that exchange rate instability should have a destabilizing effect on investment, therefore, the positively signed coefficient of exchange rate fluctuations is a deviation from the a priori expectation. This result conforms to that of Aliyu (2011). He noted that, alternatively, a reasonable explanation to this is the important role of Naira appreciation through imports and that an appreciating Naira can provide the opportunity of importing relatively required technological inputs and capital, thereby, boosting real GDP.

The result also indicates that there exists a negative relationship between the GDP and other independent variables (BOP, INF and OREV). A percentage increase in BOP, OREV and INF will result to reduction in GDP by 3.236%, 0.934% and 23462.23% respectively. All these variables are also statistically significant. The negative relationship between BOP and GDP stems from the fact the Balance of Payment position in Nigeria has in most cases been unfavourable. Also, the inverse relationship between oil revenue accruing to the government and GDP is not in conformity with the expected result. This could be a result of the misappropriation and poor administration of public funds. Also, prior to the introduction of Sovereign Wealth Fund, excess crude oil revenue were shared among the tiers of government who misapplied the funds with little or nothing to show in terms of value added to the economy. Also, inflation rate affects macro-economic performance adversely and it is statistically significant. This indicates that expansionary macroeconomic policy that increases the inflation rate will deter GDP.
4.2 SHORT-RUN ANALYSIS: OLS

The OLS estimation technique was employed in examining a short-run impact of exchange rate volatility on macro-economic performance. The table below shows the summary of the results.

TABLE 4: OLS RESULT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>T-statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXR</td>
<td>1848.534</td>
<td>632.455</td>
<td>2.9228*</td>
<td>0.0084</td>
</tr>
<tr>
<td>BOP</td>
<td>-0.04634</td>
<td>0.0567</td>
<td>-0.8185</td>
<td>0.4227</td>
</tr>
<tr>
<td>OREV</td>
<td>0.05158</td>
<td>0.011</td>
<td>4.697*</td>
<td>0.0001</td>
</tr>
<tr>
<td>INF</td>
<td>1196.744</td>
<td>966.539</td>
<td>1.2382</td>
<td>0.2300</td>
</tr>
<tr>
<td>R²</td>
<td>0.8408</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.8089</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>26.409*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Author’s computation

*denotes significance at the 5% level

From above, the coefficient of determination of the multiple regression is 84.08%, indicating that the independent variables can explain 84.08% variation in GDP while the remaining 15.92% can be explained by variables outside the model. The Adjusted R² which takes account of all variables is also high (80.89%). This shows that there is high causal relationship between GDP and all the independent variables (EXR, BOP, OREV and INF). All independent variables are significant except Balance of Payment and Inflation Rate. This shows that BOP and INF play no important role in determining GDP in the short-run. The F-statistic is 26.409 showing the significance of the whole model. The coefficients of all independent variables also have a positive sign except BOP.

5. CONCLUSION AND RECOMMENDATIONS

Volatility in exchange rate affects the aggregate demand and supply of any nation but the degree of effectiveness and their consequences depend on the existing economic conditions. This study employs empirical analysis in examining the effect of exchange rate volatility on macro-economic performance using data from 1986 to 2010. ADF was employed in testing for the stationary of the variables and the hypothesis of non-stationarity was rejected at second difference.

The Johansen co-integration result test reveals one co-integrating equation at 1% significance level. This is an indication that, there is tendency for the variables to be at equilibrium on the long run. The short run and long run analysis show a negative relationship between GDP and BOP, indicating persistent unfavourable position of Nigeria’s Balance of Payment. Oil Revenue is positively related to GDP in the short-run but negatively related to it in the long run, showing a high level of mismanagement of fund by government, so also, is Inflation. Oil revenue is significant in both long and short run while BOP and INF are significant in the long run but insignificant is the short run.

It has been observed in this study that Exchange Rate Volatility is significant and has positive relationship with macro-economic performance both in the long and short run. Due to exchange rate volatility, investor utilize the opportunity of an appreciating Naira to imports required capital and technology. Thus, reflecting the positive trend.

In the light of results of our study, we recommend:

First, a renewed commitment by the government to fighting graft in the administration of oil wealth. Second, monetary authority should focus on reversing the persistent BOP trend by paying more attention to Agriculture and Solid mineral sectors. Third, monetary authorities should pursue policies that would curb inflation and ensure stability of the exchange rate.
REFERENCES


