

## **The Effect of Exchange Rate on Imports and Exports in Nigeria from January 1996 to June 2015**

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### **Abstract**

*This study examines the effect of exchange rates on imports and exports in Nigeria using monthly data from 1996 - 2015. A three variable vector auto regression (VAR) consisting of imports, exports and exchange rates (US dollar to Naira) is considered to examine the effect of exchange rate on imports and exports in Nigeria. Augmented Dickey Fuller (ADF) test is used to test the stationarity of each of the variables. There are two lagged values of each variable. VAR lag order selection discloses that the lag of order 2 is sufficient for the model based on Schwarz information criterion (SIC). The VAR result shows that exchange rates have a positive and insignificant effect on imports while it has a negative and insignificant effect on exports at lag 1 but positive and insignificant effect at lag 2. Exports were also found to affect exchange rates negatively while imports affect exchange rates positively. The above result thus shows that exchange rate in Nigeria is not affected by the activities of imports and exports. Neither does an exchange rate affect the volume of imports and exports in Nigeria. Contrary to economic theory that a fall in the exchange rate will cause imports to fall, imports in Nigeria has been on the increase irrespective of the exchange rates. The result of the impulse response function shows that exchange rates responded positively to imports and negatively to exports. This study therefore recommend the following: Exportation in Nigeria particularly in the non-oil sector should be encouraged through entrepreneurial development. The high level of imports mainly consumer goods can be discouraged by improvement in local production so that they can be competing with the foreign goods. Only goods with high proportion of necessities e.g. raw material goods should be imported. Policy measures towards the stabilization of the exchange rates are highly recommended so that level of imports can be controlled and exports encouraged. Exports capacity should be enhanced through acquisition of improved technology and means of production; this will in turn further reduce the demand for imports. Deliberate policies targeted at diversifying foreign earnings should be introduced. Going by the results of this study, the Central Bank of Nigeria is advised not to devalue the naira due to its insignificant effect/impact on export in Nigeria.*

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**Keywords:** *Exchange rate, Imports, Exports, Vector Auto regression (VAR)*

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## **1.0 Introduction**

Most of the countries of the world are engaged in trade with one another in which Nigeria is not an exception. Nigeria exports agricultural products such as cocoa, palm produce, rubber as well as solid minerals such as gold, tin and columbite etc. The major foreign earner is crude oil and liquefied natural gas. Nigeria imports machinery, refined petroleum product, automobile, etc. The exchange of goods between countries is predicted from the economists' concept of the doctrine of comparative advantage which enjoins countries to produce goods in which they are endowed in order to minimize the cost of producing such goods. The drop in the oil prices in the world market has led to drastic reduction in foreign earnings with its attendant consequences in the economy. The depreciation of local currency has also affected the non – oil sector and imported goods have become expensive. Economists believe that appreciation of exchange rate increases imports while depreciation would increase exports and discourage imports. Also exchange rates depreciation causes a change from foreign goods to local goods. Generally, it is believed that trade is an instrument of growth and increases the welfare of a nation. However, there is still some ambiguity with empirical evidence on benefit of trade mainly for countries with volatile exchange rates. The main objective of this study therefore is to evaluate the effect of exchange rate on import and export in Nigeria using monthly data series from January 1996 to June 2015. The paper is structured in five sections: section one is the introduction of the research. The next section summarizes some literature reviews and Econometric theory involved in past and current study. Section three describes the Research Methodology applied in the study, while section four is on the Discussion of the Result. The last section which is five, gave the conclusion and recommendation.

## **2.0 Literature Review**

Exchange rate is involved in the flow of goods and services in any nation. In Nigeria there were a lot of policies measure put in place to control excessive demand for foreign exchange due to experiences in the late 1970s and early 1980s. The objectives were to preserve the value of the domestic currency, maintain a favourable external reserves position, and ensure external balance without compromising the need for internal balance and overall goal of macroeconomic stability (CBN, 2015).

According to Omojimite and Akpokodje (2010), in 1982 full exchange rate controls were adopted due to the increase in demand for foreign exchange at a time when the supply was reduced, this gave opportunity to develop a flourishing parallel market for foreign exchange. In September, 1986, first and second tier foreign exchange market (SFEM) was implemented and was changed to FEM in 1987. Bureau de change came into existence in 1989 to broadening the scope of FEM. The policy was reversed in 1994 where exchange rate was pegged to the US dollar, there was centralization of foreign exchange in the CBN. There was another policy reversal in 1995, this translated into the establishment of the Autonomous Foreign Exchange Market (AFEM) and this later changed into a daily two-way quote Inter-Bank Foreign Exchange Market (IFEM) in 1999. The Retail Dutch Auction System (RDAS) was used in July 22, 2002 as a result of increase in the demand force in foreign exchange market and the determination in the reduction of the country's external reserves. In 2006, Wholesale Dutch Auction System (WDAS) was introduced where CBN engaged in active trading with authorized dealers. In the early 2009

there was a policy reversal and there was re-introduction of RDAS. There was another reversal in July, 2009 with the introduction of WDAS. Exchange rates policy in Nigeria kept changing.

Trade policy in Nigeria has experienced extreme policy fluctuations since 1960s (Adenikinju, 2005). Tariffs have been used to increase fiscal revenue several times, protect the domestic industries from competition and limit imports to secure foreign exchange. Also, to limit importation of particular items, different forms of non-tariff barriers such as prohibitions, licensing schemes and quotas were used. Trade policy was also used to promote manufactured exports and improve the ties in the domestic economy to increase and stabilize exports revenue and brought down the dependency of the economy on the oil sector (Olaniyi, 2005).

Exchange rates have effects on the volume of imports and exports as well as country's balance of payments position (Hossain, 2002). Azeez, Kolapo & Ajayi (2012), also took note and affirmed that exchange rate is called exchange rates volatility when there is deviation of exchange rates over a period of time from the equilibrium. Aliyu (2011) noted that appreciation of exchange rates results in increased imports and reduced exports while depreciation expand exports and discourage imports. Exchange rates depreciation is likely to cause a shift from foreign goods to local goods.

Jarita (2008) studied the impact of exchange rate shocks on prices of imports and exports in Malaysia (1999 – 2006). He used Vector Error Correction Model, Impulse Response Function and Variance Decomposition. The result shows that exchange rate shocks significantly affected the fluctuation of imports prices in Malaysia.

Moshen (2013) made research on the effect of exchange rate on imports, exports, product prices and other macroeconomic variables from 1960 to 2012. He used Vector Autoregression model, Cointegration test and Impulse Response Function for the analysis. His results showed that exchange rate has no effect on macro-economic variable.

Carmen and Nicolae (2011) studied the effect of exchange rate on export in Romania (2nd quarter 2003 – 1st quarter 2011). He used Vector Autoregression model and Impulse Response Function for the analysis. It was discovered that a shock in exchange rate has significant effect on export.

Godfrey and Cosmas (2014) made investigation on the impact of exchange rates on exports, imports and national output Tanzania. (1990 – 2011). He adopted Vector Error correction model, Impulse Response Function, Variance Decomposition and Time series Simulation. The variables have long run relation and converging at equilibrium as times passes but lower long run impact on and export and import.

Muhammed (2014) studied whether exchange rate instability in Pakistan affects import, export, trade balance, foreign exchange reserve and GDP. He used yearly data 1952 to 2010. Correlation Removal method, multi colinearity detection and granger causality test were used for the analysis. The result showed that depreciation of exchange rate has positive effect on exports.

Mahmood, Ehsanallah & Ahmed (2011), they worked on whether fluctuation in exchange rates affects the macro-economic variables in Pakistan. They used monthly data from 1975 to 2011. Generalized Autoregressive Condition Heteroskedasticity (GARCH) method was used for the analysis. The result shows that exchange rate positively affected the variables.

Odili (2015) studied the effect of real exchange rate volatility on Nigerian imports from 1971 to 2011. Co-integration and Parsimonious Error Correction were used. The result showed that exchange rate has positive and significant effect on import only in the long run and there is unidirectional causality from exchange rate and import.

Odili (2015) analyzed the long and short run impact of real exchange rates volatility and level of economic growth on international trade (exports and imports) in Nigeria. He used vector error correction model for the analysis and employed time series data from 1971 to 2012. His result revealed that in both short and long run, exports and imports were influenced by real exchange rate, exchange rate volatility, foreign income, gross domestic product, term of trade and changes in exchange rate policies. The findings also revealed, that exchange rate depressed import and export at the long run. The result of pairwise Granger Causality test, revealed unidirectional Causality running from export to exchange rate volatility; and from exchange rate to import. Also there is unidirectional causality flow from real GDP to import and export.

Ibikunle and Akhanolu (2011), studied the impact of exchange rates volatility on the trade flow in Nigeria. They used Generalized Autoregressive Condition Heteroskedasticity (GARCH) for the analysis and annual data from 1970 to 2009 was used. The result revealed an inverse and statistical insignificant relationship between aggregate trade and exchange rates volatility in Nigeria.

Oyovwi (2012) studied the effect of exchange rates volatility on economic growth in Nigeria using annual data from 1970 to 2009. He also employed the Generalised Autoregressive Conditional Heteroscedasticity (GARCH) technique to generate exchange rates volatility; his findings showed that in the short run, economic growth had positively responsive to exchange rates volatility, while in the long run; a negative relationship existed between the two variables.

Bahmani-Oskooee & Kovyryalova (2008), in their investigations on the impact of exchange rates volatility on international trade, 177 commodities trade between the United State (US) and United Kingdom (UK) were used. They used co-integration and error correction techniques to analyze the data covering the period of 1971 to 2003. The results showed that the volatility of the real bilateral dollar – pound rates has a short-run significant effect on the imports of 109 and exports of 99 industries. In the long run, it was revealed that the number of significant cases reduced with imports of 62 and exports of 86 industries which are significantly affected by the exchange rates volatility.

### **3.0 Research Methodology**

#### **3.1: Vector Auto regression model (VAR)**

The vector Auto regression model was used to analyse data in this study. According to Brooks (2008), the model was popularized in econometrics by Sims (1980) as a natural generalization of univariate autoregressive model. A VAR is a system regression model where there is more than one dependent variable. The purpose of VAR is to see what effect a given change in a variable would have upon the future values of the variables in the system or examines the relationship between the variables. Three sets of statistics will be estimated with VAR model: block significance test/causality, impulse response and variance decomposition. (Agung, 2009).

#### **3.2 Research Hypotheses**

The research hypotheses are:

1.  $H_0$ : Exchange rate has no significant effect on imports  
 $H_A$ : Exchange rate has significant effect on imports
2.  $H_0$ : Exchange rate has no significant effect on exports  
 $H_A$ : Exchange rate has significant effect on exports

### 3.3 Model Specification

VAR model that is used for this project work is stated below:

$$y_{1t} = \beta_{10} + \beta_{11}y_{1t-1} + \beta_{12}y_{1t-2} + \lambda_{11}y_{2t-1} + \lambda_{12}y_{2t-2} + \delta_{11}y_{3t-1} + \delta_{12}y_{3t-2} + u_{1t} \quad (3.1)$$

$$y_{2t} = \beta_{20} + \beta_{21}y_{1t-1} + \beta_{22}y_{1t-2} + \lambda_{21}y_{2t-1} + \lambda_{22}y_{2t-2} + \delta_{21}y_{3t-1} + \delta_{22}y_{3t-2} + u_{2t} \quad (3.2)$$

$$y_{3t} = \beta_{30} + \beta_{31}y_{1t-1} + \beta_{32}y_{1t-2} + \lambda_{31}y_{2t-1} + \lambda_{32}y_{2t-2} + \delta_{31}y_{3t-1} + \delta_{32}y_{3t-2} + u_{3t} \quad (3.3)$$

This can be written in matrix form

$$\begin{bmatrix} y_{1t} \\ y_{2t} \\ y_{3t} \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \lambda_{11} & \delta_{11} \\ \beta_{21} & \lambda_{21} & \delta_{21} \\ \beta_{31} & \lambda_{31} & \delta_{31} \end{bmatrix} \begin{bmatrix} y_{1t-1} \\ y_{2t-1} \\ y_{3t-1} \end{bmatrix} + \begin{bmatrix} \beta_{12} & \lambda_{12} & \delta_{12} \\ \beta_{22} & \lambda_{22} & \delta_{22} \\ \beta_{32} & \lambda_{32} & \delta_{32} \end{bmatrix} \begin{bmatrix} y_{1t-2} \\ y_{2t-2} \\ y_{3t-2} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \end{bmatrix} \quad (3.4)$$

Where  $y_{1t}$  = Import                       $y_{2t}$  = Export                       $y_{3t}$  = Exchange rate

**3.4 Impulse response and Variance Decomposition:** In VAR model, F-test will not reveal whether changes in the value of a given variable have positive or negative effects on other variables or how long it would take for the effect of the variable to work through the system. Such information will however be given by an examination of the VAR's impulse responses and variance decompositions.

Impulse response traces out the responsiveness of the dependent variables in the VAR shocks to each of the variables, so for each variable from each equation separately, a unit shock is applied to error, and the effects upon VAR system are noted. Thus, if there are  $g$  variables in a system, a total of  $g^2$  impulse response could be generated. This is achieved in practice by expressing the VAR model as vector moving average (VMA).

Variance decomposition gives the proportion of the movements in dependent variables that are due to their own shocks versus shocks to the other variables. It determines how much of the step ahead forecast error variance of a given variable is explained by innovations to each explanatory variable.

### 3.5 Test for Stationarity

Dickey and Fuller developed Augmented Dickey – Fuller (ADF) test. The test is conducted by adding lagged values of the dependent variables  $\Delta y_t$ . Augmented Dickey – Fuller (ADF) test consists of estimating the following regression.

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \sum \delta_i \Delta y_{t-i} + u_t, \quad (3.7)$$

Where  $u_t$  is a white noise error term and where  $\Delta y_{t-1} = (y_{t-1} - y_{t-2})$ ,  $\Delta y_{t-2} = (y_{t-2} - y_{t-3})$ , etc.

## 4.0 DISCUSSION OF THE RESULT

### 4.1 Lag order selection (Lag length)

Table 4.1 below reveals that the lag of order 2 is sufficient for the model based on Schwarz information criterion (SIC) or Schwarz Bayesian information criterion (SBIC). However, the Final predictor error (FPE), Akaike information criterion (AIC) and Hannan-Quinn information criterion (HQ) selected lags of order 3, while Sequential modified LR tested statistics (LR) selected lag of order 7.

**Table 4.1: VAR Lag Order Selection Criteria**

VAR Lag Order Selection Criteria  
Endogenous variables: IMP EX  
EXCR



Exogenous variables: C  
Date: 10/30/15 Time: 09:45  
Sample: 1996M01 2015M06  
Included observations: 226

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-7511.469	NA	1.52e+25	66.49972	66.54513	66.51805
1	-6892.171	1216.673	6.88e+22	61.09886	61.28048	61.17216
2	-6836.979	106.9664	4.57e+22	60.69008	61.00791*	60.81834
3	-6821.371	29.83348	4.31e+22*	60.63160*	61.08566	60.81484*
4	-6815.829	10.44749	4.45e+22	60.66220	61.25247	60.90041
5	-6810.998	8.976779	4.61e+22	60.69910	61.42559	60.99228
6	-6801.389	17.60340	4.59e+22	60.69371	61.55641	61.04186
7	-6791.949	17.04187*	4.58e+22	60.68981	61.68873	61.09294
8	-6783.840	14.42460	4.62e+22	60.69769	61.83283	61.15579

Source: Estimate by Eviews 9

#### 4.2 Stationarity Test

Augmented Dickey Fuller (ADF) test at level is used to test the stationarity of each of the variables with a constant and no trend. Schwarz's criterion chooses 2 lags of dependent variables in the test regression. It is shown that the p-value for imports (IMP), exports (EX) and exchange rates (EXCR) were 0.6097, 0.3606 and 0.7147 respectively. The values are greater than critical value of 0.05; we cannot reject  $H_0$  then, the series have unit roots and non-stationary. Non-stationary data produces spurious regression hence stationarity is tested using Augmented Dickey Fuller (ADF) test at first difference. The p-value for all the variables were 0.000 respectively, therefore we reject  $H_0$ , showing that the series are stationary. See Tables 4.2 below.

**Table 4.2: Augmented Dickey Fuller (ADF)**

Variables	At level	At first difference
Imports	0.6097	0.0000
Exports	0.3606	0.0000
Exchange rates	0.7147	0.0000

Probability values only reported

#### 4.3 Vector Autoregression Estimate

Vector Autoregression Estimate is to test the significance of the variables. Based on t-statistic for testing lag of the individual variable, the result reveals that some of the coefficients are not significantly different from zero. Imports (IMP) has positive and significant effect on exports (EX) at first lag but has positive and insignificant effect at second lag while adjusted partial effect of imports (IMP) on exchange rates (EXCR) has positive and insignificant effect at both lags. Export (EX) has positive and insignificant adjusted partial effect on imports (IMP) and; negative and insignificant effect on exchange rates (EXCR) at both lags. EXCR(-1) and EXCR(-2) have positive and insignificant effect on imports while it has negative and insignificant effect on exports at lag 1 but positive and insignificant effect on lag 2. The above result thus shows that

exchange rate in Nigeria is not affected by the activities of imports and exports. Neither does an exchange rate affect the volume of imports and exports in Nigeria. Contrary to economic theory that a fall in the exchange rate will cause imports to fall, imports in Nigeria has been on the increase irrespective of the exchange rates.

Testing the joint significance of the lags of the variables on each variable using the F-test, the result shows that all the joint coefficients of the variables were significant. F- critical value at 0.05 level of significant i.e.  $F_{\alpha}(k-1)$ , (n-k) degree of freedom where  $k = 7$ ,  $n = 232$ ,  $F_{0.05}(6,225) = 2.09$ . Given the F-test calculated values for imports (IMP), exports (EX) and exchange rates (EXCR) as 109.6075, 241.8531 and 1940.689 respectively, the joint coefficients were significantly different from zero ( $F_0 > F_{0.05}(6,225)$ ). Thus we do not fail to reject  $H_0$  and conclude that variables in the model have significant impact on the future values of each of the variables. See Table 4.3

R-square for IMP in Table 4.3 is 0.75, implies that the last period's values of IMP, EX and EXCR explains 75 per cent of the variation in the current imports value while the adjusted R-square is 0.74 (74 per cent). The R-square value for EX is 0.87, this shows that about 87 per cent of the variation in current value of EX was explained by past values of IMP, EXCR and EX. The adjusted R-square was 0.86 (86 per cent). Table 4.3 also shows the R-square value of EXCR which is 0.98, indicating that the previous period's value of the variables of the model accounts for 98 per cent of current value of EXCR. It also has an adjusted R-square of 0.98 (98 per cent). The above results show good fitness of the model given the amount of variations that were taken care of by each of the models of the system.

**Table 4.3: Vector Autoregression Estimates**

Vector Autoregression Estimates

Date: 10/30/15 Time: 09:40

Sample (adjusted): 1996M03 2015M06

Included observations: 232 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	IMP	EX	EXCR
IMP(-1)	[ 3.49835]	[ 3.32903]	[ 0.40564]
IMP(-2)	[ 9.48140]	[ 0.92258]	[ 0.82045]
EX(-1)	[ 1.25137]	[ 7.25831]	[-0.05118]
EX(-2)	[ 0.24360]	[ 5.31702]	[-0.36301]
EXCR(-1)	[ 0.07346]	[-1.02259]	[ 15.6466]
EXCR(-2)	[ 0.21551]	[ 1.22088]	[-0.84171]
C	-15363.19 (26425.0) [-0.58139]	-14253.08 (40722.8) [-0.35000]	2.376815 (1.26535) [ 1.87839]

R-squared	0.745084	0.865761	0.981043
Adj. R-squared	0.738287	0.862182	0.980538
Sum sq. resids	4.37E+12	1.04E+13	10027.78
S.E. equation	139417.1	214851.9	6.675920
F-statistic	109.6075	241.8531	1940.689
Log likelihood	-3073.732	-3174.067	-766.0935
Akaike AIC	26.55804	27.42299	6.664599
Schwarz SC	26.66203	27.52699	6.768595
Mean dependent	277966.7	638202.2	122.7015
S.D. dependent	272522.9	578742.7	47.85360
Determinant resid covariance (dof adj.)			
		3.86E+22	
Determinant resid covariance			
		3.52E+22	
Log likelihood			
		-7009.795	
Akaike information criterion			
		60.61030	
Schwarz criterion			
		60.92229	

### Impulse Response Function

This is used to find the direction of the dynamic behaviour of the variables. This analysis is important because it allows us to assess the extent of shock of the variables on a particular variable for appropriate policy recommendation.

Figure 4.1 panel a below shows the reaction of imports (IMP) to a shock in itself, exports (EX) and exchange rates (EXCR). IMP, EX and EXCR responds positively to IMP throughout the 10 periods with IMP falling in its response while EX and EXCR almost constant throughout the period. The response of EX to itself, IMP and EXCR as presented in and Figure 4.1 panel b shows that EX responded positively to the three variables during the periods with the exception of period 1 of IMP and period 2-4 of EXCR. The result shows that the response of EX to itself was falling throughout the period but not zero. The response of EXCR to itself, IMP and EX is shown in panel c of Figure 4.1, EXCR responded positively to itself and IMP; and negatively to EX throughout the period.



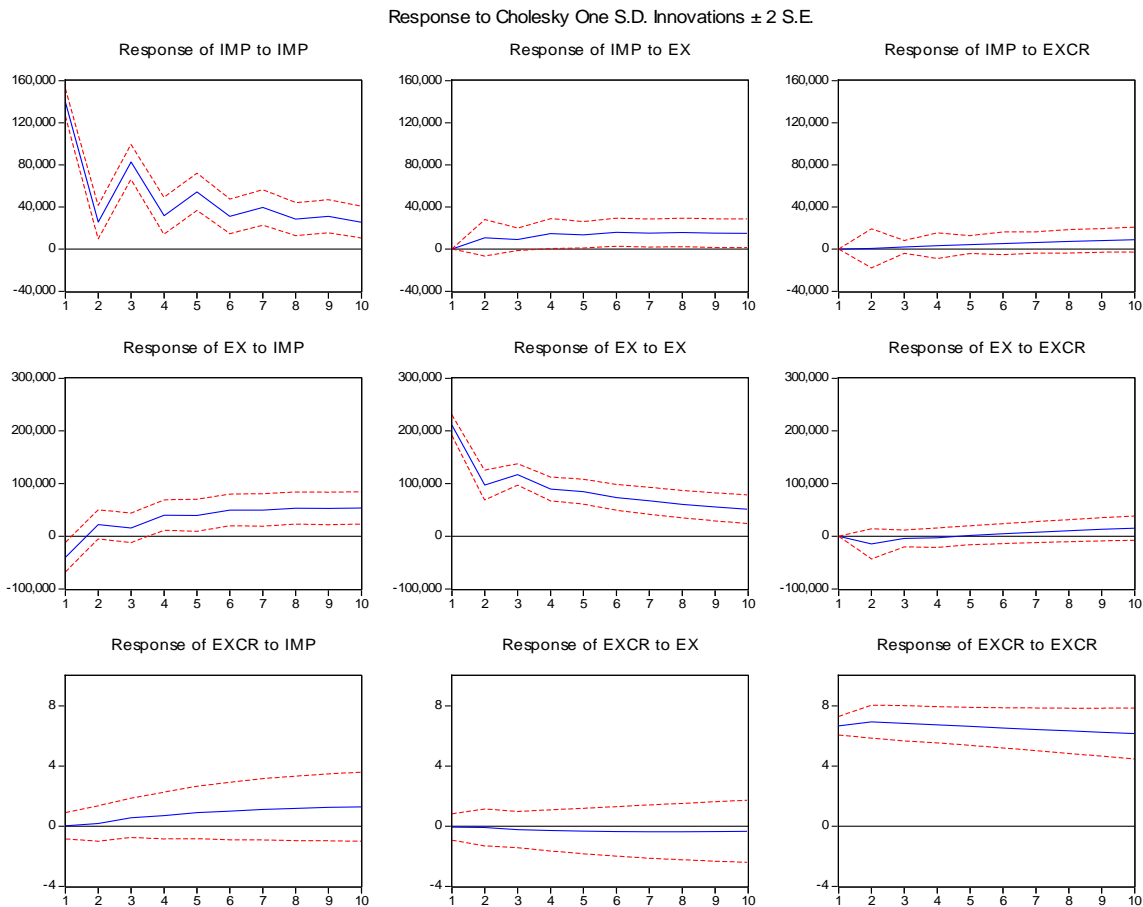


Figure 4.1: Impulse Response

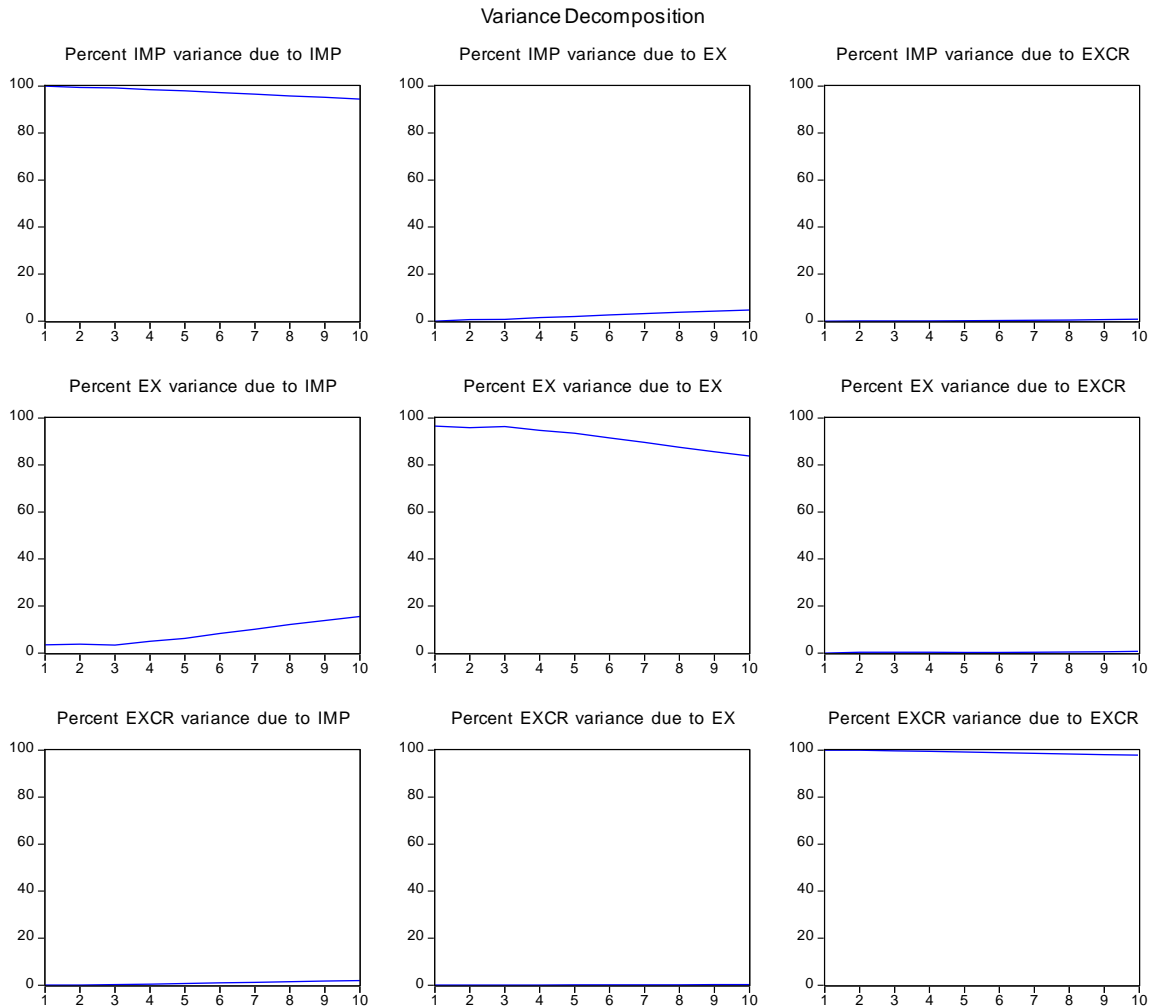
#### 4.5 Variance decomposition

The variance decomposition of IMP forecast error is displayed in Figure 4.2 panel a using the ordering IMP, EX and EXCR. Variance decomposition of IMP in the first period shows that none of the other variables i.e. EX and EXCR could explain any variation on IMP. After 10 periods, EX explains 5.2 per cent of the forecast error's variance while EXCR accounts for 0.3 per cent. Thus the driving force behind the variation in IMP is EX. The variance decomposition of EX as shown in Figure 4.2 panel b shows that in the first period IMP contribute to variability in EX (3.4 per cent) while EXCR could not explain variability in EX. After 10 periods, IMP accounts for 16 per cent of the forecast error's variation while EXCR accounts for 0.38 per cent. From this the driving force behind EX is IMP. The above thus explains that EXCR accounts less in the variation of IMP and EX. Exchange rates in Nigeria do not have much impact on imports and exports.

Finally from figure 4.2 panel c, in the first period IMP and EX explain variability in the forecasting error variance in EXCR. After 10 periods the variance decomposition of EXCR reveals that IMP accounts for only 0.86 per cent of forecast error's variation in EXCR while EX accounts for only 0.64 per cent, both accounting for about only 1 per cent in the variation in

EXCR. This has also stressed the result of the VAR that imports and exports do not respond to the variation in exchange rates neither do exchange rates respond to the variation in imports and exports in Nigeria.

**Figure 4.2: Variance Decomposition**



**5.0 Conclusion/ Recommendation**

The conventional perception is that international trade contributes to higher GDP growth both in the short run and the long run through the provision of foreign exchange and raw materials for industrialization for the developing countries. It thus suggests that the international trade is the growth engine particularly in the developing countries. However, most of the developing countries are not achieving these benefits of trade as a result of their volatile exchange rates. Effective policy measures to tackle these are of great important for the development of Nigeria given its abundance of resources that it can trade on.

### 5.1 The following recommendations are made.

Exportation in Nigeria particularly in the non-oil sector should be encouraged through entrepreneurial development. The high level of imports mainly consumer goods can be discouraged by improvement in local production so that they can be competitive with the foreign goods. Only goods with high proportion of necessities e.g. raw material goods should be imported. Policy measures towards the stabilization of the exchange rates are highly recommended so that level of imports can be controlled and exports encouraged. Exports capacity should be enhanced through acquisition of improved technology and means of production; this will in turn further pull down demand for imports. Deliberate policies aimed at diversifying foreign earnings should be introduced. Going by the results of this study, the Central Bank of Nigeria is advised not to devalue the naira due to its insignificant effect/impact on export in Nigeria.

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