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Appraising the Exchange Rate Volatility, Stock Market Performance and Aggregate Output Nexus in Nigeria

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Abstract

This research work appraises the exchange rate volatility, stock market performance and aggregate output nexus in Nigeria. Making used of quarterly time series data with the use of ARCH and GARCH model, Bayesian VAR, VAR causality and Granger Causality model. The research work found that Exchange Rate and Stock price are Volatiles and the dwindling grossly affect the aggregate output. Also, there is high degree of positive relationship between Exchange rate, Stock Price Movement and Aggregate output. More so, Exchange rate volatility granger cause Stock price movement and Aggregate Output and vice versa. Furthermore, Exchange rate volatility and Stock Market performance has a positive significant impact on Aggregate output. Finally, there is joint causal impact of volatility of exchange rate, stock price, reserve on aggregate output in Nigeria. conclusion was made that there is a clear causal relationship between exchange rate volatility, stock market performance and Aggregate Output in Nigeria. Economic growth is achieved through sound an effective exchange rate that encourages FDI and financial inflow in the stock market. However, conclusion was made that there is presence and persistency of volatility shocks in the exchange rates for naira vis-à-vis US dollar in Nigeria between 1985 and 2015. This implies that the conventional monetary management policies instituted have proved ineffective in stabilizing the exchange rate of a unit US dollar to naira over the years. This therefore calls for the need of other forex management measures especially in terms of meeting the high demand for foreign currency which characterized and dictate the performance and trade balance and overall economic performance in Nigeria.

Keywords: Exchange rate; Volatility; Stock market

Introduction

The Nigerian stock market is a market that deals with the exchange of securities issued by publicly quoted companies and the government. It is a major channel for providing long term loans to industries as well as other investors [1]. On one hand, it provides for an individual, a key instrument for holding personal wealth as well as a way to diversify, spread and reduce risks. On the other hand, it represents to a firm, one of the ways to obtain financing and a central link between the financial world and the real economy.

In the same vein, the market serves as a channel through which surplus funds are moved from lenders-savers to borrower-spenders who have shortages of funds [2]. Basically, stock market prices are fundamental to the functioning of a market- based economy because they reveal the value of the companies that issued the stocks and like all other prices, they allocate scarce investment resources. Some fundamental macroeconomic variables such as interest rates, money supply, inflation, exchange rate and gross domestic product are generally believed to be determinants of stock prices, hence, changes in stock prices are linked with macroeconomic behaviour in developed economies which can be ambiguous in developing countries.

The impact of exchange rates on economic growth via capital markets which can have both a short term and a long term dimension. From the short term perspective, fixed exchange rates can foster economic growth by a more efficient international allocation of capital when transaction costs for capital flows are removed [3]. When international capital market segmentations are removed, debtors in high yield emerging market economies benefit from a substantial fall in interest rates as a result of investment from low yield developed economies and an incentive to maintain capital inflows through efficient financial supervision is created [4]. In the long term however, fluctuation in the exchange rate level constitute a risk for growth in emerging markets economies because banks and enterprise balance sheets which are denominated in foreign currency are adversely affected and sharp depreciations in exchange rates also inflates liabilities in terms of domestic currency thereby increasing the probability of default and financial crisis Adam [5] and influence the values of firms since the future cash flows of the firm change with the fluctuations [6].

However, two basic approaches that explain the relationship between stock prices and the exchange rates are “flow oriented” and “stock oriented” models. The flow oriented model assume that the exchange rate is largely determined by the current account and trade balance performance, and through that affect competitiveness of the economy [7]. The stock oriented model, assumes that the exchange rate responds to changes in the stock market [8-9]. The empirical analysis of the two model have certain features that are convenient for the purposes of this thesis and indicate different causation (between the markets) which constitutes the direction of this study in appraising the exchange rate volatility, stock market performance and aggregate output nexus in Nigeria.

After about 16 months of battling to stabilize the naira-dollar official exchange rate at N197/US$1 in the face of macro-economic headwinds and dwindling foreign exchange earnings which fell “from

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about US$3.24 bn monthly to current levels of below a billion dollars per month", the Central Bank of Nigeria finally succumbed to pressure from both within and outside Nigeria to adopt a flexible inter-bank exchange rate system in which the exchange rate would be market-driven. The new forex policy is expected to bring about a significant increase in capital importation and Diaspora remittances which will shore up the country's foreign reserves. It is also capable of narrowing the huge gap between the interbank and parallel market rates thereby reducing round-tripping, arbitrage opportunities and artificial demand from the market. Being a managed float system, the CBN is expected to participate in the market through periodic interventions to either buy or sell foreign currency as the need arises and in a bid to boost liquidity in the market, the apex bank has also appointed primary dealers. Without doubt, these measures, which are intended to enhance efficiency and facilitate a liquid and transparent forex market, will rub off positively on the stock market. As a pointer to this optimism, the market performance on Wednesday, June 15, 2016, when the policy was unveiled, was quite remarkable with equities capitalisation rebounding from a previous three-day losing streak to close at N9.6tn- about the highest level in June 2016. In the same vein, the benchmark All Shares Index (ASI) gained 3.2 per cent to close at 27,891.96 points with all sector indices reflecting a strong appetite witnessed across board [10-12].

On the flip side, the new policy is likely to exert more inflationary pressure in the near term as the naira is bound to weaken further in any contest with the dollar on strictly market forces dynamics given the import-dependent and shallow export base of the Nigerian economy. In its Consumer Price Index report for the month of May, the National Bureau of Statistics indicated that the cost of food imports contributed significantly to headline inflation which was put at 15.6 per cent compared to 13.7 per cent recorded in April 2016 with the imported food sub-index increasing by 18.6 per cent in May 2016. This further confirms the pass on effects of the increase in the cost of imported goods. A further spike in inflation is a disincentive to domestic investors in the stock market considering its negative impact on real stock returns. Given the cost-push nature of the current inflationary pressure and the limitations of monetary policy tools in this regard, a number of countervailing fiscal policy actions, anchored on the stimulation of real sector growth, should be undertaken from the extra money which the government stands to reap following the participation of the CBN in the market at a forex rate expected to trade higher than the current peg of N197 to the dollar when the policy becomes fully operational.

However, empirical investigations from Nigeria also presented a mixed result. Study such as Zubair [13] reported absence of causality between exchange rate changes and stock market. On the other hand Umoru and Asekome [1] found a uni-directional causal relationship between the Naira-US$ exchange rate movement and the reaction to stock prices [14]. This implies lack of consensus in findings on the direction of causation among exchange rate volatility, stock price movement and aggregated output and therefore inconclusive. More importantly, all these studies adopted a bivariate analysis on the issue of causality either between exchange rates changes and stock prices or between stock prices and economic growth or between exchange rates and economic growth [15-17]. Therefore, this study will differ by examining a tri-variate analysis of the causal relationship among exchange rates volatility, stock prices movement and aggregate output in Nigeria. The broad objective of this study is to analyse the relationship between exchange rate volatility, stock price movement and aggregate output in Nigeria from 1986 to 2015 [18].

Methodology

This section presents the research methods through which the research objectives would be achieved. This chapter comprises the theoretical framework, conceptual framework the model specification, techniques of analysis and measurement of variables.

Theoretical framework

The theoretical framework of this study has its basis drawn from endogenous growth theory. According to Barro [19] and Barro and Sala-i-Martin [20] endogenous growth theory indicates that government can influence long run growth of the economy through its expenditure or investment in physical capital, human capital and technology. The endogenous growth model will be used to derive the models for estimation for this study given its inherent capability to address exchange rate, stock market prices and aggregate output.

Using a typical Cobb Douglas production function, endogenous growth model can be stated as

$$Y_t = f(A, L_t, K_t) \quad (1)$$

Where Y_t is aggregate output, L_t is stock of labour, K_t is stock of capital and A represent technology or total factor productivity.

According to Demirgue and Levine [21] and Cudi Tuncer and Alovsat [22], technology (A) is affected by exchange rate, therefore, equation 1, is decompose to ref. [23]

$$A = g(\mathrm{Re}er) \quad (2)$$

Where Reer is real exchange rate.

Furthermore, capital in equation 1 can be divided into two: physical capital and human capital

$$K = h(K_p, K_h) \quad (3)$$

Where K_p is physical capital and K_h human capital

Following the work of Kunt and Levin [24], human capital is constant, therefore equation 3 can be written as

$$K = h(K_p) \quad (4)$$

Substituting equation 2 and 4 in equation 1,

$$Y = \phi(\mathrm{Re}er, L, K_p) \quad (5)$$

Model specification

In line with the theoretical framework discussed above, the effect of exchange rate volatility on stock market prices and aggregate output is captured by the model expressed in equation 5 [25]. Following the works of Ewah et al. [26] and Ariyo and Adelegan [27] the model for the linkage among real exchange rate, stock market and output is stated as

$$Gdp = f(\mathrm{Re}er, Asi) \quad (6)$$

Where Asi is all share index, proxy for stock prices movement.

It has been noted in the literature (Harrigan et al. [28] Usman [29]) that relationship between stock prices movement and aggregate output are attributed to changes is some macro-economic variables such as interest rate, broad money supply, inflation etc [30-32]. Therefore, equation 6 above is modified to include important macro-economic variables since effective exchange rate can be control through effective monetary policy and that involves the use on monetary policy in the model [33-34].

$$Gdp = f(\mathrm{Re}er, Asi, Int, Inf, M2) \quad (7)$$

Incorporating exchange rate volatility into equation 7 to capture exchange rate risk, the model becomes

$$Gdp = f(h, Asi, Int, Inf, M2) \quad (8)$$

Where h is exchange rate volatility

In Bollerslev [35], for the first time, proposed using the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) method as a method of determining volatility in exchange rate or inflation rate. Since then, several studies (Adjasi and Biekpe [36]; Dell'Ariccia [37]; Wang et al., [38]; and Clark et al., [39]) had used the GARCH (1, 1) specification. As the name suggests, this approach of determining exchange rate volatility is based upon conditioning the variance by allowing changing over time based on past errors, also ability to capture both volatility clustering and unconditional return distribution with heavy tails. While conventional time series and econometric models operate under an assumption of constant variance, this type of model is useful in modeling variability in the exchange rate and inflation [40]. Furthermore, because the Autoregressive Conditional Heteroskedasticity (ARCH) proposed by Engle [41] encountered the problem of negative variance parameter estimates in empirical applications, extension of the ARCH model including a more flexible lag structure was immediately sought [35].

ARCH (p) is stated as

$$\sigma_t^2 = \partial_0 + \sum_{j=1}^{p} \chi_j u_{t-j}^2 \quad (9)$$

Where u^2_{t-j} is previous period's squared residual derived from previous period information about volatility.

Furthermore, ARCH (p) simultaneously models the mean equation as

$$y_t = \alpha + \beta' X_t + u_t \quad (10)$$

$$u_t \approx iid(0, h_t)$$

While the variance equation was model as

$$h_t = \partial_0 + \sum_{j=1}^{p} \delta_j u_{t-j}^2 \quad (11)$$

From equation 9 above, ARCH (p) model can be parsimoniously reduce to GARCH (1,1)

$$h_t = \delta_0 + \psi_1 h_{t-1} + \psi_2 u_{t-1}^2 \quad (12)$$

$\delta_0>0$, $\Psi_1>0$, $\Psi_2>0$ and $\Psi_1+\Psi_2<1$, so that the next period forecast of the variance is a combination of last period squared return and last period forecast [42-45].

Where h_t is variance or current period volatility, h_{t-1} is previous year residual variance or volatility.

From equation 8, the specific equation is specified as

$$Gdp = \alpha + \beta h + \chi Asi + \delta Int + \varphi Inf + \gamma M2 + \varepsilon \quad (13)$$

Model specification on direction of causality among exchange rate volatility, stock market prices and output: Thus, to determine the direction of causality among exchange rate volatility, Stock Market Prices and Aggregate Output, a dynamic model of vector autoregressive (VAR) is used. The VAR method has become an important tool used in empirical macroeconomics studies and is specified in a system of simultaneous equation [46-47]. From equation 13, VAR model is specified as

$$h = \alpha_2 + \sum_{j=0}^{n} \kappa_{2j} Gdp_{t-j} + \sum_{j=1}^{n} \beta_{2j} h_{t-j} + \sum_{j=0}^{n} \chi_{2j} Asi_{t-j} + \sum_{j=0}^{n} \delta_{2j} Int_{t-j} + \sum_{j=0}^{n} \varphi_{2j} Inf_{t-j} + \sum_{j=0}^{n} \gamma_{2j} M2_{t-j} + \varepsilon_{2t} \quad (14)$$

$$h = \alpha_2 + \sum_{j=0}^{n} \kappa_{2j} Gdp_{t-j} + \sum_{j=1}^{n} \beta_{2j} h_{t-j} + \sum_{j=0}^{n} \chi_{2j} Asi_{t-j} + \sum_{j=0}^{n} \delta_{2j} Int_{t-j} + \sum_{j=0}^{n} \varphi_{2j} Inf_{t-j} + \sum_{j=0}^{n} \gamma_{2j} M2_{t-j} + \varepsilon_{2t} \quad (15)$$

$$\Delta Asi = \alpha_1 + \sum_{j=0}^{n} \kappa_{1j} \Delta Gdp_{t-j} + \sum_{j=0}^{n} \beta_{1j} \Delta h_{t-j} + \sum_{j=1}^{n} \chi_{1j} \Delta Asi_{t-j} + \sum_{j=0}^{n} \delta_{1j} \Delta Int_{t-j} + \sum_{j=0}^{n} \varphi_{1j} \Delta Inf_{t-j} + \sum_{j=0}^{n} \gamma_{1j} \Delta M2_{t-j} + \lambda_1 Asi_{t-1} + \lambda_2 Gdp_{t-1} + \lambda_3 h_{t-1} + \lambda_4 Int_{t-1} + \lambda_5 Inf_{t-1} + \lambda_6 M2_{t-1} + \varepsilon_{1t} \quad (16)$$

$$Int = \alpha_4 + \sum_{j=0}^{n} \kappa_{4j} Gdp_{t-j} + \sum_{j=0}^{n} \beta_{4j} h_{t-j} + \sum_{j=0}^{n} \chi_{4j} Asi_{t-j} + \sum_{j=1}^{n} \delta_{4j} Int_{t-j} + \sum_{j=0}^{n} \varphi_{4j} Inf_{t-j} + \sum_{j=0}^{n} \gamma_{4j} M2_{t-j} + \varepsilon_{4t} \quad (17)$$

$$Inf = \alpha_5 + \sum_{j=0}^{n} \kappa_{5j} Gdp_{t-j} + \sum_{j=0}^{n} \beta_{5j} h_{t-j} + \sum_{j=0}^{n} \chi_{5j} Asi_{t-j} + \sum_{j=0}^{n} \delta_{5j} Int_{t-j} + \sum_{j=1}^{n} \varphi_{5j} Inf_{t-j} + \sum_{j=0}^{n} \gamma_{5j} M2_{t-j} + \varepsilon_{5t} \quad (18)$$

$$M2 = \alpha_6 + \sum_{j=0}^{n} \kappa_{6j} Gdp_{t-j} + \sum_{j=0}^{n} \beta_{6j} h_{t-j} + \sum_{j=0}^{n} \chi_{6j} Asi_{t-j} + \sum_{j=0}^{n} \delta_{6j} Int_{t-j} + \sum_{j=0}^{n} \varphi_{6j} Inf_{t-j} + \sum_{j=1}^{n} \gamma_{6j} M2_{t-j} + \varepsilon_{6t} \quad (19)$$

Where n is the lag length and will be chosen optimally using Schwarz information criterion [48-49]. From equations 14-19, the direction of causation will be identified by testing the significance of the coefficients of the dependent variables.

Model specification on the effect of exchange rate volatility on stock market prices and output: In order to examine the effect of exchange volatility on stock market price and output, Auto Regressive Distributed Lag is used [50-51]. This technique captures the short and long run relationship. From equation 13, the ARDL model is stated as

$$\Delta Asi = \alpha_1 + \sum_{j=0}^{n} \kappa_{1j} \Delta Gdp_{t-j} + \sum_{j=0}^{n} \beta_{1j} \Delta h_{t-j} + \sum_{j=1}^{n} \chi_{1j} \Delta Asi_{t-j} + \sum_{j=0}^{n} \delta_{1j} \Delta Int_{t-j} + \sum_{j=0}^{n} \varphi_{1j} \Delta Inf_{t-j} + \sum_{j=0}^{n} \gamma_{1j} \Delta M2_{t-j} + \lambda_1 Asi_{t-1} + \lambda_2 Gdp_{t-1} + \lambda_3 h_{t-1} + \lambda_4 Int_{t-1} + \lambda_5 Inf_{t-1} + \lambda_6 M2_{t-1} + \varepsilon_{1t} \quad (20)$$

$$\Delta Gdp = \alpha_2 + \sum_{j=1}^{n} \kappa_{2j} \Delta Gdp_{t-j} + \sum_{j=0}^{n} \beta_{2j} \Delta h_{t-j} + \sum_{j=0}^{n} \chi_{2j} \Delta Asi_{t-j} + \sum_{j=0}^{n} \delta_{2j} \Delta Int_{t-j} + \sum_{j=0}^{n} \varphi_{2j} \Delta Inf_{t-j} + \sum_{j=0}^{n} \gamma_{2j} \Delta M2_{t-j} + \lambda_{21} Asi_{t-1} + \lambda_{22} Gdp_{t-1} + \lambda_{23} h_{t-1} + \lambda_{24} Int_{t-1} + \lambda_{25} Inf_{t-1} + \lambda_{26} M2_{t-1} + \varepsilon_{2t} \quad (21)$$

Where Δ is change and n is the lag length which will be selected optimally. γ, β, χ, δ, φ and ϕ are short run coefficients, while λ are long run coefficients.

Estimation techniques

In this study, both descriptive and econometrics techniques of analysis will be adopted. To achieve objective one which is the trend of exchange rate volatility, stock prices movement and aggregate output, descriptive analyses such as trend analysis, graphs and tables will be used (Figure 1) (Table 1). Objective two will be achieved by performing Granger causality test on VAR model specified in equation 14-19. Also, objective three which is the effect of exchange volatility on stock market prices and aggregate output will be achieve by estimating equation 20 and 21 using Bayesian VAR. This estimation technique

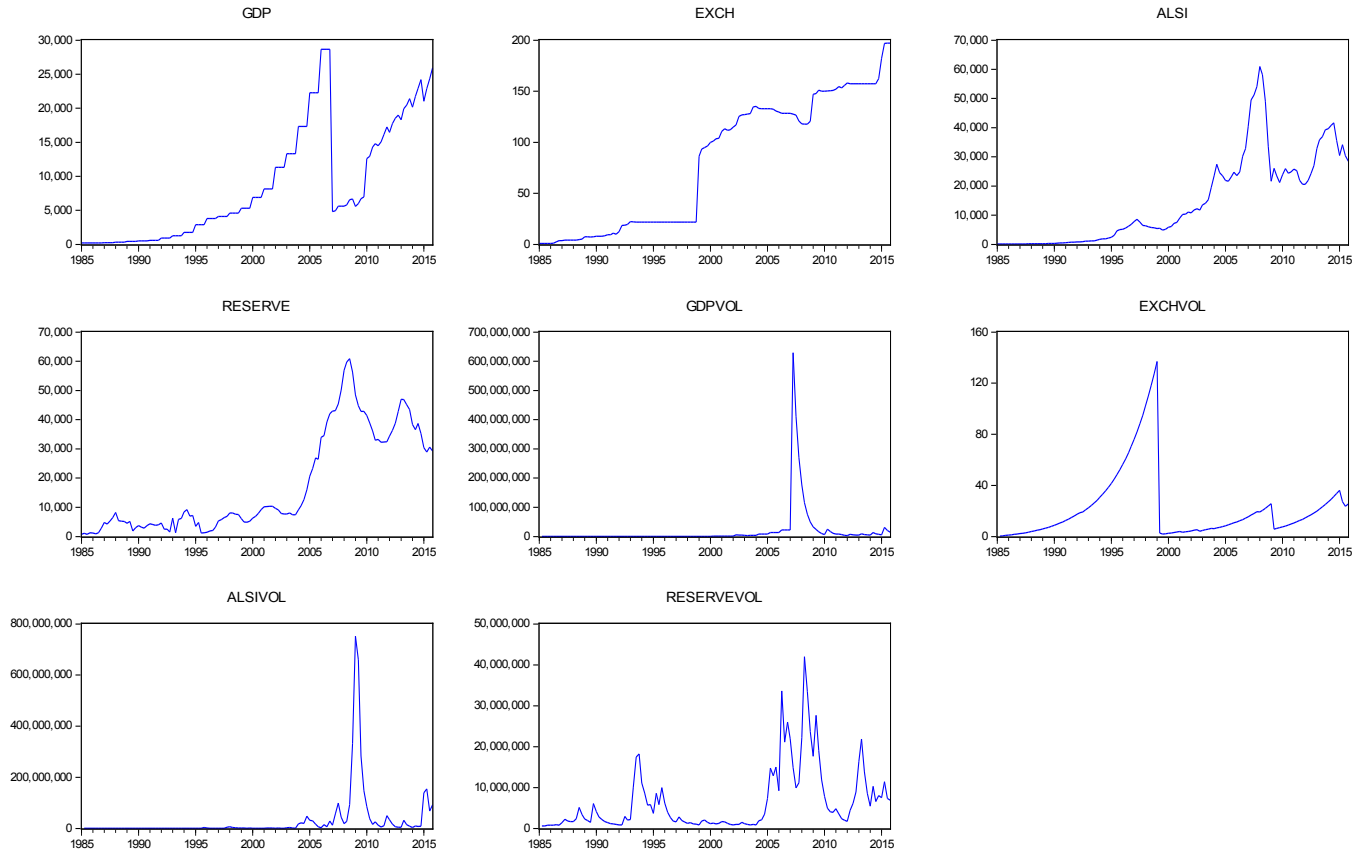

Figure 1: Trend analysis.

S/N	Variables	Definition and measurement of variable	Source of data
1	All Share Index (ASI)	This is a measure of the performance of the stock market which mirrors the information about macroeconomic performance at any time. It is positively and significantly correlated with long run economic growth.	Central Bank of Nigeria, National Bureau of Statistics and the Nigeria Stock Exchange.
2	Gross Domestic Product (GDP)	This is a measure of total real economic activities in the country. It is a very crucial measure of determining the stock market returns in the country.	National Bureau of Statistics and the Central Bank of Nigeria
3	Real Effective Exchange Rate (REER)	Exchange rate is a relative price that measures the worth of a domestic currency in terms of another currency ($reer = \frac{p_x}{p^*} e$). It relates the purchasing power of a domestic currency, in terms of the goods and services it can purchase, vis-à-vis a trading partners' currency over a given period. US will be used as proxy for trading partners' currency.	World Bank Development Indicator, 2013 edition
4	Exchange rate volatility (h)	Exchange rate volatility is a measure that intends to capture the uncertainty faced by both exporters and importers due to unpredictable fluctuations in the exchange rates	Derived from real exchange rate using GARCH (1, 1)
5	Inflation (INF)	This will be measured by consumer price index (CPI). It measured as the rate of change over time of some general index of price. Inflation is usually refers to as a continuing rise in prices as measured by an index such as the consumer price index or by the implicit price deflator for gross national product	World Bank Development Indicator, 2013 edition
6	Broad Money Supply (M2)	This is a measure of money supply in the economy.it represents the monetary sector analysis in which the boundaries of narrow money shifts overtime to accommodate new financial instruments. This captures the contributions of money market to economic activities.	Central Bank of Nigeria and the National Bureau of Statistics

Table 1: Measurement of variables and source of data.

was preferred because of the advantages attached to it. Firstly, Bayesian VAR approach does not required pre-testing for unit root test and the variables do not need to be integrated of the same order (only to ensure that no variable was I(2)). The Bayesian VAR provided alternative test for examining a long-run relationship irrespective of whether the variables are I(0) or I(1), evenly integrated. Secondly, Bayesian VAR approach to cointegration provides better result in a small sample data as the case in the studies of these authors Haug [52], indicated that the estimates obtained from the Bayesian VAR method of cointegration analysis are unbiased and efficient. This approach also helps to avoid the problem that may ensue in the presence of serial correlation and endogeneity. Lastly, according to Banerjee and Newman [53] a dynamic

error correction can be derived from a modified Bayesian VAR model through a linear transformation. These will be preceded by performing volatility test, unit root test, co-integration and lag selection criteria (Figure 2).

Data Presentation and Analysis

Presentation of results

This section presents the data set used for the analysis, the trend diagram and descriptive statistics in examining exchange rate volatility, stock market performance and aggregate output Nexus in Nigeria [54-57]. The data used in this study are quarterly time series in nature, and span through 1985-2015 (Table 2). Section 4.1.2 gives the data presentation, trend analysis and descriptive statistics of the variables, while 4.1.3 displays the stationarity test using Augmented Dickey Fuller (ADF) and Phillip Perron (PP) test [58-60]. Section 4.1.4 presents the ARCH test of volatility; Section 4.1.4 presented the trend volatility of the model. Also the remaining Sections presents Bayesian VAR impulse

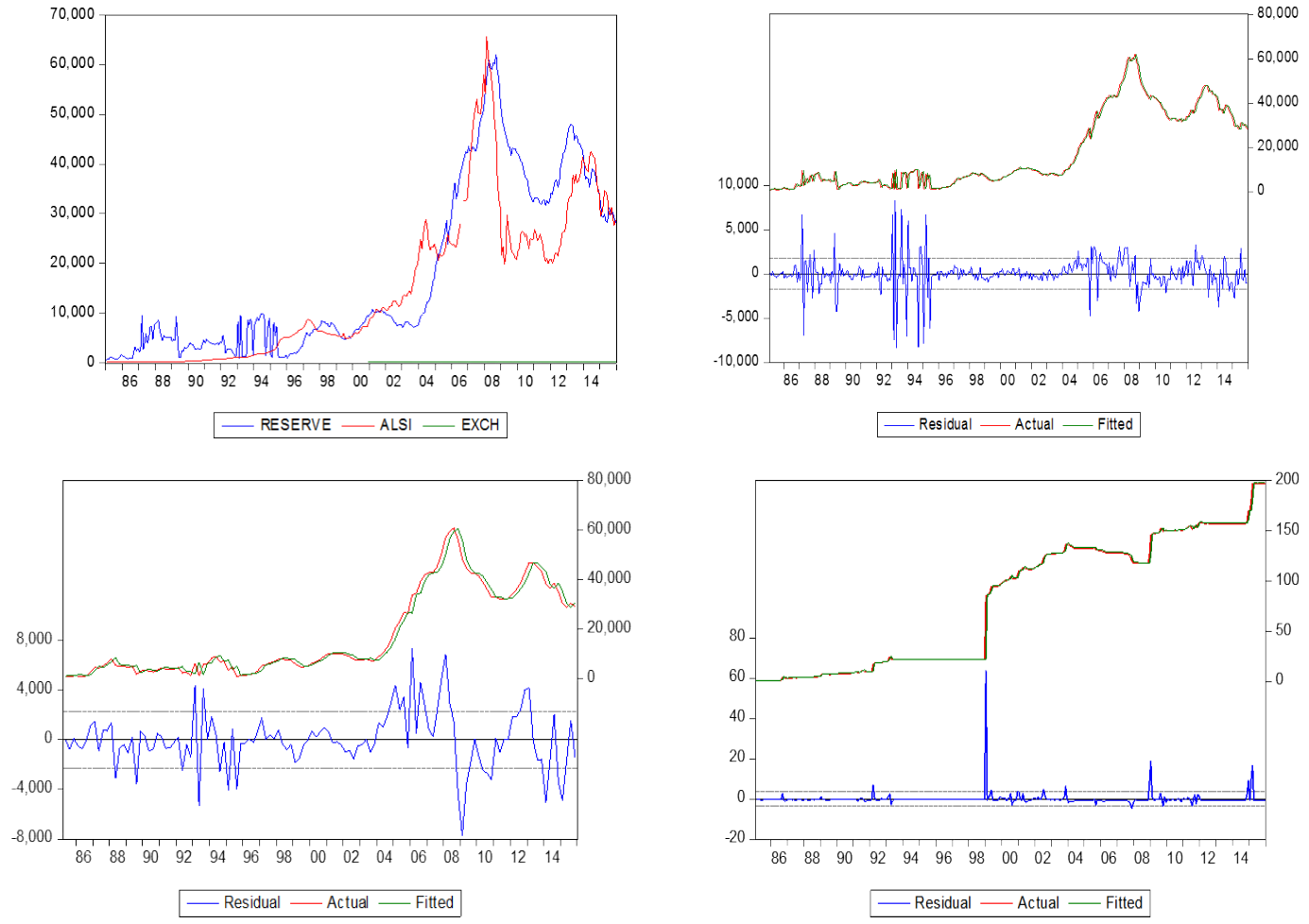

Figure 2: Trend analysis of volatility.

Mean	8576.454	80.68012	14665.28	17476.59
Median	5439.389	102.3212	7748.433	7894.638
Maximum	28662.47	196.99	60952.95	60875.24
Minimum	192.27	0.902567	112.3	716.9333
Std. Dev.	8407.195	64.24025	15225.85	17232.6
Skewness	0.820342	0.017777	0.974505	0.857315
Kurtosis	2.424678	1.34151	3.159053	2.265366
Jarque-Bera	15.61802	14.21791	19.75703	17.97815
Probability	0.000406	0.000818	0.000051	0.000125
Sum	1063480	10004.34	1818495	2167098
Sum Sq. Dev.	8.69E+09	507597.6	2.85E+10	3.65E+10
Observations	124	124	124	124
Source: Author's Computation (2016).				

Table 2: Descriptive statistics.

response, Granger causality test, while section 4.1.7 and 4.1.8 presents the VAR joint Causality test and the VAR inverse root polynomial stability test [61].

Trend analysis: The trend diagram depicts an upward trend for GDP, and steady increase was observed between 1990 and 2004 before rising sharply in 2010 [62-64]. This trend has been increasing steadily ever since, before recent collapse in growth rate. Exchange rate in Nigeria experienced steady increase since 1990 till date. Exchange rate (EXCH) has been increasing since inception of the study period, and slight volatility was observed between 2008 and 2012 before rising thereafter [65-69]. The All Share Index (ALSI) trend showed slightly upward sloping trend from its inception and continued in that form till 2008 before it broke down the trend downward to its lowest ever. Though, it starts picking up in 2012.

Descriptive statistics: The statistical properties of the variables are highlighted here. The emphasis here is on the mean, standard deviation, Jarque-Bear and its Probability statistics for the variables involved in this study. The result showed that the mean of the variables GDP, EXCH, ALSI, and RESERVE are all positive [70]. In the case of their skewness, all the variable under consideration are positively skewed. Regarding kurtosis that measures the peakness of the distribution of the variables, it can either be leptokurtic if its value is higher than 3, mesokurtic if equal to 3 and platykurtic if it less than 3. From the descriptive statistic table, the Kurtosis value for all the variables is less than 3, thus the variables are platykurtic with exception of ALSI which is leptokurtic. Finally, the Jarque-Bera statistics and its probability value indicate the statistical significance of the variables. If the probability value is less than 5%, the variables are significant and vice versa [71]. All the variables under consideration are statistically significant even at 1% significant level. To establish the null hypothesis of normality, we made use of the test and detected that all the variables in the model had positive values they were all statistically significant at the one percent level. Therefore, we fail to accept the null hypothesis of normality and accept the alternative hypothesis that the statistical distribution of these variables follows a normal process.

Correlation analysis: The correlation analysis of the variables under consideration shows that there is positive significant relationship between the variables. There is high positive correlation between GDP and Exchange rate, GPD and All Share Index, and GDP and Foreign Reserve (Table 3) [72].

GDP	1	0.842662	0.659388	0.60067387
EXCH	0.84266159	1	0.798956	0.76376588
ALSI	0.65938776	0.798956	1	0.91134481
RESERVE	0.60067387	0.763766	0.911345	1

Table 3: Correlation analysis.

Stationary test (ADF & PP): Prior to the estimation of cointegration, the characteristics of the data have to be examined. Testing the stationarity of economic time series data is important since standard econometric methodologies assume stationarity in the time series while they are in the real sense non-stationary. Hence, the usual statistical tests are likely to be inappropriate and the inferences drawn are likely to be erroneous and misleading. For example, the ordinary least squares (OLS) estimation of regressions in the presence of non-stationary variables gives rise to spurious regressions if the variables are not co-integrated [73].

The trends of all the variables were used to conduct unit root tests to determine the stationarity of the variables using both the Augmented Dickey-Fuller (ADF) test and Philip Perron tests respectively. The results of the unit root tests are presented in Table 4. The results in Table 4 show that all the variables are stationary in their first differences [74-76].

The result of the stationarity test as reported using Augmented Dickey Fuller test for stationary, it was observed that all the four variables were not stationary at Level with exception of ALSI which was stationary at 5% significant level, while all the others became stationary at First difference [77]. Similar result was obtained from the analysis of the Phillip Perron test, four of the variables are stationary at the First difference at either the 1% or the 5% critical value.

The above result shows that all the variables such as exchange rate, All Share Index and Foreign Reserve are volatile with an exception of GDP which is not volatile at 5% significant level. The heteroskedasticity test shows that the variables have ARCH terms which necessitate the conduction of ARCH and GARCH model of volatility.

Trend analysis of volatility: The Above trend analysis of the residual of the variables under consideration shows the level volatility of each variables. It shows that the period of high volatility is followed by the period of high volatility while the period of low volatility is followed by the period of low volatility [78-81]. The Nigeria exchange started to be relatively volatility after the SAP era of 1986 which it was volatile till 1996 before experience an era of low volatility for the next one decade before the recent high volatility which can be traced jointly with other variables such All share index, foreign reserve and Aggregate Output (Table 5).

Granger causality test: Having established the direction and strength of the volatility between Exchange rate, Stock market performance and aggregate output variables, it becomes pertinent to establish the direction of causation since correlation is not causality

Date: 11/28/16 Time: 14:11				**Date: 11/28/16 Time: 16:11**			
Sample: 1985Q1 2015Q4				**Sample: 1985Q1 2015Q4**			
Test Type: ADF				**Test Type: PP**			
	Level	**First**	**Second**		**Level**	**First**	**Second**
GDP	-2.82525	-11.0218**	-9.12768	GDP	-2.82525	-11.033**	-76.3416
EXCH	-2.09814	-9.55416**	-10.2038	EXCH	-2.27515	-9.54828**	-93.284
ALSI	-3.51856**	-6.22932	-11.7116	ALSI	-2.83734	-6.19447**	-19.9421
RESERVE	-2.45574	-4.60736**	-19.3551	RESERVE	-1.88934	-7.96443**	-47.4174
1% level	-4.03565	-4.03565	-4.03565	1% level	-4.03436	-4.035	-4.03565
5% level	-3.44738	-3.44738	-3.44738	5% level	-3.44677	-3.44707	-3.44738
10% level	-3.14876	-3.14876	-3.14876	10% level	-3.1484	-3.14858	-3.14876
**Denotes significance at 1% and 5% level. Source: Authors computation (2016).							

Table 4: Stationary test.

Exchange Rate			
F-statistic	67.89333	Prob. F(1,120)	0.0000
Obs*R-squared	44.08345	Prob. Chi-Square(1)	0.0000
GDP			
F-statistic	3.048859	Prob. F(1,120)	0.7253
Obs*R-squared	2.668642	Prob. Chi-Square(1)	0.6456
ALSI			
F-statistic	6.212070	Prob. F(1,120)	0.0231
Obs*R-squared	5.102308	Prob. Chi-Square(1)	0.0417
RESERVE			
F-statistic	30.062536	Prob. F(1,120)	0.0000
Obs*R-squared	24.525242	Prob. Chi-Square(1)	0.0000
Heteroskedasticity Test: ARCH.			

Table 5: Testing volatility of the variables.

Null hypothesis:	Obs	F-statistic	Prob.	Decision
EXCH does not Granger Cause GDP	122	5.38346	0.0058	Rejected
GDP does not Granger Cause EXCH		0.06687	0.9354	Accepted
ALSI does not Granger Cause GDP	122	0.25230	0.7774	Accepted
GDP does not Granger Cause ALSI		12.9328	8.00E-06	Rejected
ALSI does not Granger Cause EXCH	122	4.81329	0.0098	Rejected
EXCH does not Granger Cause ALSI		5.44374	0.0055	Rejected
EXCHVOL does not Granger Cause EXCH	121	5.81450	0.0039	Rejected
EXCH does not Granger Cause EXCHVOL		272.267	2.00E-44	Rejected
RESERVE does not Granger Cause ALSI	122	2.02767	0.1362	Accepted
ALSI does not Granger Cause RESERVE		10.0184	0.0001	Rejected
GDPVOL does not Granger Cause ALSI	121	0.65410	0.5218	Accepted
ALSI does not Granger Cause GDPVOL		6.45013	0.0022	Rejected
ALSIVOL does not Granger Cause ALSI	121	4.19082	0.0175	Rejected
ALSI does not Granger Cause ALSIVOL		61.5188	6.00E-19	Rejected
RESERVEVOL does not Granger Cause GDPVOL	121	3.89792	0.023	Rejected
GDPVOL does not Granger Cause RESERVEVOL		6.09894	0.003	Rejected
RESERVEVOL does not Granger Cause ALSIVOL	121	25.3134	8.00E-10	Rejected
ALSIVOL does not Granger Cause RESERVEVOL		1.84531	0.1626	Accepted
Date: 11/28/16 Time: 14:42. Sample: 1985Q1 2015Q4. Lags: 2.				

Table 6: Pairwise granger causality tests.

[82]. Consequently, the research work employs granger causality tests to examine the direction of causality, and the results are presented in Table 6.

1. There is unidirectional causality between exchange rate and aggregate output but it flows from GDP to EXCH. Therefore, GDP granger cause EXCH but not vice versa.

2. There is unidirectional causality between Stock market performance and aggregate output but it flows from GDP to ALSI. Therefore, GDP granger cause ALSI but not vice versa.

3. There is bi-directional causality between Stock Market Performance and Exchange rate. Therefore, ALSI granger cause EXCH and vice versa.

4. There is bi-directional causality between Exchange rate volatility and Exchange rate. Therefore, ExchVol granger cause EXCH and vice versa.

5. There is unidirectional causality between Stock market performance and foreign Reserve but it flows from ALSI to RESERVE. Therefore, ALSI granger cause RESERVE but not vice versa.

6. There is unidirectional causality between Stock market performance and GDP volatility but it flows from GDPvol to ALSI. Therefore, GDPvol granger cause ALSI but not vice versa.

7. There is bi-directional causality between Stock Market Volatility and Stock market performance. Therefore, ALSIvol granger cause ALSI and vice versa.

8. There is bi-directional causality between RESERVE volatility and GDP volatility. Therefore, reserve volatility granger cause ALSI and vice versa.

9. There is unidirectional causality between reserve volatility and Stock market volatility but it flows from reservevol to ALSI. Therefore, reservevol granger cause ALSI but not vice versa.'

Lag length selection criteria

To select the most appropriate VAR lag length, we considered the based automatic bandwidth parameter methods as recommended [83] (Table 7). The result obtained indicated that the Schwarz information criterion (SC) assigned the second lag length, while the likelihood ratio (LR) test and the Hannan-Quinn information criterion (HQ) specified the seventh lag length as most desirable for the VAR. We narrowed down on the estimates and choice the final prediction error (FPE) and the Akaike information criterion (AIC) as the most appropriate

lag length order for the VAR process [84]. This is because eighth lag length is enough time to ascertain the effectiveness of policies over the observation studied.

Impulse response

Response of variables to exchange rate shocks: Using the Cholesky two-standard-error shock, this section examines the response of macroeconomic variables under consideration to Exchange rate Shocks when some perturbations occur in the economy. The essence of this is to find out the impact of unanticipated shocks in Exchange Rate measures on Stock market performance and Aggregate Output [85]. This analysis is very important particularly in a developing country like Nigeria where government international policy switch have strong impact on macroeconomic stability (Table 8).

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-11103.7	NA	1.17e+74	193.2475	193.4384	193.3250
1	-10263.2	1549.449	1.59e+68	179.7431	181.4617	180.4407
2	-9923.88	578.3651	1.35e+66	174.9545	178.2006*	176.2721
3	-9815.64	169.4181	6.49e+65	174.1851	178.9589	176.1227
4	-9696.15	170.4079	2.67e+65	173.2200	179.5214	175.7777
5	-9618.12	100.4253	2.38e+65	172.9759	180.8049	176.1537
6	-9514.54	118.8918	1.46e+65	172.2876	181.6442	176.0854
7	-9285.6	230.9257*	1.12e+64	169.4191	180.3034	173.8370*
8	-9193.11	80.42744	1.06e+64*	168.9236*	181.3355	173.9615

Source: Authors estimation, Eviews 9, November 2016.
Note: *Indicate lag order selected by the Criterion, LogL: Log Likelihood Ratio test, LR: Sequential modified LR test statistics, FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion and the HQ: Hannan-Quinn information criterion.

Table 7: The VAR Lag order selection criteria test.

Dependent variable: EXCH				**Dependent variable: EXCHVOL**			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
GDP	0.681268	2	0.7113	GDP	0.804705	2	0.6687
ALSI	5.782825	2	0.0555	EXCH	810.2235	2	0.0000
RESERVE	0.433388	2	0.8052	ALSI	0.956320	2	0.6199
GDPVOL	0.772296	2	0.6797	RESERVE	5.069728	2	0.0793
EXCHVOL	10.89784	2	0.0043	GDPVOL	1.391137	2	0.4988
ALSIVOL	0.182931	2	0.9126	ALSIVOL	22.50468	2	0.0000
RESERVEVOL	0.580707	2	0.7480	RESERVEVOL	0.249245	2	0.8828
All	25.47019	14	0.0302**	All	840.9695	14	0.0000*
Dependent variable: ALSI				**Dependent variable: ALSIVOL**			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
GDP	40.82055	2	0.0000	GDP	14.60422	2	0.0007
EXCH	0.295468	2	0.8627	EXCH	1.129448	2	0.5685
RESERVE	9.849679	2	0.0073	ALSI	107.2236	2	0.0000
GDPVOL	32.70806	2	0.0000	RESERVE	1.630612	2	0.4425
EXCHVOL	1.834208	2	0.3997	GDPVOL	14.24936	2	0.0008
ALSIVOL	5.697633	2	0.0579	EXCHVOL	0.248926	2	0.8830
RESERVEVOL	2.774138	2	0.2498	RESERVEVOL	19.84548	2	0.0000
All	94.11335	14	0.0000*	All	251.7311	14	0.0000*
Dependent variable: RESERVE				**Dependent variable: RESERVEVOL**			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
GDP	9.128158	2	0.0104	GDP	5.991921	2	0.0500
EXCH	0.425478	2	0.8084	EXCH	7.087171	2	0.0289
ALSI	3.639689	2	0.1621	ALSI	2.831266	2	0.2428
GDPVOL	21.53883	2	0.0000	RESERVE	19.28866	2	0.0001
EXCHVOL	0.371788	2	0.8304	GDPVOL	4.165733	2	0.1246
ALSIVOL	1.180630	2	0.5542	EXCHVOL	1.492671	2	0.4741
RESERVEVOL	10.03599	2	0.0066	ALSIVOL	12.53019	2	0.0019
All	55.50437	14	0.0000*	All	61.23204	14	0.0000*
Dependent variable: GDPVOL							
Excluded	Chi-sq	df	Prob.				
GDP	365.2477	2	0.0000				
EXCH	0.351169	2	0.8390				
ALSI	2.195743	2	0.3336				
RESERVE	2.908248	2	0.2336				
EXCHVOL	0.183344	2	0.9124				
ALSIVOL	0.162405	2	0.9220				
RESERVEVOL	5.177181	2	0.0751				
All	492.2572	14	0.0000*	A			

Date: 11/28/16 Time: 20:49.
Sample: 1985Q1 2015Q4.
Included observations: 121.

Table 8: Exchange rate, stock market performance and aggregate output nexsus using granger casuality in the VAR environment.

The graphs of a Cholesky two-standard-error shock show the actual impulse response functions for each of the endogenous variables given that, each asymptotically deviated from the normal path. Figure 3 presents the dynamic responses of GDP, ALSI and Foreign Reserve to a Cholesky two-standard-error shock of Exchange rate. The effect on GDP, ALSI as well as Foreign Reserve is found to be persistent in a defined period.

Figure 3 presents the dynamic responses of aggregate output (GDP) to a two-standard-error shock of Exchange rate. The effect on GDP is found to be persistent. The impact on GDP is significantly negative over a period of up to 10 quarters after the shock [86]. Devaluation of naira shock caused GDP to persistently decrease over time. On impact the effect was delayed one lag period but gradually became asymptotic to the steady state over the time horizon. Expenditure measure of growth shows the import dependence level of Nigerian Economy which complies with approx. expectation about the marshal Lerner Index (EXCHvol) has a profound impact on GDP. This is expected because the sum of elasticity of import and that of Export is less than one and this also affects the decline the foreign reserve, which ultimately affect the level of the international credibility of the Nation in the number of month she can finance her import. Also, this leads to negative effects on stock market performance as a result of decrease in the aggregate demand.

VAR stability control test: The VAR stability condition test indicates the inverse roots of AR characteristics Polynomial which shows the stability of VAR estimates the null hypothesis state that the

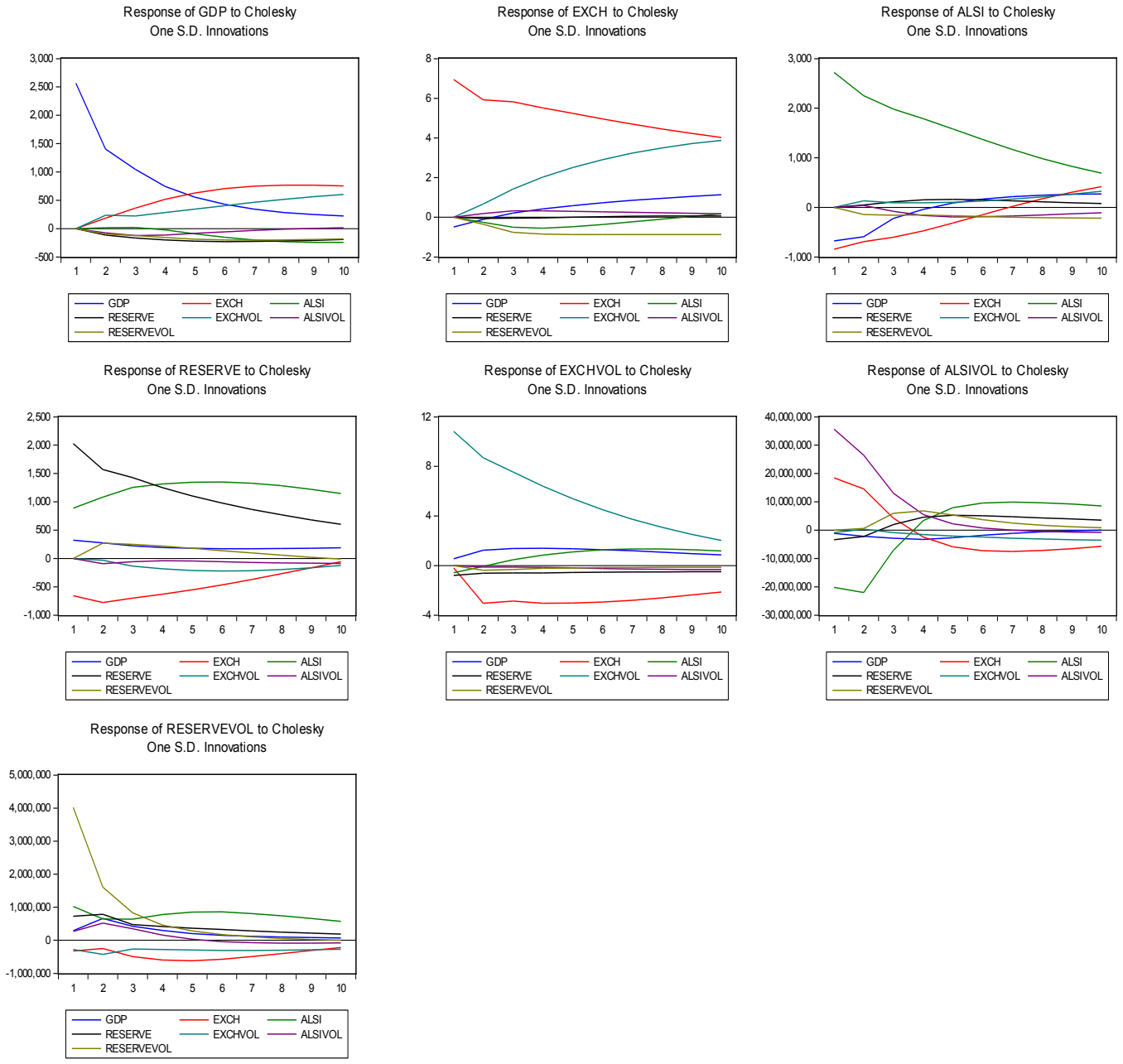

Figure 3: Response of variables to exchange rate shocks.

inverse roots lies outside the unit circle of the system by system model while the alternative against it (Figure 4).

The above result of Inverse roots of AR characteristics polynomial Shows that all the roots are located inside the unit circle which shows the high level of stability of model since majority are found around the parameters which shows the reliability of the estimates for policy recommendation.

Summary, Conclusion and Recommendations

Having reviewed some of the related literatures and collected all necessary data's, which have been analysed and discussed in chapter four. This chapter therefore provides a summary, and conclusion. Recommendations were also made in line with the results and suggestions for further research studies were provided.

Summary of findings

The research work found that Exchange Rate and Stock price are Volatiles and the dwindling grossly affect the aggregate output.

Also, there is high degree of positive relationship between Exchange rate and Stock Price Movement, Exchange rate and Aggregate output and Stock Price and Aggregate output.

More so, Exchange rate volatility granger cause Stock price movement and Aggregate Output and vice versa.

Furthermore, Exchange rate volatility and Stock Market performance has a positive significant impact on Aggregate output.

Finally, there is joint causal impact of volatility of exchange rate, stock price, reserve on aggregate output in Nigeria.

Conclusion

The finding concludes that there is a clear causal relationship between exchange rate volatility, stock market performance and Aggregate Output in Nigeria. Economic growth is achieved through sound an effective exchange rate that encourages FDI and financial inflow in the stock market.

From the findings, each of the volatility measure series for nominal and real exchange rates revealed different estimate of volatility indicating the presence and persistency of volatility shocks in the nominal and real exchange rates for naira vis-à-vis US dollar in Nigeria except the coefficient of variation measure under the real exchange rate which indicated overshooting volatility shocks in terms of degree. However, further evaluation concluded that there is presence and persistency of volatility shocks in the exchange rates for naira vis-à-vis US dollar in Nigeria between 1985 and 2015. This implies that the conventional monetary management policies instituted have proved ineffective in stabilizing the exchange rate of a unit US dollar to naira over the years. This therefore calls for the need of other forex management measures especially in terms of meeting the high demand for foreign currency which characterized and dictate the performance and trade balance and overall economic performance in Nigeria.

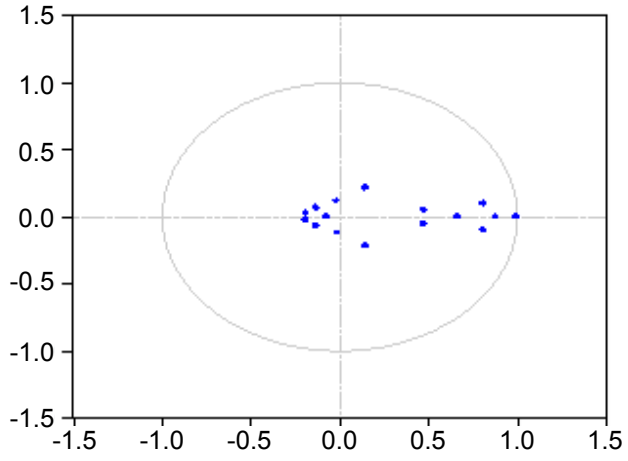

Figure 4: VAR stability condition test.

Conclusively, the result obtained in this finding shows that Exchange rate and stock market performance has positive and significant impact on aggregate output in Nigeria since the captured variables were all positive and significant in promoting economic growth in Nigeria.

Recommendations

The following recommendations are made to improve the level of Economy in Nigeria:

1. This calls for the need of other forex management measures especially in terms of meeting the high demand for foreign currency which characterized and dictate the performance and trade balance and overall economic performance in Nigeria. There is also the need for sound monetary policy to attain stability in the exchange rate and also fiscal measure to serve as pull factors for foreign investor can also be applied.

2. That more private limited liability companies and informal sector operators should be encouraged to access the stock market for fresh capital

3. Security Exchange Commission should be more productive in its surveillance role so as to check sharp practices which undermine the stock market integrity and investors' confidence.

4. Restoration of confidence to the market by regulatory authorities through ensuring transparency and fair trading transactions and dealings in the stock market

5. Slacking of trading investment such as high transaction costs to encourage more trading in stocks.

6. That policies that will further increase the volume of market transaction in the market be instituted through making more investment instruments (such as derivatives, convertibles, futures, swaps etc.) available, this will in turn bring about economic growth.

7. Ensuring the stability of macroeconomic environment and encouraging multinational companies or their subsidiaries to be listed in the Nigerian stock market.

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