Quest Journals
Journal of Software Engineering and Simulation
Volume 5 ~ Issue 1 (2019) pp: 56-64
ISSN(Online) :2321-3795 ISSN (Print):2321-3809
www.questjournals.org

Research Paper

Long-Run Impact of Exports and Imports on Trade

[1*]Olorunpomi, O.T.and [2]. Olorunpomi, C. K.
[1]Department of Computer Science and Mathematics, Nigeria Police Academy, Kano; Nigeria.
[2]Department of Statistics, University of Ilorin, Ilorin; Nigeria.
Corresponding Author; Olorunpomi

ABSTRACT: *Long-run effect of exports and imports of goods and services on tradewas examinedvia multivariate error correctionmechanism in Nigerian economy over periods 1960-2017. The presence of unit roots in the three series was associated with the stochastic trend and this is responsible for their non-stationarity.The long-run behaviour exhaustively revealed that 1% increase in imports of goods and services will tend to increase trade by 46%; more so, 1% increase in exports of goods and services will tend to increase trade by 51%. Imports and exports of goods and services exerted upward pressure on the long-run elasticity, but the positive effect of exports has been larger. At disequilibrium, it takes trade a speed of -7.07 to return back to equilibrium; while imports and exports of goods and services take a speed of -1.17 and -10.52 individually to return back to equilibrium. Moreover, the export of goods and services is quicker to the adjustment. There is a significant opportunity to explore critically the importance of exporting agricultural products, energy goods, manufactured goods, mineral products, raw material goodsandsolid mineral goods in Nigerian economy to influence the level of economic growth, employment and the balance of payments.*

Keywords: *Balance of payments, Error correction, Export, Import, Long-run elasticity, Stochastic trend, Trade, Unit root*

***R**eceived 05 Aug., 2019; **A**ccepted 20 Aug, 2019 © The author(s) 2019.*
P**ublished with open access at **www.questjournals.org

I. INTRODUCTION

A growth of 2.50 per cent was recorded in the first quarter of 2019 in the Nigerian economy with a total trade value of N8.2 billion as mentioned by National Bureau of Statistics (NBS). The volume of total merchandise trade in the first quarter of the year grew slightly by 7.52 per cent when compared to the corresponding quarter in 2018. The trade balance remained positive at N831.6bn in Q1 2019, boosted by increases in both exports and imports. The boost also helped total trade increase to N8.239tn, 2.50 per cent and 7.52 per cent higher compared to Q4 2018 and Q1 2018 according to NBS's report on foreign trade statistics. It said the value of total imports increased to N3.7tn in Q1 2019 representing 3.39 per cent and 29.84 per cent compared to Q4 2018 and Q1 2018. Imported Agricultural products were 7.98 per cent higher in value than in Q4 2018, and 28.1 per cent higher than in Q1, 2018.The value of Raw material imports grew 6.62 per cent more than the value recorded in Q4, 2018 and 20.76 per cent more than the value recorded in Q1 2018.The value of Solid minerals imports was 1.26 per cent more than the value of imports in Q4, 2018 and 35.90 per cent higher than the value recorded in Q1 2018.The value of Energy goods imports was 20.28percent lower than in Q4, 2018 when compared with the corresponding quarter of 2018, a decrease of 0.94 per cent was recorded.The value of imported manufactured goods increased by 25.81 per cent in Q1, 2019 against the value recorded in Q4, 2018 and rose by 130.7 per cent against its value in Q1, 2018" the report highlighted. The increase in the value of imported manufactured goods, according to the report was partly as a result of the importation of hygienic or pharmaceutical product for humanitarian purposes during the quarter.Also, the value of other oil products imported was 58.4 per cent lower than in Q4, 2018 and 72.71 per cent lower than the corresponding quarter of 2018.China, Swaziland, US, India and Netherlands were the major import trading partners.

The NBS'sreport also confirmed that, the value of Nigeria's export fell by 3.9 per cent in the first quarter of this year, compared to the same period in 2018. The country's total exports was valued at N4.535tn in Q1 2019, corresponding to a 1.78 per cent rise compared to the fourth quarter of 2018. In Q1 2019 the value of agricultural exports was 11.89 per cent lower than in Q4, 2018 but 17.5 per cent higher than Q1 2018. The value of raw material exports in Q1, 2019 was 10.67 per cent lower than the value in Q4, 2018 but 11.57 per cent higher than in Q1, 2018. Major traded agricultural products are Seamus seeds, good fermented Nigerian cocoa beans, superior quality raw cocoa beans, cashew nuts in shell, frozen shrimps and prawns, quality raw cocoa beans etc. Export trade was dominated by crude oil exports, which contributed N3.376tn or 74.45 per cent to the value of total exports in Q1 2019. Furthermore, it was revealed that Nigeria exported mainly mineral products, which amounted to N3.95tn or 87.1 per cent of the total value of exports. This was followed by vehicles, aircraft and parts; prepared food stuff, beverages, spirits; and vegetable products, which respectively accounted for N418bn or 9.22 per cent, N55.4bn or 1.2 per cent and N49.0bn or 1.1 per cent of the total exports. In Q1 2019, products exported to Europe, Asia and Africa were valued at N1.833tn (40.43 per cent of total exports), N1.324tn (29.2 per cent) and N936.8bn (20.67 per cent) respectively. The country exported goods worth N405.8bn (8.95 per cent) to the Americas and N34.5bn (0.76 per cent) to Oceania. Nigeria exported goods valued at N300.6bn to ECOWAS member states represent 32.08 per cent of total merchandise exports to Africa. Nigeria exported goods mainly to India, Spain, Netherlands, South Africa and France, valued at N745bn (16.43 per cent), N487.1bn (10.74 per cent), N405.4bn (8.9 per cent), N325.5bn (7.2 per cent) and N302.3bn (6.7 per cent) respectively.

The aim of this study is to verify the influence of exports and imports of goods and services on trade via multivariate error correction model in Nigerian economy over periods 1960-2017.

II. METHODOLOGY

In a stochastic process, the value of the time series at time t is the value of the series at time t-1. AR process describes how one time shock affects value of the evolving variable extremely far into the future. VAR(p) model describes the joint mechanism of stochastic time series. The right hand side of a VAR(p) model can be thought of as all available information set at time t-1 that can be exploited for forecasting future values (Sims, 1980, Tiao and Box, 1981, Engle and Granger, 1987, Lutkepohl, 1991, Harvey, 1993, Lutkepohl, 2005, Shumway and Stoffer, 2011).

The realization of n stochastic processes:

$$y_t = \left(trade_{1t}, \mathrm{impgs}_{2t}, \mathrm{expgs}_{3t}\right)' \qquad (1)$$

where, y_t is an $(n \times 1)$ vector of random variables that follows a pth order Gaussian VAR for all t (t=1,2,…,T), T_{1t} is the total trade, $impgs_{2t}$ is the imports of goods and services and , $expgs_{3t}$ is the exports of goods and services.

The linear combinations of a VAR model will have zero expected values and finite variances, so that not only will the expected value of these terms be zero, but will also be meaningful in that there will be a non-trivial likelihood of being close to it. If this combination results in a zero mean stationary process, then the relationship holds with an error that has mean zero, constant variance, damps off autocorrelation quickly. It will not wander widely from its mean value of zero and will cross it frequently; hence, a stationary VAR process (Granger, 1983, Hendry, 1986, Engle and Granger, 1987, Johansen, 1988, Judge, et al. 1995, Hendry, 1995, Watson, 1994, Bruke and Hunter, 2005).

If y_t is cointegrated, then VAR(p) model will not be the most suitable for the analysis because the cointegrating relations are not overtly specious. The solutions of (1) has a root $\phi(\mathrm{L}) \geq 1$; then either some or all of the variables in y_t are integrated of order one, $I(1)$. It might be the case, that cointegration between the variables does exist. This instance can be analyzed in the context of a vector error correction model, VECM (p-1) (Granger, 1983, Johansen, 1988, Harvey,1993, Hamilton, 1994, Franses, 1998, Hayashi, 2000,Hendry and Juselius, 2000, Mills, and Markellos, 2008).

VECM transcribes Δy_t as a function due to changes in z_t and the extent to which the system is out of equilibrium in the past period y_{t-1}.

$$\Delta y_t = \pi y_{t-1} + \sum_{i=1}^{p-1} z_i \Delta y_{t-i} + \varepsilon_t \qquad (2)$$

where, $\pi = \alpha\beta' = -\left(1 - \phi_1 - \phi_2 - \cdots - \phi_p\right)$ contains the accumulative long-run impact; ϕ_i's are the autoregressive parameters, $z_i = -(\phi_{i+1} + ... + \phi_p)$ for i=1,…,p-1, measures the short-run effect;and $\varepsilon_t = \left(\varepsilon_{1t}, ..., \varepsilon_{kt}\right)'$ is an unobservable zero mean independent white noise process with time variant positive definite covariance matrix $\mathrm{E}\left(\varepsilon_t \varepsilon_t^{'}\right) = \sum_{\varepsilon}$ (Hendry, 1986, Johansen, 1991, Hayashi, 2000, Franses and Dijk, 2003, Bruke and Hunter, 2005, Pfaff, 2008).

Δy_t does not contain stochastic trends by our assumption that all variables have unit root. The number of cointegrating vectors is less than or equal to the number of variables n and strictly less than n if the variables have unit roots (Johansen,1988, Lutkepohl, 1991, Hamilton, 1994, Hatanaka, 1996,Lutkepohl and Poskitt, 1998, Roger, 2003, Lutkepohl, 2005).

Equilibrium correction concepts indicate an essential association about which the process or processes under scrutiny vary without differing for too long away from the values that would have to exist if the correlation is held exactly at each period in time. The equilibrium error is positive if the y process is of a value higher than is consistent with equilibrium. Thus, such an error should exert a downward pressure on y_t in the next period. Moreover, there should be a negative pressure on the transformation and the coefficient on the lagged equilibrium error in (2) ought to be negative if the interactive rule applies. Likewise, if the equilibrium error is negative, there should be upward pressure, and this argument is for a negative coefficient on y_{t-1}. The speed of adjustment to equilibrium is measured by the size of the coefficient on the disequilibrium error. Assuming correct negative sign, the larger this is in absolute value the faster the correction. In order for the equilibrium (i.e.long-run) solution to exist, it must be non-zero because itappears as a divisor in the equilibrium error term (Engle and Granger, 1987, Lutkepohl and Kratzig, 2004, Bruke and Hunter, 2005).

Eviews 10provides a starting point for the statistical computing and graphics. The data were sourced from the World Bank Data 2017 over the period 1960 to 2017.

III. RESULTS AND DISCUSSIONS

Graphic depictions of log of trade, imports and exports of goods and services in Nigerian for periods 1960-2017 were plotted against time as shown in Figure 1.

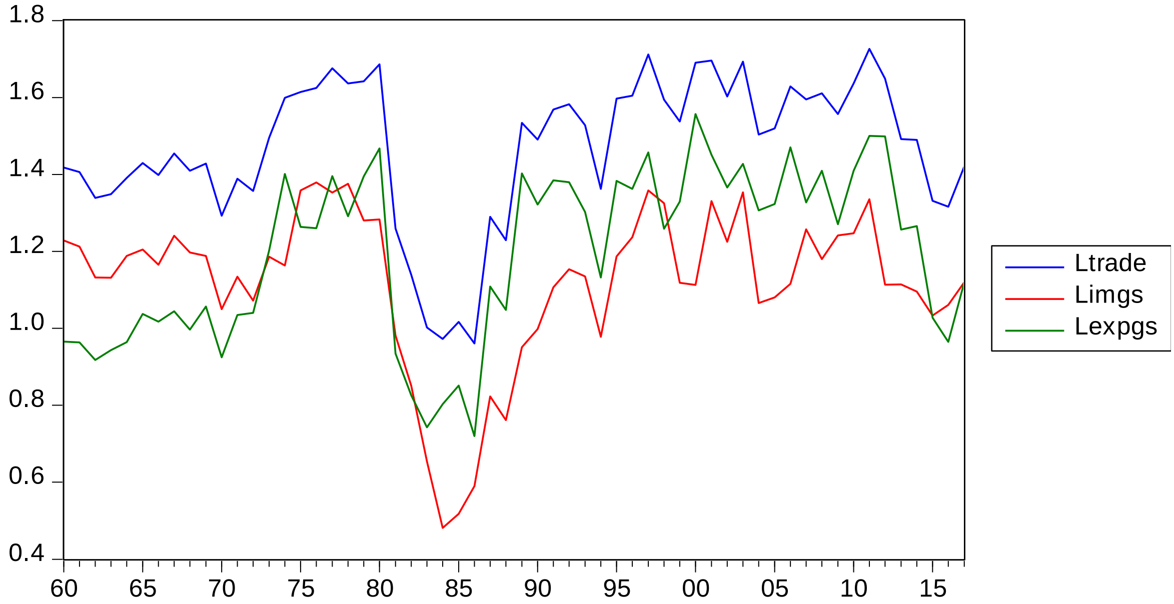


Figure 1: Time series plots of log trade, log import, and log export of good and services

Figure 1.0 showed that, the trending in the four time series is not even linear let alone being horizontal; but slightly upward trend was detected. The variability of the time series does not appear to be uniform, which raises the possibility that the variances are changing over time and their autocorrelations will remain close to one even at long lags. Thus, the four time series are not covariance stationary and there is need for conversion to stationarity.

Table 3.0: Descriptive Statistics

VariableMeanMinimumMaximum Standard Deviation				
Ltrade1.4685380.9607491.726548			0.189976	
Limgs1.117429	0.481408	1.378803	0.203243	
Lexpgs1.194451 0.720084		1.556583	0.221233	

The mean for Ltrade, Limpgs and Lexpgsas given in Table 3.0; they stand at 1.468538, 1.117429 and 1.194451 respectively. However, the minimum and maximum values for these variables are 0.960749; 0.481408; 0.720084 and 1.726548; 1.378803 and 1.556583respectively.

Table 3.1: Jarque-Bera Test

Variable	Test statistics	p-value	Skewness	Kurtosis
Ltrade10.97310.0041	-1.0187	3.6242		
Limpgs29.46940.0000-1.4287	5.0073			
Lexpgs 3.923080.1406-0.36161.9510				

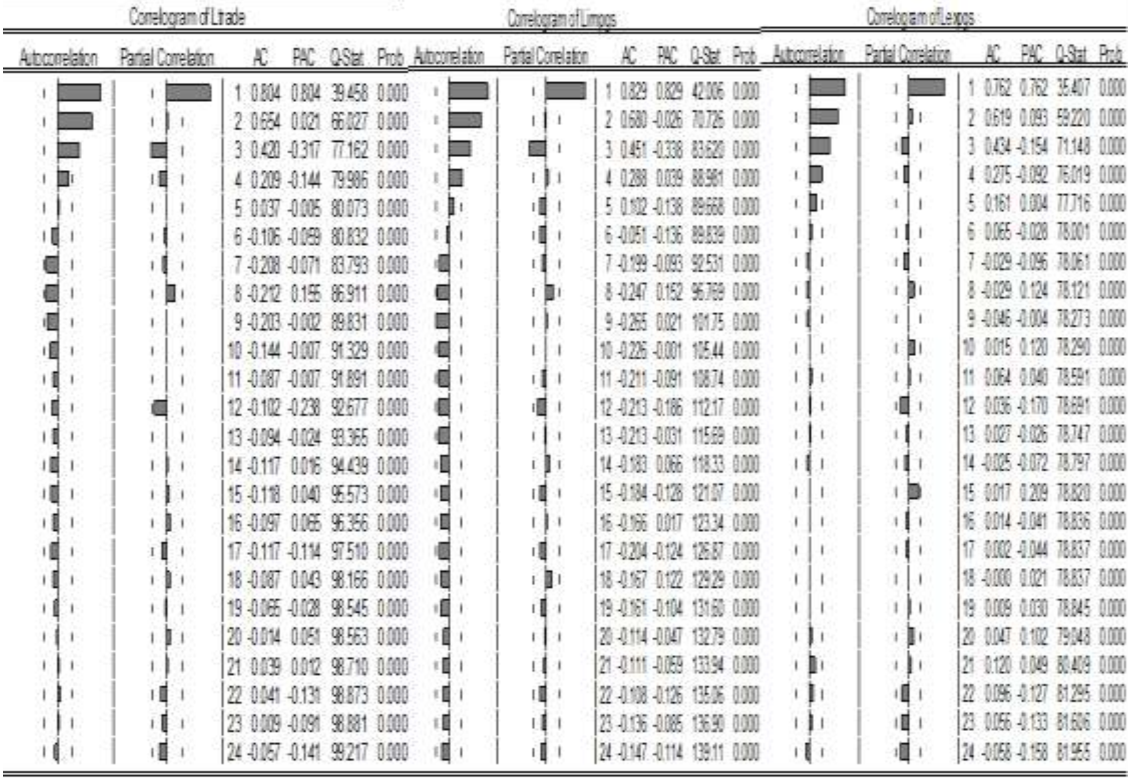
The negative skewness of -1.0187; -1.4287 and -0.3616 for the variables are less than 1; which implies that, there are more frequent large return observation to the left of the distribution with more small and mid-range positive return observation to the right of the distribution.The extreme values of 3.6242 and5.0073 for the kurtosis of trade and imports are greater 3.0 of the normal distribution; and their curves are said to be leptokurtic (have fat tails) while, the kurtosis of 1.9510 for exports is less than 3.0 of the normal distribution; and its curve is said to be platykurtic (have thin tails). Thus, the series are non-normal in distribution.

Table 3.2: Empirical Distribution Test

		Methods Cramer-von Mises (W2)Watson (U2)Anderson-Darling (A2)		
Ltrade	Value	0.1810	0.1380	1.3683
	Adj. Value	0.1825	0.1392	1.3869
	p-value	0.0090	0.0230	0.0014
Limpgs	Value	0.3824	0.3112	2.3344
	Adj. Value	0.3857	0.3139	2.3661
	p-value	0.0000	0.0001	0.0000
Lexpgs	Value	0.2657	0.2563	1.4128
	Adj. Value	0.2680	0.2585	1.4320
	p-value	0.0008	0.0005	0.0011

The p-values of the empirical distribution tests of Table 3.2 failed to account for the normally distributed null hypothesis assumption; as such, the series are confirmed to be non-normal in distribution.

Table 3.3: Correlogram of log trade, log imports and log exports of goods and services



	Correlogram of Ltrade				Correlogram of Limpgs				Correlogram of Lexpgs			
	AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob
1	0.804	0.804	39.458	0.000	0.829	0.829	42.006	0.000	0.762	0.762	35.407	0.000
2	0.654	0.021	66.027	0.000	0.680	-0.026	70.726	0.000	0.619	0.093	59.220	0.000
3	0.420	-0.317	77.162	0.000	0.451	-0.338	83.620	0.000	0.434	-0.154	71.148	0.000
4	0.209	-0.144	79.986	0.000	0.288	0.039	88.981	0.000	0.275	-0.092	76.019	0.000
5	0.037	-0.005	80.073	0.000	0.102	-0.138	89.668	0.000	0.161	0.004	77.716	0.000
6	-0.106	-0.059	80.832	0.000	-0.051	-0.136	89.839	0.000	0.065	-0.028	78.001	0.000
7	-0.208	-0.071	83.793	0.000	-0.199	-0.093	92.531	0.000	-0.029	-0.096	78.061	0.000
8	-0.212	0.155	86.911	0.000	-0.247	0.152	95.769	0.000	-0.029	0.124	78.121	0.000
9	-0.203	-0.002	89.831	0.000	-0.265	0.021	101.75	0.000	-0.046	-0.004	78.273	0.000
10	-0.144	-0.007	91.329	0.000	-0.226	-0.001	105.44	0.000	0.015	0.120	78.290	0.000
11	-0.087	-0.007	91.891	0.000	-0.211	-0.091	108.74	0.000	0.064	0.040	78.591	0.000
12	-0.102	-0.238	92.677	0.000	-0.213	-0.186	112.17	0.000	0.036	-0.170	78.691	0.000
13	-0.094	-0.024	93.365	0.000	-0.213	-0.031	115.69	0.000	0.027	-0.026	78.747	0.000
14	-0.117	0.016	94.439	0.000	-0.183	0.066	118.33	0.000	-0.025	-0.072	78.797	0.000
15	-0.118	0.040	95.573	0.000	-0.184	-0.128	121.07	0.000	0.017	0.209	78.820	0.000
16	-0.097	0.065	96.356	0.000	-0.166	0.017	123.34	0.000	0.014	-0.041	78.836	0.000
17	-0.117	-0.114	97.510	0.000	-0.204	-0.124	126.87	0.000	0.002	-0.044	78.837	0.000
18	-0.087	0.043	98.166	0.000	-0.167	0.122	129.29	0.000	-0.000	0.021	78.837	0.000
19	-0.065	-0.028	98.545	0.000	-0.161	-0.104	131.60	0.000	0.009	0.030	78.845	0.000
20	-0.014	0.051	98.563	0.000	-0.114	-0.047	132.79	0.000	0.047	0.102	79.048	0.000
21	0.039	0.012	98.710	0.000	-0.111	-0.059	133.94	0.000	0.120	0.049	80.409	0.000
22	0.041	-0.131	98.873	0.000	-0.108	-0.126	135.06	0.000	0.096	-0.127	81.295	0.000
23	0.009	-0.091	98.881	0.000	-0.136	-0.085	136.90	0.000	0.056	-0.133	81.606	0.000
24	-0.057	-0.141	99.217	0.000	-0.147	-0.114	139.11	0.000	-0.058	-0.158	81.955	0.000

The autocorrelation and partial autocorrelationfunctions up to lag 24 showedpatterns of time-based dependence in the series with significant p-values at 0.05 level. This typically make sense only for non-stationary time series.

Table 3.4: Unit root Tests for Ltrade, Limpgs and Lexpgs in levels

Ltrade		**Limpgs**		**Lexpgs**	
1% 5% 10%		1% 5% 10%		1% 5% 10%	
-2.6062 -1.9467 -1.6131		-2.6062 -1.9467 -1.6131		-2.6062 -1.9467 -1.6131	
ADF Test stat:	-0.2966	ADF Test stat:	-0.5145	ADF Test stat:	-0.3442
p-value:	0.5746	p-value:	0.4893	p-value:	0.5567
PP Test stat:	-0.2796	PP Test stat:	-0.5069	PP Test stat:	-0.2716
p-value:	0.5819	p-value:	0.4925	p-value:	0.5839

The result of Table 3.4 providesstrong evidence in favor of the unit root process in log levels of the series and therefore non-stationary.The presence of unit root in a group of series makes it possible to identify the presence of a long run link between the series and to describe the underlying equilibrium behaviour.

Table 3.5: Unit root Tests for Ltrade, Limpgs and Lexpgs in fisrt difference

d(Ltrade)		**d(Limpgs)**		**d(Lexpgs)**	
1% 5% 10%		1% 5% 10%		1% 5% 10%	
-2.6062 -1.9467 -1.6131		-2.6062 -1.9467 -1.6131		-2.6062 -1.9467 -1.6131	
ADF Test stat:	-8.3663	ADF Test stat:	-4.1397	ADF Test stat:	-9.2227
p-value:	0.0000	p-value:	0.0000	p-value:	0.0000
PP Test stat:	-8.3226	PP Test stat:	-7.8588	PP Test stat:	-9.2227
p-value:	0.0000	p-value:	0.0000	p-value:	0.0000

The unit root test in first difference for the series does not contain unit root. Thus, the series are integrated of order one and a VAR model can be estimated.

Table 3.6: Roots of Characteristic Polynomial

Endogenous variables: LtradeLimpgs, Lexpgs **Lag specification: 1 5**	
Root	Modulus
0.888273	0.888273
-0.875016	0.875016
0.784803 - 0.303410i	0.841411
0.784803 + 0.303410i	0.841411
0.344810 - 0.728360i	0.805855
0.344810 + 0.728360i	0.805855
-0.516256 - 0.527943i	0.738406
-0.516256 + 0.527943i	0.738406
-0.029633 - 0.679839i	0.680484
-0.029633 + 0.679839i	0.680484
-0.559057 - 0.348122i	0.658584
-0.559057 + 0.348122i	0.658584
0.516828 - 0.359907i	0.629797
0.516828 + 0.359907i	0.629797
0.252713	0.252713

No roots of the characteristic polynomial in Table 3.1 lies outside the unit circle; thus, VAR(5) model fulfills the stability condition. The estimates of VAR(5) model for AIC= -9.1469 and Log likelihood of 290.3935 is given by equation 3.1:

$$\begin{bmatrix} Ltrade_{1t} \\ Limpgs_{2t} \\ Lexpgs_{3t} \end{bmatrix} = \begin{pmatrix} 1.45 \\ -0.45 \\ 2.46 \end{pmatrix} + \begin{pmatrix} -1.59 & 1.21 & -3.10 \\ 1.20 & 0.17 & 1.94 \\ 1.27 & -0.49 & 2.77 \end{pmatrix} \begin{pmatrix} Ltrade_{1t-1} \\ Limpgs_{2t-1} \\ Lexpgs_{3t-1} \end{pmatrix} + \begin{pmatrix} 2.44 & 0.20 & 3.84 \\ -0.76 & 0.14 & -1.36 \\ -1.39 & -0.05 & 0.86 \end{pmatrix} \begin{pmatrix} Ltrade_{1t-2} \\ Limpgs_{2t-2} \\ Lexpgs_{3t-3} \end{pmatrix} + \begin{pmatrix} -0.51 & 1.14 & -1.77 \\ 0.11 & -0.80 & 0.75 \\ 0.16 & -0.69 & 0.86 \end{pmatrix} \begin{pmatrix} Ltrade_{1t-3} \\ Limpgs_{2t-3} \\ Lexpgs_{3t-3} \end{pmatrix}$$

$$+ \begin{pmatrix} -1.70 & -1.50 & -1.81 \\ 0.76 & 0.80 & 0.78 \\ 0.80 & 0.73 & 0.83 \end{pmatrix} \begin{pmatrix} Ltrade_{1t-4} \\ Limpgs_{2t-4} \\ Lexpgs_{3t-4} \end{pmatrix} + \begin{pmatrix} -0.87 & 1.02 & -2.19 \\ 0.13 & -0.50 & 0.54 \\ 0.67 & -0.55 & 1.53 \end{pmatrix} \begin{pmatrix} Ltrade_{1t-5} \\ Limpgs_{2t-5} \\ Lexpgs_{3t-5} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{pmatrix} \quad (3.1)$$

Table 3.7: VAR(5) Residual Serial Correlation Lagrange Multiplier Tests

Null hypothesis: No serial correlation at lag k						
Lag	**LREstat**	**df**	**Prob.**	**Rao F-stat**	**df**	**Prob.**
1	10.31365	9	0.3257	1.169158	(9, 78.0)	0.3264
2	14.14173	9	0.1174	1.642152	(9, 78.0)	0.1179
3	13.85961	9	0.1274	1.606531	(9, 78.0)	0.1280
4	7.892692	9	0.5450	0.881288	(9, 78.0)	0.5457
5	10.33111	9	0.3244	1.171264	(9, 78.0)	0.3251
Null hypothesis: No serial correlation at lags 1 to k						
1	10.31365	9	0.3257	1.169158	(9, 78.0)	0.3264
2	21.00756	18	0.2790	1.197534	(18, 82.5)	0.2826
3	27.14875	27	0.4558	1.010602	(27, 76.6)	0.4666
4	33.39364	36	0.5932	0.909266	(36, 68.7)	0.6153
5	44.70744	45	0.4843	0.974477	(45, 60.2)	0.5314

Diagnostic tests performed in Tables 3.7revealed that there are no serial correlations in the residuals ofVAR(5) model at lag k and lag 1 to k.

Table 3.8: VAR(5) Residual Normality Tests

Null Hypothesis: Residuals are multivariate normal				
Component Skewness Chi-sqdf Prob.				
1	-0.299591	0.792833	1	0.3732
2	0.092496	0.075574	1	0.7834
3	-0.661551	3.865903	1	0.0493
Joint		4.734310	3	**0.1923**
Component Kurtosis Chi-sqdf Prob.				
1	3.241002	0.128265	1	0.7202
2	3.539157	0.641941	1	0.4230
3	2.927770	0.011521	1	0.9145
Joint		0.781727	3	**0.8538**
Component Jarque-BeradfProb.				
1	0.921098		2	0.6309
2	0.717515		2	0.6985
3	3.877424		2	0.1439
Joint	5.516037		6	**0.4795**

The null hypothesis that the residuals of the VAR(5) model are multivariate normal cannot be rejected with p–values of the joint components being greater than 0.05 level for the skewness, kurtosis and Jarque-Bera tests.Thus, the residuals of the model are normally distributed.

Table 3.9: Johansen System Cointegration Test

Trace Method for Unrestricted Cointegration Rank Test				
Hypothesized no. of CE(s)	**Eigenvalue**	**Trace Stat.**	**0.05 Critical Value**	**Prob.**
None *	0.301873	37.50518	35.19275	0.0277
At most 1	0.208546	**18.45943**	**20.26184**	0.0868
At most 2	0.108106	6.063594	9.164546	0.1859

Johansen system cointegration test in Table 3.6 pointed out that one cointegration relation exists between the series with trace statistics value less than 0.05 critical value and p-value of 0.0868. The existence of a long run relationship concerning the indicators indicated that the three time series are causally related in one direction.The estimated VEC(4) model for AIC: -8.9873 and Log likelihood of 281.1638 is given below in equation (3.2):

$$\begin{bmatrix} d\left(Ltrade_{1t}\right) \\ d\left(Limpgs_{2t}\right) \\ d\left(Lexpgs_{3t}\right) \end{bmatrix} = -0.35 + \begin{pmatrix} -7.02 \\ -1.17 \\ -10.52 \end{pmatrix} \begin{pmatrix} 1.00 & -0.46 & -0.51 \end{pmatrix} \begin{pmatrix} Ltrade_{1t-1} \\ Limpgs_{2t-1} \\ Lexpgs_{3t-1} \end{pmatrix}$$

$$+ \begin{pmatrix} 3.75 & 2.31 & 5.15 \\ -1.74 & -1.21 & -2.23 \\ -1.56 & -1.05 & -2.75 \end{pmatrix} \begin{pmatrix} d\left(Ltrade_{1t-1}\right) \\ d\left(Limpgs_{2t-1}\right) \\ d\left(Lexpgs_{3t-1}\right) \end{pmatrix} + \begin{pmatrix} 5.01 & 1.85 & 7.27 \\ -1.95 & -0.70 & -2.85 \\ -2.62 & -0.78 & -3.97 \end{pmatrix} \begin{pmatrix} d\left(Ltrade_{1t-2}\right) \\ d\left(Limpgs_{2t-2}\right) \\ d\left(Lexpgs_{3t-2}\right) \end{pmatrix}$$

$$+\begin{pmatrix} 3.46 & 2.28 & 4.12 \\ -1.43 & -1.21 & -1.55 \\ -1.89 & -1.11 & -2.32 \end{pmatrix}\begin{pmatrix} d\left(Ltrade_{1t-3}\right) \\ d\left(Limpgs_{2t-3}\right) \\ d\left(Lexpgs_{3t-3}\right) \end{pmatrix}+\begin{pmatrix} 1.25 & 0.04 & 1.97 \\ -0.40 & -0.05 & -0.57 \\ -0.83 & -0.02 & -1.33 \end{pmatrix}\begin{pmatrix} d\left(Ltrade_{1t-4}\right) \\ d\left(Limpgs_{2t-4}\right) \\ d\left(Lexpgs_{3t-4}\right) \end{pmatrix}+\begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{pmatrix} \quad (3.2)$$

Table 3.10: VEC(4) Error Correction Model

Ltrade	Limpgs	Lexpgs	C
1.00	-0.46 (0.01) [-48.18]	-0.51 (0.01) [-54.34]	-0.35 (0.01) [-36.32]

The normalized cointegrating equation of Table 3.10 showed the long-run elasticity relation between the variables considered. The result above revealed that, 1% increase in imports of goods and services will tend to increase trade by 46%; more so,1% increase in exports of goods and services will tend to increase trade by 51%. Thus, import and export of goods and services exerted an upward pressure on the long-run elasticity but the positive effect of exports has been larger on trade.

Table 3.11: Adjustment Coefficients

d(Ltrade)	d(impgs)	d(Lexpgs)
-7.07 (3.52)	-1.17 (3.44)	-10.52 (4.26)

The adjustment coefficients to equilibrium were negative as required. At disequilibrium, it takes trade a speed of -7.07 to return back to equilibrium; while, import and export of goods and services take a speed of -1.17 and -10.52individually to return back to equilibrium. Consequently, export of goods and services is quicker to the adjustment.

Table 3.12: VEC(4) Residual Serial Correlation Lagrange Multiplier Tests

Null hypothesis: No serial correlation at lag k						
Lag	**LREstat**	**df**	**Prob.**	**Rao F-stat**	**df**	**Prob.**
1	10.23703	9	0.3316	1.158080	(9, 85.3)	0.3323
2	9.633974	9	0.3809	1.086096	(9, 85.3)	0.3815
3	9.552048	9	0.3880	1.076355	(9, 85.3)	0.3886
4	3.376663	9	0.9475	0.367340	(9, 85.3)	0.9476
5	8.060825	9	0.5280	0.900602	(9, 85.3)	0.5286
Null hypothesis: No serial correlation at lags 1 to k						
1	10.23703	9	0.3316	1.158080	(9, 85.3)	0.3323
2	22.47608	18	0.2115	1.288506	(18, 91.0)	0.2142
3	25.92936	27	0.5225	0.959141	(27, 85.3)	0.5312
4	34.65972	36	0.5323	0.953833	(36, 77.5)	0.5516
5	40.63206	45	0.6574	0.869016	(45, 69.1)	0.6894

Diagnostic tests executed in Tables 3.12 inferred that there are no serial correlations in the residuals of the VEC(4) model at lag k and lag 1 to k.

Table 3.13: VEC(4) Residual Normality Tests

Null Hypothesis: Residuals are multivariate normal				
Component Skewness Chi-sqdfProb.				
1	-0.490799	2.127806	1	0.1446
2	-0.052834	0.024658	1	0.8752
3	-0.654313	3.781772	1	0.0518
Joint		5.934236	3	**0.1149**
Component Kurtosis Chi-sqdfProb.				
1	4.155832	2.950215	1	0.0859
2	3.131990	0.038472	1	0.8445
3	2.746488	0.141926	1	0.7064
Joint		3.130613	3	**0.3719**
Component Jarque-BeradfProb.				
1	5.078021		2	0.0789
2	0.063130		2	0.9689
3	3.923698		2	0.1406
Joint	9.064849		6	**0.1700**

The null hypothesis that the residuals of VEC(4) model are multivariate normality cannot be rejected with p-values of the joint components greater than 0.05 level. Thus, the residuals are normally distributed and the VEC(4) model is adequate for forecasting.

IV. CONCLUSIONS

The long-run elasticity relationship of log import and log export on log trade was examined via multivariate error correction mechanism in the Nigerian economy over periods 1960-2016.It was observed that there are more frequent large return observation to the left of the indicator's distribution with more small and mid-range positive return observation to the right of their distribution. The curves of trade and importare said to be leptokurtic (have fat tails) while, the curve of export is said to be platykurtic (have thin tails). The p-values of the empirical distribution tests failed to account for the normally distributed null hypothesis assumption and the series are confirmed to be non-normal in distribution. The autocorrelation and partial autocorrelation functions up to lag 24 showed patterns of time-based dependence in the series with significant p-values at 0.05 level. The four time series considered were not covariance stationary and there is need for conversion to stationarity.The unit roots in the three series were associated with the stochastic trend and this is responsible for their non-stationarity. The long-run behaviour exhaustively revealed that 1% increase in import of goods and services will tend to increase trade by 46%; more so, 1% increase in exports of goods and services will tend to increase trade by 51%. Import and export of goods and services exerted upward pressure on the long-run elasticity but the positive effect of exports has been larger. At disequilibrium, it takes trade a speed of -7.07 to return back to equilibrium; while import and export of goods and services take a speed of -1.17 and -10.52 individually to return back to equilibrium. Moreover, the export of goods and services is quicker to the adjustment. There is a significant opportunity to explore critically the importance of exporting other commodities in relation to crude oil in Nigerian economy to influence the level of economic growth, employment and the balance of payments.

REFERENCES

[1]. Bruke, S.P. and Hunter, J. (2005).Modelling Non-Stationary Time Series. A Multivariate Approach.First edition.Palgrave Macmillian, New York, USA.
[2]. Engle, R. F. and Granger, C.W. J. (1987). Co-integration and Error Correction: Representation, Estimation and Testing. Econometrica 55, 251–276.
[3]. Franses, P.H. and Dijk, D.V. (2003).Non Linear Time Series Models in Empirical Finance.Second edition.Cambridge University Press, NewYork, USA.
[4]. Franses, P.H. (1998). Time Series Models for Business and Economic Forecasting.Cambridge University Press, Cambridge, U.K.
[5]. Granger, C.W.J. (1983).CointegratedVariables and Error Correcting Models.Discussion Paper No.83 13a, University of California, San Diego, USA.
[6]. Hamilton, J.D. (1994). Time Series Analysis. Princeton, NJ: Princeton University Press.
[7]. Harvey, A.C. (1993). Time Series Models.International Journal of Forecasting, 9, issue 4, Pp. 582-583.
[8]. Hatanaka, M. (1996).Time-Series-Based Econometrics: Unit Roots and Co-Integration. Oxford University Press, U.K.
[9]. Hayashi, F. (2000).Econometrics.Princeton University Press.
[10]. Hendry, D.F. and Juselius, K. (2000).Explaining Cointegration Analysis: Part I. Energy Journal 21, 1–42.
[11]. Hendry, D. F. (1995).Dynamic Econometrics. Oxford: Oxford University Press.
[12]. Hendry, D. F. (1986). Econometric Modelling with Cointegrated Variables: An Overview. Oxford Bulletin of Economics and Statistics 48 (3), 201–212.
[13]. Johansen, S. (1991).Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models.Econometrica59, 1551-80.
[14]. Johansen, S. (1988).Statistical Analysis of Cointegrated Vectors.Journal of Economic Dynamics and Controls 12, 231-254.
[15]. Judge, G.G., Griffiths, W.E., Hill, R.C., Lutkepohl, H. and T.C. Lee (1985).The Theory and Practice of Econometrics, 2nd edition, J.Willey& Sons, INC, NY.
[16]. Lutkepohl, H. (2005). New Introduction to Multiple Time Series Analysis. Springer-Verlag Berlin Heidelberg. ISBN 3540401725.
[17]. Lutkepohl, H. and Kratzig, M. (2004).Applied Time Series Econometrics, Cambridge University Press, Cambridge.
[18]. Lutkepohl, H. and Poskitt, D. S. (1998), Consistent Estimation of the number of Cointegration relations in a Vector Autoregressive Model,inR.Galata&H.Kuchenho (eds.), Econometrics in Theory and Practice. Festschrift for Hans Schneewei, Heidelberg: Physica-Verlag, 87-100.
[19]. Lutkepohl, H. (1991). Introduction to Multiple Time Series Analysis. Springer Verlag, Berlin.
[20]. Mills, T.C and Markellos, R.N. (2008).The Econometrics of Financial Time Series.Third edition.Combribdge University press, U.K.
[21]. Pffaf, B. andTaunus, K. (2008). VAR, SVAR and SVEC Models: Implementation within R Package vars. Journal of Statistical Software 27(4). http://www.jstatsoft.org.
[22]. Roger, P. (2003). Unit roots and Cointegration. Lecture Notes: Department of Economics. University of Starthclyde, Glassgow, Scotland.
[23]. Shumway, R.H and D.S. Stoffer (2011).Time Series Analysis and Its Applications, With R Examples.Third edition.Springer New York Dordrecht Heidelberg London.DOI 10.1007/978-1-4419-7865-3_1.
[24]. Sims, C. A. (1980): Macroeconomics and Reality. Econometrica 48(1), 1-48.

[25]. Tiao, G. C., and Box, G. E. P. (1981): Modeling Multiple Times Series with Applications. Journal of the American Statistical Association, 76(376), 802-816.

[26]. Watson, M. W. (1994). Vector Autoregressions and Cointegration.Handbook of Econometrics.Volume IV. R.F. Engle and D. McFadden (eds.). Elsevier Science Ltd., Amsterdam.

Olorunpomi" Long-Run Impact of Exports and Imports on Trade" Quest Journals Journal Of Software Engineering And Simulation, Vol. 05, No. 01, 2019, Pp. 56-64