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Position Analysis of the Relationship Between the Naira Exchange Rate, Gb Pounds, Euro and US-Dollars

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Abstract: *The main objective of this research is to investigate the true position of the causal relationship between the Nigeria Naira exchange rate against the Euro, GBP and Dollars on the long and short run. We considered the structural break which is believed to be as a result of the government deliberate devaluation of the Naira. Unit root test indicated stationarity at the first difference for all the variables. The result of the vector error correction model reveals that the position of the relationship on long run pair wise test between NGNUSD, NGGBP and NGNEUR shows unidirectional causality running from NGNUSD→NGNGBP→ and NGNUSD→NGNEUR. This implies that NGNUSD affects NGNGBP and NGNEUR in the long run. It is observed that NGNUSD is useful to forecast NGNGBP and NGNEUR, but the converse is not true. Moreover, it is observed that there is bi-directional causality between NGNGBP and NGNEUR, which implies that all the series affect each other in the long run. On the other hand, the position of the relationship in the short run using the Wald test reveals a* ***unidirectional*** *causality running from NGNEUR to NGNGBP, which means NGNEUR affects NGNGBP in the short-run. We observed that NGNEUR is useful to forecast NGNGBP in the short-run but the converse is not true. This reveals that the position of the relationship between the Naira, Dollar, Euro and GB-pound is responsible for the constant price hike in Nigeria, making the living condition of Nigeria, making living condition of Nigerians harshly unbearable.*

Keywords: *Position Analysis, exchange rate, vector error correction, causal relationship, co-integration.*

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1.0 Introduction

The forecasting of exchange rate is crucial as it has a significant impact on the macroeconomic fundamentals such as oil price, interest rate, wage, unemployment and the level of economic growth (Ramzan *et al*, 2012). Therefore, the position of any nation's economic currency concerning its major trade partners is very vital for economic growth. Foreign exchange markets are among the most important and the largest financial markets in the world with trading taking place twenty – four hours a day around the globe and trillions of dollars of different currencies transacted each day (Khashei & Bijari, 2011).

The main objectives of the exchange rate policy in Nigeria are to preserve the value of the Naira and to maintain enough foreign exchange reserves (Oleka & Okolie, 2016). The evolution of the Nigerian foreign exchange market was influenced by such factors as the changing patterns of international trade, institutional changes in the economy and structural shifts in production (CBN, 2011). The oil boom experienced in the nineteen seventies led to enhanced foreign exchange receipts; hence the need to develop a local foreign exchange market became paramount (Mojekwu *et al*, 2011).

Timely forecasting of the exchange rates can give important information to the decision- makers as well as partakers in the area of internal finance, buy and sell, and policy- making (Alam, 2012). But today, rather than allow the Naira to compete with its foreign competitors, the government is making policy devaluating the Naira, denying it the opportunity to compete with other currencies. This is indeed a disadvantage to the Nigerian economy in favor of other nations.

Vector Autoregression method (VAR) was employed by Domac (2003), Odusola and Akihlo (2001), Siklos (1991), Canetti and Green (2000) while Bawumia and Otoo (2003) applied the Error correction Model (ECM).

Since September 1986 when the market-determined exchange rate system was introduced via the second- tier foreign exchange market, the naira exchange rate has exhibited the features of continuous depreciation and instability. This instability and continued depreciation of the naira in the foreign exchange market has resulted in a decline in the standard of living of the populace, increased cost of production which also leads to cost- push inflation. It has also tended to undermine the international competitiveness of non-oil exports and make planning and projections difficult at both macro and micro levels of the economy. The recent crises across different assets and markets at the global level show the importance of the causality effect between the international markets. Four currencies in the world's economy are considered in this research work and these are the Nigeria naira (₦), Us Dollar ($), GB pounds (£) and Euro (€).

The primary objective of the study is to carry out a position analysis to ascertain the long-run and short-run causal relationship between Nigeria's Naira exchange rate with US dollar (NGNUSD), GB Pounds (NGNGBP) and Euro (NGNEUR) and Vector Error Correction approach is employed. A Great deal of research has been documented, but the examination of structural breaks in the flow system is found wanting. This work intends to bridge this gap in the light of the causal relationship here after referred to as position analysis and strictly speaking, other works in literature has been limited to Dollar and Pounds but this work extends to other currency, the trade volumes between Nigeria and other countries.

2.0 Materials and Methods

2.1 Source of data

The dataset used for this research work consists of three- time series of foreign exchange rates, namely Nigeria naira (₦), Us Dollar ($), GB pounds (£) and Euro (€). The data is monthly and covers the years 2010-2020. The data was obtained from the CBN website www.cbn.gov.ng and to simplify the work, the following tools are employed. Finally, the analysis was performed using the econometric software Eviews 9. It is seen from the literature of the time series that if the series is non-stationary or I(1) process, the regression results with variables at a level will be spurious (Granger and Newbold, 1974; Phillips, 1986).

2.2 Methodology

Augmented Dickey- Fuller (ADF) test, Phillip-Perron (PP) test, Johansen co-integration test, Vector error correction models (VECM) and Wald test. First, ADF and PP test is used to examine the stationarity of the two variables. Second, the Johansen co-integration test is used to identify the existence and the number of co-integrating vectors. Finally, with the presence of the co-integrating vectors, the VECM and Wald test is employed to identify the true position causal relationship between the variables used in the study.

2.2.1 Johansen Co-integration test

When the variables are integrated in the same order, the Johansen test of co-integration can be applied. The Johansen (1988) approach determines the number of co-integrated vectors for any given number of non-stationary variables of the same order. Johansen uses two statistics for testing the co-integration viz., λtrace and λmax statistics, which are as follows:

$$J_{trace} = -T\sum_{i=r+1}^{n}\ln\left(1-\hat{\lambda}_i\right) \tag{1}$$

$$J_{\max} = -T\ln\left(1-\hat{\lambda}_{r+1}\right) \tag{2}$$

Here T is the sample size and $\hat{\lambda}_i$ is the ith largest canonical correlation

2.2.2 Vector error correction model

The vector error correction (VEC) model is a restricted VAR (vector autoregression) designed for use with nonstationary series that are known to be co-integrated. The VEC has co-integration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge their co-integrating relationships while allowing for short-run adjustment dynamics (Engle and Granger, 1987). The co-integration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments.

If the variables are co-integrated in the same order, then a valid error correction model exists between the two variables. The determination of the co-integration relationship (co-integrated vector) that shows the presence of a long-term relationship between variables and causality relationships must be analyzed with the error correction model.

The corresponding VEC model is:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{q}\beta_{1i}\Delta y_{t-i} + \sum_{i=1}^{q}\beta_{2i}\Delta X_{t-i} + \sum_{i=1}^{q}\beta_{3i}\Delta R_{t-i} + \alpha_1 Z_{t-1} + \varepsilon_{1t} \tag{3}$$

$$\Delta X_t = \phi_0 + \sum_{i=1}^{r}\phi_{1i}\Delta X_{t-i} + \sum_{i=1}^{r}\phi_{2i}\Delta R_{t-i} + \sum_{i=1}^{r}\phi_{3i}\Delta Y_{t-i} + \lambda_1 Z_{t-1} + \varepsilon_{2t} \tag{4}$$

$$\Delta R_t = \omega_0 + \sum_{i=1}^{r}\omega_{1i}\Delta R_{t-i} + \sum_{i=1}^{r}\omega_{2i}\Delta y_{t-i} + \sum_{i=1}^{r}\omega_{3i}\Delta X_{t-i} + \psi_1 Z_{t-1} + \varepsilon_{3t} \tag{5}$$

Where Z_{t-1} is the error correction term (ECT) and is the OLS residual obtained from the long-run co-integrating regression relationship between NGNUSD(Y_t), NGNGBP(X_t) and NGNEUR (R_t):

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 R_t + \varepsilon_t \tag{6}$$

And is defined as

$$Z_{t-1} = ECT_{t-1} = Y_{t-1} - \beta_0 - \beta_1 X_{t-1} - \beta_2 R_{t-1} \tag{7}$$

From equation (3), the coefficient of ECT, α_1, is the speed of adjustment, because it measures the speed at which Y returns to equilibrium after a change in X and R. Also from equation (4), the coefficient of ECT, λ_1, is the speed of adjustment which measures the speed at which X returns to equilibrium after a change in R and Y. In equation (5), the coefficient of ECT, ψ_1, is the speed of adjustment which measures the speed at which R returns to equilibrium after a change in X and Y.

The above error correction model (ECM) implies that possible sources of causality are two: lagged dynamic regressors and lagged co-integrating vector. Accordingly, by equation (3), NGNGBP and NGNEUR Granger causes NGNUSD, if the null of either $\sum_{i=1}^{q}\beta_{2i} = 0$ and $\sum_{i=1}^{q}\beta_{3i} = 0$ or $a_1 = 0$ is rejected. On the other hand, by equation (4), NGNUSD and NGNEUR Granger causes NGNGBP, if λ_1 is significant or $\sum_{i=1}^{r}\phi_{2i}$ and $\sum_{i=1}^{r}\phi_{3i}$ are jointly significant. Also, by equation (5), NGNUSD and NGNGBP Granger causes NGNEUR, if ψ_1 is significant or $\sum_{i=1}^{q}\omega_{2i}$ and $\sum_{i=1}^{q}\omega_{3i}$ are jointly significant.

2.2.3 Wald test

To ascertain the position in the short run, the Wald test is used. The Wald test computes a test statistic based on unrestricted regression. The Wald statistic measures how close the unrestricted estimates come to satisfying the restrictions under the null hypothesis. If the restrictions are true, then the unrestricted estimates should come close to satisfy the restrictions.

3.0 Results and Discussion

To check stationary and non-stationary time series, line graph and **unit root tests** are used

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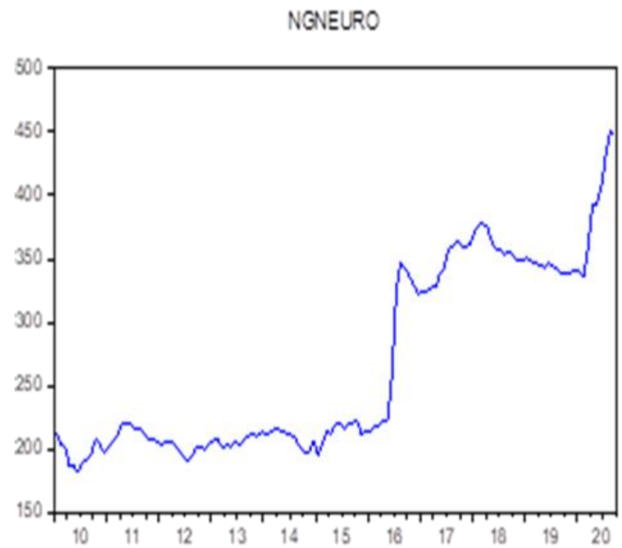
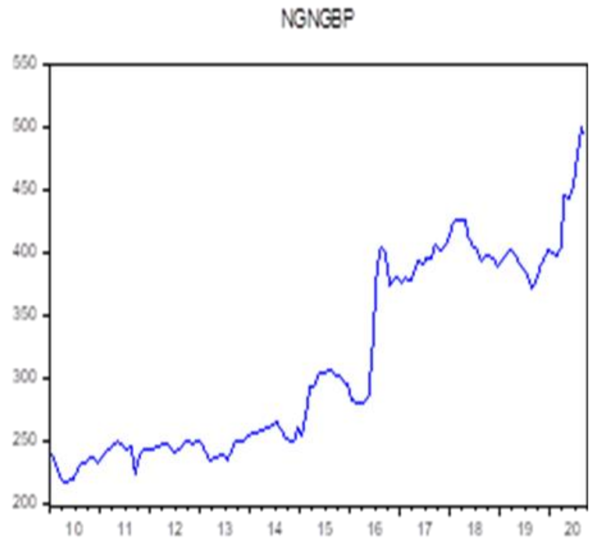
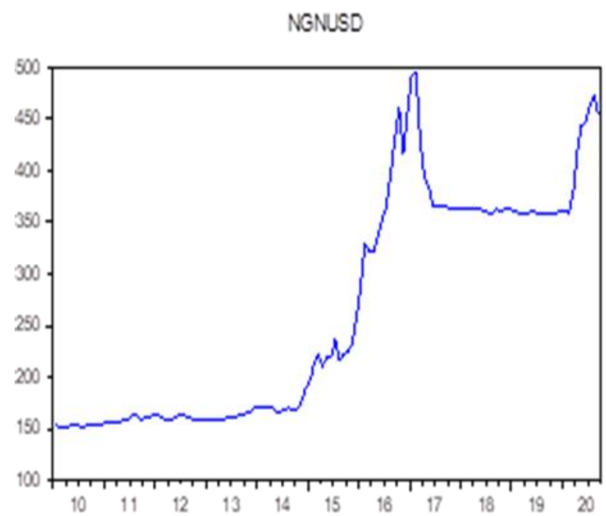




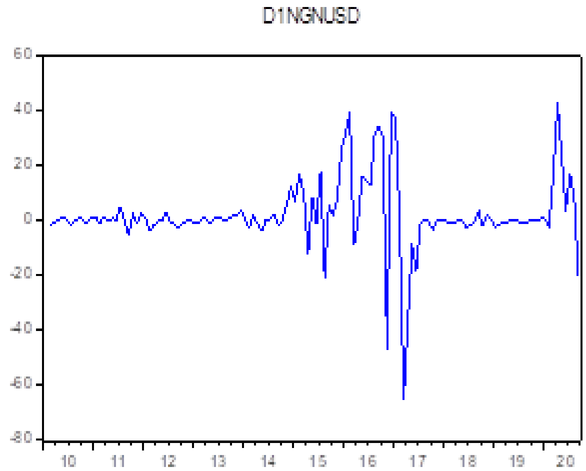


(c)

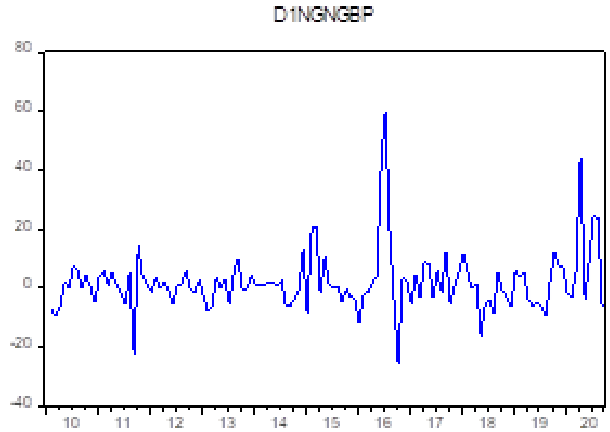
Fig1: Time Plot of Variables (NGNUSD and NGNGBP) at level difference

Fig. 1 (a) shows the trend of Nigeria's Naira exchange rate with GPD (NGNGBP) at level difference. It was noticed that there is a fairly stable trend in the first year (2010) to over 5 years and there was a structural beak after the year 2014, the time plot of Euro also look fairly stable with a structural break after about 5 years while the plot for Dollar (NGNDOLLA) the trend look constant over the years until the structural break which was as a result of government policy of devaluation, because of this structural break and fluctuation thereafter is responsible for the instability in the exchange rate system.

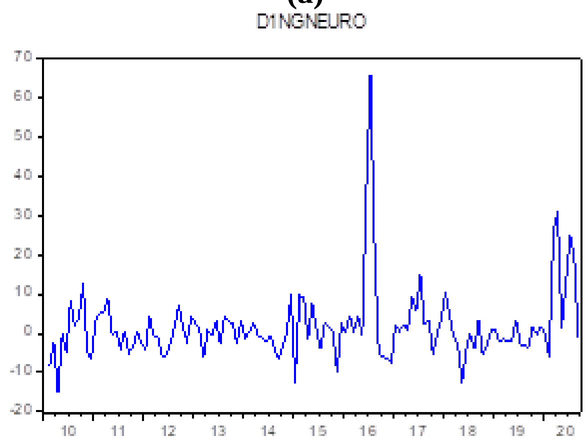
From Fig.1, it shows that the series are not stationary so, taking first the difference as: DNGNUSD, DNGNGBP, and NGNEUR.



(a)



(b)



(c)

Fig 2: Time Plot of Variables (NGNEUR, NGNGBP and NGNDollar) at first difference

Fig 2 (a), (b) and **(c)** is a graph of the first difference of NGNEURO, NGNGBP and NGNDollar. Notice that the three series now looks approximately stationary (at least the Mean and Variance are more or less constant) but it is not at all random (a strong seasonal pattern remains). To make the above conclusion more firm, we perform a unit root test (Augmented Dickey-Fuller) and Phillips-Perron (PP) test to observe whether the series are stationary or not.

3.1 Unit root test

The stationary position of the time series was checked by applying unit root tests. In the unit root, two tests are used, the first one is 'Augmented Dickey Fuller' **(ADF)** and the second one is 'Philllips- Perron' statistical tool.

Table 1(A): Result of Augmented Dickey Fuller (ADF) Test at level and first difference

Variables	**Augmented Dickey-Fuller (ADF) Test**			**Process**	**Test Critic**
	Statistic	**P-value**	**Unit Ro**		**At 5%**
NGNUSD	-0.534481	0.8795	Yes	I(1)	-2.884291
D(NGNUSD)	-8.089890	0.0000	No	I(0)	-2.884291
NGNGBP	-0.123856	0.9435	Yes	I(1)	-2.884291
D(NGNGBP)	-8.126675	0.0000	No	I(0)	-2.884291
NGNEUR	-0.117001	0.9443	Yes	I(1)	-2.884291
D(NGNEUR)	-6.886738	0.0000	No	I(0)	-2.884291

Table 2(B): Result of Phillip-Perron (PP) Test at level and first difference

Variables	Adj. t-value	P-value	Critical Value (At 5%)	Unit Root	Process
NGNUSD	-0.351798	0.9126	-2.884109	Yes	I(1)
D(NGNUSD)	-8.075041	0.0000	-2.884291	No	I(0)
NGNGBP	0.704951	0.9919	-2.884109	Yes	I(1)
D(NGNGBP)	-8.014975	0.0000	-2.884291	No	I(0)
NGNEUR	0.516690	0.9867	-2.884109	Yes	I(1)
D(NGNEUR)	-6.790868	0.0000	-2.884291	No	I(0)

Note: **D** stands for the first difference of the variables. The null hypothesis states that the variable has a unit root. P-values are used to decide the unit roots at the 5% significance level. The AIC determines the lag length (P) in the ADF tests (See Stock and Watson 2007 for details). If P-value is greater than 5% do not reject Ho, thus the series is non-stationary. Alternatively, if the absolute t-statistics is less than the absolute Critical value, the null hypothesis is not rejected hence there is a unit root.

It is observed from Table 1(A) and Table 2(B) that all the examined series at levels (NGNUSD, NGNGBP and NGNEUR) are integrated of order one, I(1) and series at 1st difference D(NGNUSD), D(NGNGBP) and D(NGNEUR) are integrated of order zero, I(0). Once it is established that the variables are I(1), the next step is to test for the existence of any co-integration relationship between NGNUSD, NGNGBP, and NGNEUR.

3.2 Empirical results of group statistical tests **Pairwise Correlation**

The correlation between the selected exchange rates are as presented in the table below.

Table 3: Correlation between NGNUSD, NGNGPB and NGNEUR

	NGNUSD	NGNGBP	NGNEUR
NGNUSD	1.000000	0.940992	0.919328
NGNGBP	0.940992	1.000000	0.982161
NGNEUR	0.919328	0.982161	1.000000

From Table 3 above, we have that there is a strong positive relationship between the series NGNUSD, NGNGBP and NGNEUR at the original value, which is statistically significant at 1% level of significance.

3.3 Johansen co-integration test

Johansen method is used to determine the number of co-integration vectors; it provides two different likelihood ratio tests viz: the Trace test and the Maximum Eigen-Value test and the results are shown in Table 4

Table 4: Result of Johansen Co-integration Test Series: NGNUSD, NGNGBP, and NGNEUR

Unrestricted Co-integration Rank Test(Trace)				
Hypothesized No. of CE(s)	**Eigen Value**	**Trace Statistic**	**Critical Value (5%)**	**Probability**
None*	0.190173	36.74278	29.79707	0.0067
At Most 1	0.077098	10.58689	15.49471	0.2382
At Most 2	0.005132	0.638065	3.841466	0.4244

Trace test indicates 1 Co-integration equation at 0.05 level

Unrestricted Co-integration Rank Test (Max. Eigen-Value)				
Hypothesized No. of CE(s)	**Eigen Value**	**Max-Eigen Statistic**	**Critical Value (5%)**	**Probability**
None*	0.190173	26.15589	21.13162	0.0090
At Most 1	0.077098	19.948825	14.26460	0.2153
At Most 2	0.005132	0.638065	3.841466	0.4244

Max-Eigen test indicates 1 Co-integration equation at a 0.05 level

It is inferred that the Trace Statistic as well as the Max-Eigen statistic, is greater than the critical values (None), which established a long-run co-integration relationship in the model. The P-value for both statistics is significant at a 5% level of significance, which implies that, there is one co-integrating vector between the three variables. Therefore, the Granger causality tests are to be modeled using Error Correction Model (ECM) as explained in equation (3), (4) and (5). The majority of VAR lag length Selection Criterion choose lag2. On the basis of Akaike Information Criteria (AIC), lag 2 was chosen for the model.

3.4 Vector error correction

3.4.1 Vector error correction' on 'model-1 (Dependent variable: NGNUSD):

The VECM equation for the Dependent variable NGNUSD is:

D(NGNUSD) = C(1)*(NGNUSD(-1) - 2.28681021815*NGNGBP(-1) +1.05604418148*NGNEUR(-1) + 174.754714439) + C(2)*D(NGNUSD(-1)) + C(3)*D(NGNUSD(-2)) + C(4)*D(NGNGBP(-1)) + C(5)*D(NGNGBP(-2)) + C(6)*D(NGNEUR(-1)) + C(7)*D(NGNEUR(-2)) + C(8) (8)

where D(NGNUSD) = Dependent Variable, D(NGNGBP) and D(NGNEUR) = Independent variable, C(1) = Coefficient of Co-integrating equation (Long-term Causality). **C(2), C(3), C(4), C(5), C(6), and C(7),** are coefficients of co-integrating equations (Short-run Causality), **C(8)** = Constant/Intercept.

From the above equation (4.2.3.1), we have the co-integrating equation (Long-run Model) as:

$ECT_{t-1} = 1.0000*NGNUSD_{t--1} - 2.28681021815*NGNGBP_{t-1} +1.05604418148*NGNEUR_{t-1} + 174.754714439$

Table 5: Result of vector error correction model dependent variable: D(NGNUSD)

	b	Std. Error	t-Statistic	Prob.
C(1)	-0.061333	0.032035	-1.914551	0.0580
C(2)	0.313802	0.092843	3.379903	0.0010
C(3)	-0.091161	0.094402	-0.965662	0.3362
C(4)	-0.027018	0.204135	-0.132352	0.8949
C(5)	-0.203296	0.203809	-0.997483	0.3206
C(6)	0.194660	0.231179	0.842032	0.4015
C(7)	0.301012	0.228789	1.315674	0.1908
C(8)	1.353130	1.194102	1.133178	0.2594

The result of the error correction model is presented in Table 5 above. The Error Correction Coefficient or the Speed of Adjustment C(1) = -0.061333 means that about 6.1% of departure from long-run equilibrium is corrected each period at a speed of 6.1. Since the error term is negative (-0.061333) and is insignificant (p=0.0580) at the 5% level, this implies that NGNGBP and NGNEUR had no long-run causality on NGNUSD. In other words, NGNGBP and NGNEUR do not cause NGNUSD in long run.Since the error term from the VECM is insignificant with a negative sign, the Ho^{1a} “there is no long run causality between NGNUSD, NGNGBP and NGNEUR” is not rejected. The result thus shows that there exists no long-run causality running from NGNGBP and NGNEUR to NGNUSD.

3.4.2 Vector error correction’ on ‘Model-2 (dependent variable: D(NGNGBP)):

The ‘vector error correction model’ between NGNGBP, NGNUSD and NGNEUR in which NGNGBP is a dependent variable is:

D(NGNGBP) = C(1)*(NGNGBP(-1) - 0.437290332212*NGNUSD(-1) - 0.461797910952*NGNEUR(-1) - 76.4185471327) + C(2)*D(NGNGBP(-1)) + C(3)*D(NGNGBP(-2)) + C(4)*D(NGNUSD(-1)) + C(5)*D(NGNUSD(-2)) + C(6)*D(NGNEUR(-1)) + C(7)*D(NGNEUR(-2)) + C(8) (9)

where NGNGBP = Dependent variable, NGNUSD and NGNEUR = Independent variable, C(1) = Coefficient of Co-integrating equation (Long-term Causality). **C(2), C(3), C(4), C(5), C(6), and C(7),** are coefficients of co-integrating equations (Short-run Causality), **C(8)** = Constant/Intercept.

Table 6: Result of vector error correction model dependent variable: NGNGBP

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.154055	0.053468	-2.881237	0.0047
C(2)	0.084985	0.148989	0.570412	0.5695
C(3)	0.207314	0.148750	1.393705	0.1660
C(4)	-0.061682	0.067762	-0.910277	0.3645
C(5)	-0.008495	0.068900	-0.123292	0.9021
C(6)	0.461674	0.168727	2.736223	0.0072
C(7)	-0.413975	0.166983	-2.479151	0.0146
C(8)	1.574844	0.871519	1.807011	0.0733

From the above model (6), we have the co-integrating equation (Long-run Model) as:

$ECT_{t-1} = 1.0000*NGNGBP_{t-1} - 0.437290332212*NGNUSD_{t-1} - 0.461797910952*NGNEUR_{t-1} - 76.4185471327$

The model (7) derives the error correction term **‘C(1)’** having a negative value that is -0.1540555. This is indicating the coefficient value is 15.41 percent, which means the system corrects the previous period’s disequilibrium at a speed of 15.4 and is highly significant at a probability value 0.0047 (Since P-value <5%). The error correction term confirms that there exists long-run causality among the variables when NGNGBP is taken as a dependent variable.

Since the error term from the VECM is highly significant (0.0047) with a negative sign, the Ho^{2a} “there is no long run causality between NGNGBP, NGNEUR and NGNUSD” is rejected. The result thus shows that NGNUSD and NGNEUR have long-run causality on NGNGBP. In other words, NGNUSD and NGNEUR granger cause NGNGBP in long run.

3.4.3 Vector error correction’ on ‘model-3 (dependent variable: D(NGNEUR)

The 'vector error correction model' between, NGNEUR, NGNUSD and NGNGBP in which NGNEUR is the dependent variable is:

$$D(NGNEUR) = C(1)*(NGNEUR(-1) - 2.1654493801*NGNGBP(-1) + 0.94693007881*NGNUSD(-1) + 165.480495516) + C(2)*D(NGNEUR(-1)) + C(3)*D(NGNEUR(-2)) + C(4)*D(NGNGBP(-1)) + C(5)*D(NGNGBP(-2)) + C(6)*D(NGNUSD(-1)) + C(7)*D(NGNUSD(-2)) + C(8) \quad (10)$$

where NGNEUR = Dependent Variable, NGNUSD and NGNGBP = Independent variable, C(1) = Coefficient of Co-integrating equation (Long-term Causality). **C**(2), C(3), C(4), C(5), C(6), and C(7), are coefficients of co-integrating equations (Short-run Causality), C(8) = Constant/Intercept.

From the above equation (10), we have the co-integrating equation (Long-run Model) as:

$$ECT_{t-1} = 1.0000* NGNEUR_{t-1} - 2.1654493801*NGNGBP_{t-1} + 0.94693007881*NGNUSD_{t-1} + 165.480495516$$

Table 7: Result of vector error correction model dependent variable: NGNEUR

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.054056	0.022105	2.445411	0.0159
C(2)	0.398641	0.151054	2.639064	0.0094
C(3)	-0.326728	0.149492	-2.185580	0.0308
C(4)	0.133587	0.133383	1.001527	0.3186
C(5)	0.202745	0.133170	1.522454	0.1306
C(6)	0.007251	0.060665	0.119528	0.9051
C(7)	-0.023376	0.061683	-0.378967	0.7054
C(8)	1.130481	0.780234	1.448900	0.1500

The result of the error correction model is presented in Table 7 above. The Error Correction Coefficient or the Speed of Adjustment C(1) = 0.054056 means that about 5.4% of departure from long-run equilibrium is corrected each period at a speed of 5.4. Since the error term is positive (0.054056) but significant (p=0.0159) at the 5% level, this implies that NGNGBP and NGNUSD have long-run causality on NGNEUR. In other words, NGNGBP and NGNUSD cause NGNEUR in long run.

Since the error term from the VECM is significant with a positive sign, the Ho[3a] "there is no long run causality between NGNEUR, NGNUSD and NGNGBP" is rejected. The result thus shows that there exists long-run causality running from NGNGBP and NGNUSD to NGNEUR.

This shows that NGNUSD and NGNGBP have long-run causality on NGNEUR. In other words, NGNUSD and NGNGBP granger cause NGNEUR in long run.

3.5 Wald test

After the long term causality test, short term causality test is applied in which the probability of the chi-square value is checked.

Table 8: Wald test on Model 1 (dependent variable: NGNUSD)

Dependent Variable	Null Hypothesis	Chi-square Value	D.F	Probability

NGNUSD	$Ho_{1.0}$	There is no causality running from NGNGBP -→NGNUSD	0.995390	2	0.6079
NGNUSD	$Ho_{1.1}$	There is no causality running from NGNEUR -→NGNUSD	2.573601	2	0.2762

As in Error correction model1 above, the dependent variable was NGNUSD; Having NGNUSD as the dependent variable, two hypotheses were formed. In the first case when C(4)=C(5)=0 and in the second case C(6)=C(7)=0. Table 8 above is showing Wald tests result in which the dependent variable is NGNUSD. For probability value of the Wald test 0.6079 which is more than 5% indicates the null hypothesis ($Ho_{1.0}$) is not rejected, thus there is no short-run causality running from NGNGBP to NGNUSD. Same in another Null hypothesis ($Ho_{1.1}$) where the probability value of Chi-square is 0.2762 which is also more than a 5% level of significance, therefore the hypothesis is not rejected thus, there is no causality running from NGNEUR to NGNUSD.

Table 9 Wald test on Model 2 (dependent variable: NGNGBP)

Dependent Variable	**Null Hypothesis**		**Chi-square Value**	**D.F**	**Probability**
NGNGBP	$Ho_{1.2}$	There is no causality running from NGNUSD -→NGNGBP	0.946158	2	0.6231
NGNGBP	$Ho_{1.3}$	There is no causality running from NGNEUR -→NGNGBP	12.90688	2	0.0016

The Wald test result Table 9 shows the dependent variable NGNGBP, framed by two hypotheses, first (**$Ho_{1.2}$**) when no causality running from NGNUSD to NGNGBP and the second was (**$Ho_{1.3}$**) when no causality from NGNEUR to NGNGBP. For a probability value of Wald test **0.6231 (62.31%)** which is more than 5% indicating a null hypothesis $Ho_{1.2}$ is not rejected hence, there is no short run causality running from NGNUSD to NGNGBP. For probability values of Wald test **0.0016 (1.6%)** which is less than 5% indicating null hypothesis **$Ho_{1.3}$** is rejected hence, there is Short-run causality running from NGNEUR to NGNGBP.

Table 10 Wald test on Model 3 (dependent variable: NGNEUR)

Dependent Variable	**Null Hypothesis**		**Chi-square Value**	**D.F**	**Probability**
NGNEUR	$Ho_{1.4}$	There is no causality running from NGNGBP -→NGNEUR	3.016442	2	0.2213
NGNEUR	$Ho_{1.5}$	There is no causality running from NGNUSD -→NGNEUR	0.144697	2	0.9302

The Wald-test result of Table 10 showing the dependent variable NGNEUR, framed two Hypotheses; $Ho_{1.4}$ and $Ho_{1.5}$. The probability value of Chi-square were 0.2213 (22.13%) and 0.9302 (93.02%) respectively, which are more than 5%, indicating null Hypothesis $Ho_{1.4}$ and

Ho$_{1.5}$ are not rejected thus, there is no short-run causality running from NGNGBP to NGNEUR and NGNUSD to NGNEUR respectively.

3.6 Residual tests

3.6.1Testing for the Residual on 'model-1

Table 11: Diagnostic test for error correction Model 1

Test	**Statistics**	**Probability**
Breusch-Godfrey Serial Correlation LM test	Obs*R-squared=0.485845	0.7843
Heteroskedasticity test: ARCH	Obs*R-squared=17.48713	0.0002
Jarque-Bera Normality of Error	Jarque-Bera = 320.6720	0.0000

Table 11 shows the statistic of the diagnostic test for error correction model1. first, serial correlation is tested and the result shows, Observed R^2 =0.485845 and P-value = 0.7843 which is greater than 5%, thus the null hypothesis of no serial correlation is accepted indicating that there is no Serial Correlation among the residuals which is desirable. Secondly, "there is no ARCH effect" is tested and the result from Table 11 shows that the probability of the Obs*R-squared is 0.0002 which is less than 5%, thus, the null hypothesis is rejected, stating there is heteroskedasticity or there is ARCH effect among the residual.

Thirdly, the residuals are tested for normal distribution. The result from table 11 shows that the residual is not normally distributed since the probability value of Jarque-bera statistics is 0.0000 which is less than 5%.

Table 12 shows the statistic of the diagnostic test for the Error Correction model2. First, Serial Correlation is tested and the result shows, Observed R^2 =0.835321 and P-value = 0.6586 which is greater than 5%, thus the null hypothesis of no serial correlation is accepted indicating that there is no Serial Correlation among the residuals which is desirable. Also, "there is no ARCH effect" is tested and the result from the Table 12 shows that the probability of the Obs*R-squared is 0.0001 which is less than 5%, thus, the null hypothesis is rejected, stating there is heteroskedasticity or there is ARCH effect among the residual.

More also, the residuals are tested for normal distribution. The result from table 12 shows that the residual is not normally distributed since the probability value of Jarque-bera statistics is 0.0000 which is less than 5%.

3.6.2 Residual test on model-2

Table 12: Diagnostic test for error correction model 2

Test	**Statistics**	**Probability**
Breusch-Godfrey Serial Correlation LM test	Obs*R-squared=0.835321	0.6586
Heteroskedasticity test: ARCH	Obs*R-squared=18.47291	0.0001
Jarque-Bera Normality of Error	Jarque-Bera = 96.26269	0.0000

3.6.3 Residual test on model-3

Table 13: Diagnostic test for error correction Model 3

Test	**Statistics**	**Probability**
Breusch-Godfrey Serial Correlation LM test	Obs*R-squared=2.412663	0.2993
Heteroskedasticity test: ARCH	Obs*R-squared=26.57240	0.0000
Jarque-Bera Normality of Error	Jarque-Bera = 308.3264	0.0000

Table 13 shows the statistic of the diagnostic tests for the error correction model3. First, Serial Correlation is tested and the result shows, Observed R^2 =2.412663 and P-value = 0.2993 which is greater than 5%, thus the null hypothesis of no serial correlation is accepted indicating that there is no Serial Correlation among the residuals which is desirable. Secondly, “there is no ARCH effect” is tested and the result from the Table 13 shows that the probability of the Obs*R-squared is 0.0000 which is less than 5%, thus, the null hypothesis is rejected, stating there is heteroskedasticity or there is ARCH effect among the residual.

Thirdly, the residuals are tested for normal distribution. The result from table 13 shows that the residual is not normally distributed since the probability value of Jarque-bera statistics is 0.0000 which is less than 5%.

3.6.3 Stability diagnosis test (model1, model 2 nd model 3)

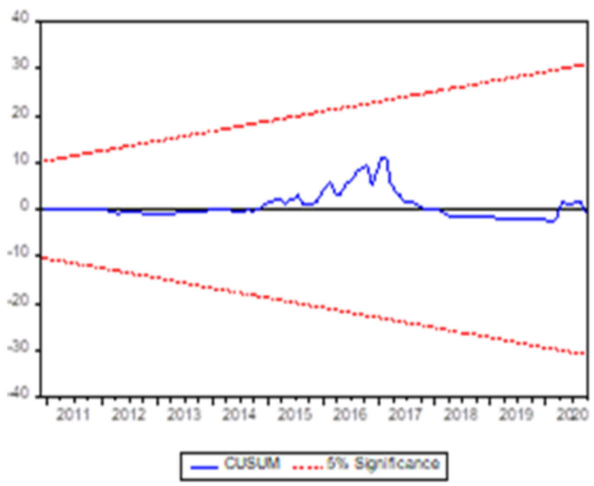


Fig. 3: Stability diagnosis test (dependent variable: NGNUSD)

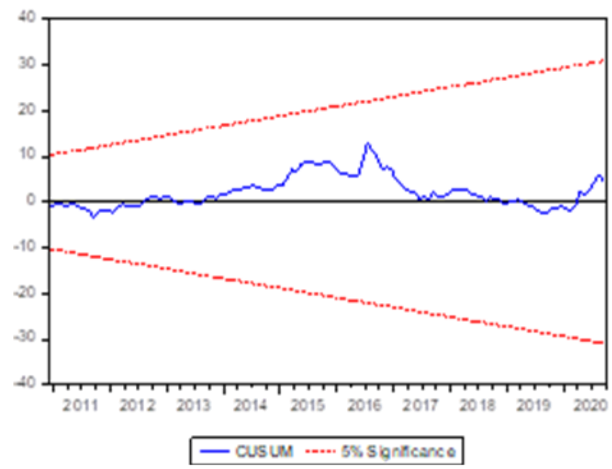


Fig. 4 : Stability diagnosis test (dependent variable: NGNGBP)

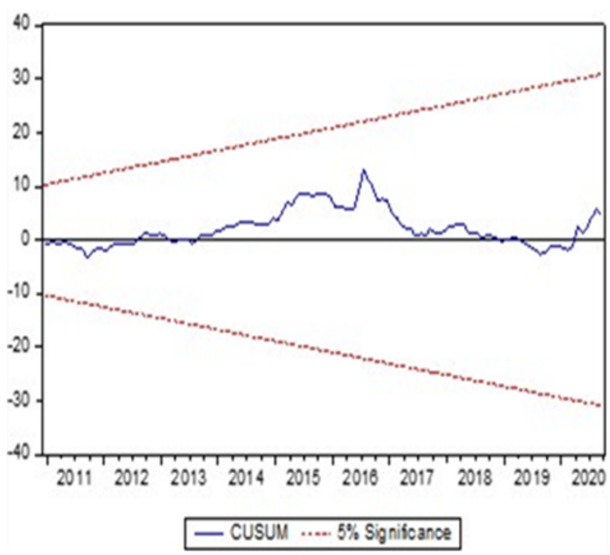


Fig. 5: Stability diagnosis test (dependent variable: NGNEUR)

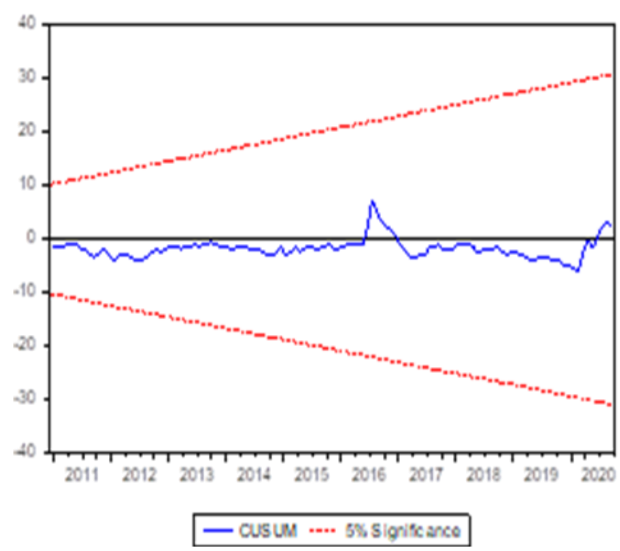


Fig. 6: Stability diagnosis test (dependent variable: NGNEUR)

Finally, the stability of the long-run coefficients is tested by the short-run dynamics. The results indicate the absence of any instability in the coefficients because the plot of the CUSUM statistic fell inside the critical bounds of the 5%

significance level of parameter stability (See Fig 4, Fig 5 and Fig 6).

4.0 Conclusion

The main objective of this research is to investigate the true position of the causal relationship between the Nigeria exchange rate against Euro, GBP and Dollars in the long and short run. We put into consideration the structural break which is believed to be a result of the government's deliberate devaluation of the Naira. We perform a unit root test to establish the relationship which exist between the currencies of study. According to the result of the research with real data, we found from the unit root test (ADF test and PP test) that the three series have a unit root which means the series are non-stationary at level difference. After taking the first difference of the series, the result of the unit root test shows stationarity at a 5% level of significance. We also found empirical support for the cointegrating relationship between NGNUSD, NGNGBP and NGNEUR. The result of the vector error correction model reveals that the position of the relationship on long run pairwise test between NGNUSD, NGGBP and NGNEUR shows Unidirectional causality running from NGNUSD→NGNGBP→ and NGNUSD→NGNEUR. This implies that NGNUSD affects NGNGBP and NGNEUR in the long run. It is observed that NGNUSD is useful to forecast NGNGBP and NGNEUR, but the converse is not true. Moreover it is observed that there is a bi-directional causality between NGNGBP and NGNEUR, which implies that all the series affects each other on the long run. On the other hand, the position of the relationship in the short run using the wald test reveals a **Unidirectional** causality running from NGNEUR to NGNGBP, which means NGNEUR affects NGNGBP in the short-run. We observed that NGNEUR is useful to forecast NGNGBP in the short-run but the converse is not true. The reveals that the position of the relationship between the Naira, Dollar, Euro and GB-pound is responsible for the constant price hike in Nigeria, making the living condition of Nigeria, making living condition of Nigerians harshly unbearable. However, if the New policy will be such that the Naira exchange will gain value of these presiding currencies. Life will become meaningful for the Nigerian people. Therefore, the Nigerian government should allow competitions between these currencies without making annihilation policies against Naira.

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