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Exchange Rate, Inflation and Interest Rates Relationships: AnAutoregressive Distributed Lag Analysis

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Abstract

This papermodelsa long runrelationship between exchange rate, interest rate and inflation using autoregressive distributed lag (ARDL)co-integration analysis. The study is motivated by the desire to ensure stability in exchange regime through a structurally nexus of interest rate and inflation volatility and targeting. Using historical data on Nigeria (1971-2010), the paper established asignificant short-run and long runpositive relationship between inflation and exchange rate. On the other hand, interest rateexhibited anegative relationship, though insignificant. Concertedeffort of all monetary authorities is therefore neededto ensure that periodic variation in inflation is kept at the barest minimum for stability in exchange rate regime to be achieved.

Keywords: exchange rates, inflation, interest rate, volatility, stability, autoregressive model, co-integration

1.0 Introduction

Finance and economic literature are awash with theories and researches linking exchange rate, interest rate and inflation. The International Fishers' Effect (IFE), interest rate parity, purchasing power parity andMundell Fleming modelsremain critical examples. IFE which suggests that currencies of countries with relatively high interest rates tend to depreciate with increasing nominal interest rate when compared with her trading partners, reflecting the expected rates of inflation.

It links exchange rate volatility toperiodic variations in interest rate and inflation.

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Sundavist (2002)insist that the differences in anticipated inflation that are embedded in the nominal interest rates are affecting the future spot rate of exchange. The IFE in its generalized formmodelsrelationships between the interest rate differentials of two countries and their corresponding inflation differentials, to the extent that countries with high rates of inflation would have higher nominal interest rates than those with lower rates of inflation.The purchasing power theory (PPP), on the other hand, states that the normal equilibrium rate of exchange between two inconvertible currencies is determined by the ratios of their purchasing powers; hence the rate of exchange tends to be established at the point of equality between the purchasing powers of the two currencies (Nucu, 2011). In essence, when one country's inflation rate rises relative to that of another country, it experiences decreases in exportsand increases imports, thereby depressing the value of the country's currency. The PPP theory in the views of Shangufta (2011) suggests that changes in exchange rate are caused by inflation rate differentials, while difference in nominal interest rates is attributed to difference in expected rates of inflation given that real interest rates are the same across countries. This paper therefore undertakes to empirically evaluate the interdependencies and significance of the relationships between exchange rate, interest rate and inflation in the short run as well as its sustainability in the long run using Nigeria as a case study.

2.0 Theoretical Literature

At the heart of the modelling the relationship between exchange rate and interest rate and inflation are theories and postulates that underpin volatility in their periodic values, which includes but not limited to:

2.1 Exchange Rate Theories

Exchange rate is one of the basic economic tools that are used to correct a number of economic misalignments facing nations. It has been widely applied in most structural adjustment programmes across the world. It has been used as a strategic policy vehicle for directing the direction of flow of economic resources (skilled labour, Capital, managerial know-how, and foreign exchange) into import and export sectors. However, for this to result to sustainable economic growth and development stability must be maintained in exchange rate regime (Schaling, 2008). A number of theories have been postulated for the determination of exchange rate.

They include Purchasing Power Parity (PPP) Theory, Interest Rate Parity theory, Demand and Supply Theory, Portfolio-balance Theory etc.

2.1.1 Purchasing Power Parity (PPP) Theory

The purchasing power theorem as posit byKuttner& Posen (2006) assumes that the normal equilibrium rate of exchange existing between two inconvertible currencies is determined by the ratios of their purchasing powers, hence the rate of exchange tends to be established at the point of equality between the purchasing powers of the two currencies. In essence, when one country's inflation rate rises relative to that of another country, decrease exports and increases imports depress the country's currency. The theory attempts to quantify inflation-exchange rate relationship by insisting that changes in exchange rate are caused by the inflation rate differentials (Kara& Nelson, 2002).In absolute terms, PPP theory states that the exchange rate between the currencies of two countries equals the ratio between the prices of goods in these countries (Ndungu, (1997), implying that exchange rate must change to adjust to the change in the prices of goods in the two countries. However, the expected inflation differential equals the current spot rate and the expected spot rate differential (Kamin, 1997).

The PPP in its simplest form asserts that in the long run, changes in exchange rate among countries will tend to reflect changes in relative price level. Kamin&Klau, (2003) are ofvthe view that if exchange rates are floating, the observed movement can be explained entirely in terms of changes in relative purchasing power while if it is fixed, equilibrium can be determined by comparing satisfactory methods for:

- Explaining the observed movements in exchange rates for countries whose rates were floating
- Determining equilibrium parity rates for whose countries whose surviving rates were out of line with post war market conditions.
- Assessing the appropriateness of an exchange rate.

Despite criticisms of PPP theory, the theoretical foundation and explanation may sound reasonable and acceptable but its practical application in real situation may be an illusion, especially in the long run (Grigorianm, 2004).

The pitfalls notwithstanding, PPP theory is generally a sine-quo-non in the exchange rate determination literature, and continues to remain relevant in the determination of exchange rate among countries of the world (Nucu, 2011).

2.1.2 Interest Rate Parity Theory

The interest rate parity characterizes the relationship between interest rate and exchange rate of two countries. It assumes that the exchange rate of two countries will be affected by their interest rate differentials. The interest rate parity tries to relate interest rate of one country to the exchange value of her trading partner (Fadli, et al;2011). In other words, interest rate charge in a country is a reflection of the exchange value of the currency of that country and her trading partners(s). Accordingly, the difference in the rate of interest in two countries should be able to explain the exchange value of the currencies of the countries (Alum, 2012). Thus, when interest rates are low, exchange value of the domestic currency in relation to international currencies will be low (devaluation). The reverse is the case if interest rates are high. But where relative interest rates levels exist, an increase in a country's interest rates will lead to a depreciation of its currency (Bergen, 2010). This is same as traditional flow model, which posits that increase in domestic interest rate relative to foreign interest rate causes an appreciation of the exchange rate through induced capital inflow (Alex & Innes, 2006). Thus, changes in interest rate (interest rate differentials) can cause major changes in the exchange ratesCarrera and Restout (2008). In the views of Abdul & Husain (2010)the nexus between exchange rate and interest rates can be explained in the following steps:

- Increasing domestic present interest attracts more foreign capital
- Increasing preference to purchase more foreign-dominated bonds.
- Increasing demandforforeign currencyput pressure on the value of foreign currency.

This therefore goes to show that the relationship between interest rate changes and the exchange rate volatility is usually inverse relationship (Alum, 2012). Hence, the interest rate structures between two economies show their exchange rates. Interest rates differentials are therefore a major determinant of exchange rate (Fadli, et al; 2011).

2.1.3 Inflation Theories

Demand Pull: The demand pull suggests that the inflation occurs when the aggregate demand for goods and services is greater than aggregate supply, such that the resultant excess cannot be satisfied by running down the existing stock, diverting surplus from exports market to the domestic market.

The cost push school: The cost push schoolsuggests that inflation arises from increase in the cost of production, rise in wages from trade union activities and embodies a socio-political view (Alpanda, et al; 2010). The cost push views attribute inflation to a host of non-monetary supply oriented influences of shocks that raise costs and consequently price.

The structuralists: The structuralistsaccording to Ezirim, et al (2012)explains the long run inflationary trend in developing countries in terms of structural rigidities, market imperfection and social tension, relative inelasticity of food supply, foreign exchange, contracts protective measures, rise in demand for food, fall in export earnings, hording import substations, industrialization, political instabilities.

The Monetarists: The Monetaristsopined that "inflation is always and everywhere" hence prices tend to rise when the rate of increase in money supply is greater than the rate of increase in real output of goods and services. This as Sundqvist (2002) explained, is in line with Fisher's equation of exchange.

$$MV = PT \quad \ldots \qquad (1)$$

Where: M = Supply of money
V = Velocity of money in circulation
P = Price of goods and services and
T = the transaction (output)

On the other hand, asAbdul & Husain (2010) argued imported inflation arises from international trade where inflation is transmitted from inflationary country to the other, especially during the period of rising price all over the world.

Empirical Literature

Bergen (2010) is of the view that the high interest rate policy doesn't defend currencies against speculative attacks; implying that there is a stinking lack of any systematic association between interest rates and the outcome of speculative attack. However, Utami and Inanga (2009) while examining the influence of interest rate differentials on exchange rate changes based on the IFE theory and the influence of inflation rate and interest rate differentials in Indonesia using quarterly and yearly data for the interest , inflation differentials and changes in exchange rate over a five year period, 2003-2008 used four foreign countries namely: the USA, Japan, Singapore and the UK and Indonesia as the home country, found that interest rate differentials have positive but no significant influence on changes in exchange rate for the USA, Singapore and the UK, relative to that of Indonesia. On the other hand, interest rate differentials have negative significant influence on changes in exchange rate for Japan. Alsothe results also that several inflation rate differentials have significantpositive influence on interest rate differentials.

In another study, Alex and Inne (2006), investigated the relationship between expected inflation and nominal interest rates in South Africa and the extent to which the Fisher Effect hypothesis holds using 3months banker's acceptance rate and the 10 year government bond rate to proxy both short and long term interest rates, found the existence of long term unit proportional relationship between nominal interest rates and expected inflation using Johansen co-integration test.

Nucu (2011) examined the influence ofgross domestic product (GDP), inflation rate, money supply, interest rates and balance of payments on exchange rate of Romanian against the most important currencies (EUR, USD) for the period 2000 to 2010 and found an inverse relationship between exchange rate (EUR/RON), GDP, and money supply. On the order hand a directrelationshipwas found between EUR/RON, Inflation and Interest rate. The validation of the correlation between exchange rate and balance of payment could not be established because it is not significant.

Odedokun (1995) using data from 35 countries for the period 1971 to 1990, obtained results suggesting that monetary growth, rate of domestic currency depreciation, and the expectation of inflation have positive effects on inflation, while expansion of per capita food production as well as overall economic growth serve to reduce inflation rates.

Ezirim, et al (2012) investigated the interdependencies between exchange rates and inflation **r**ates behavior in Nigeria. Using autoregressive distributed lag analytical framework, they found that exchange rates movements and inflation spiral are cointegrated, associating both in the short run and in the long run. Thus, indicating that in a regime of inflation targeting,policy aimed at exchange rates manipulation becomes a proper monetary action, and vice versa. The present study includes interest rate asone of the explanatory variables given that it is one of the important monetary phenomena, which is a key driver of exchange rate in an economy.

3.0 Methodology

This study isexperimentalin its approach; this informs the co-relational design adopted for analysis of association between variables.Accordingly, the paper employs econometric tool of auto-regressive distributed lag to co-integrate andanalyse the relationship between exchange rate, interest rate and inflation in Nigeria.However, extensive diagnostic tests are carried out on the variables and models specified. Based on theoretical and empirical review of the literature, the paper hypothesizes that current level of exchange rate (EXR) of Naira is a positive function of both interest rate and inflation, represented by the composite consumer price index and the lag value of exchange rates. This is informed by the effects of the partial adjustment mechanism earlier established inEzirim, et al (2012).

$$\mathrm{EXR}_t = \lambda_0 + \lambda_1 \mathrm{INT}_t + \lambda_2 \mathrm{CPI}_t + \lambda_3 \mathrm{EXR}_{t-1} + \mathrm{E}_t, \quad \lambda \text{is} > 0 \quad . . . \quad (2)$$

Where λ_0 is the intercept or constant

λ_1s are the parameters to be estimated, andE_t is the stochastic error term.

Recognizing the effects of trend (t) and seasonality in relationship, equation (2) changes to

$$\mathrm{EXR}_t = \mathrm{b}_0 + \mathrm{b}_1 \mathrm{INT}_t + \mathrm{b}_2 \mathrm{CPI}_t + \mathrm{b}_3 \mathrm{EXR}_{t-1} + \mathrm{b}_4 \mathrm{T} + \mathrm{b}_5 \mathrm{S1} + \mathrm{U}_t - \mathrm{b}_1 \mathrm{b}_2 \mathrm{b}_3 > 0 \quad . . . \quad (3)$$

Where b_0 is the intercept or constant
$b_{1s}$are the parameters to be estimated
and$U_t$is the stochastic error term.

In order to reduce the effect of possible trends and seasonal variation in the economy, we made use of the differenced of the variables.

Therefore, this study applied the Augmented Dickey - Fuller (ADF) Unit root test to check for the stationarity state of the variables.

The ADF is based on the hypothesis of σ_0 = 0 against the alternative of σ_0 < 1 and is given by

$$\Delta Y_t = \beta_0 + \beta_{1\,t}\sigma_0 X_{t-1} \sum_{t=1}^{\mathrm{p}} Y_t \Delta X_{t-1} + Et, \quad 1,2,3, \quad ... \quad (4)$$

Where ΔX_t is the first difference operator, β_0 denotes the inclusion of an intercept, X_{t-1} is the lag of the dependent variable, while ΔX_{t-1} is the difference of the lagged dependent variable, Y_t is a vector of the independent variable, and T is a time trend, Et is the error term, and P is the optimal lag length.

Augmented Dickey – Fuller (ADF) incorporates lagged values of the dependent variable in the regression model to ensure that the error term (Ut) is not auto correlated. This also ensures that the error term Ut is a white noise process.The Akaike Information Criteria is used to select the maximum lag length.From equations (2) and (3), it can be observed that the relationship between exchange rates, interest rate and inflation was loosely specified as an Auto regression (AR) model that follows the general form of ARDL:

$$\Delta \mathrm{E}XR_t = b_0 + \sum_{1=1}^{m-1} b_1 \,\Delta \mathrm{IN}T_t + \sum_{1=1}^{m-1} b_2 \,\Delta \mathrm{CPI}_t + \sum_{1=1}^{m-1} b\, 3\Delta \mathrm{E}\times R_{t-1} + \sum_{1=1}^{m-1} b_4 T_t + \sum_{1=1}^{m-1} b_5 S_1 + U_t - b_1 b_2 b_3 > 0 \quad ... \quad (4)$$

Where:

$Y_t$is a vector of the predictors (lagged values of exchange rate, inflation, interest rate, trends and seasonality variation).

U is a constant, $X_k$are coefficients to be estimated and U_t is a white noise disturbance.

The Auto-regressive distributed lag mechanism is a form of co-integration to determine if what obtains in the short-run will be sustained in the long-run. It makes use of error correction model (ECM) to check the effect of error.

Results and Discussions

This paper made use of time series annual average exchange rates of naira with respect to the dollar, interest rate and changes in consumer price indices (CPI) from 1970 through 2010.

Table1: Autoregressive Distributed Lag Estimates

ARDL(1,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is EXR
38 observations used for estimation from 1971 to 2010

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
EXR(-1)	.79269	.088882	8.9185[.000]
CPI	.0026659	.0012517	2.1298[.041]
INT	-.043813	.35353	-.12393[.902]
C	-4.3141	4.6554	-.92669[.361]
T	.68477	.42730	1.6026[.119]
S1	-2.9213	3.0581	-.95529[.347]

R-Squared	.97268	R-Bar-Squared	.96842
S.E. of Regression	9.3408	F-stat.F(5, 32)	227.8957[.000]
Mean of Dependent Variable	42.7189	S.D. of Dependent Variable	52.5597
Residual Sum of Squares	2792.0	Equation Log-likelihood	-135.5616
Akaike Info. Criterion	-141.5616	Schwarz Bayesian Criterion	-146.4743
DW-statistic	2.0968	Durbin's h-statistic	-.35677[.721]

$$EXR = 0.79EXR_{t-1} + 0.003CPI_t - 0.044INT_t - 4.314_t + 0.685T_t - 2.921S_t \quad \ldots (5)$$

Equation 5 and Table 1 shows that at 5% level, inflationary trend (CPI) influences exchange rate changes in positively and significantly, but interest rate (INT) influences exchange rate negatively and insignificantly. This is buttressed by the t-ratio of 2.1298 and probability of 0.041, and t-ratio of -0.1239 and probability of 0.902 respectively. This indicated that we cannot accept the null hypothesis of no significant relationship between inflation (CPI) and exchange rates changes (EXR) but we cannot reject the null hypothesis of no significance relationship between interest rate and exchange rate. In concrete terms, given the R-Bar-Squared = 0.96842, which implies that 96.84% of total variation in Exchange rate can be explained by the joint variation in independent variables (INT, CPI, EXR_{t-1}T and S_1). The F-statistics of 227.8957 and probability of 0.000 means that globally, the model (equation 5) fits the observed data used for analysis well.Thus, an exchange rate movement positively affects price level changes and negatively affects interest rate in Nigeria in the short run.

It is also clear from Table 1, that previous exchange rate changes is also an important factor in explaining current exchange rate. The beta coefficient is observed to be 0.79269 while the T-ratio was 8.9185 (Probability = 0.000). By inference, Lagged Value of exchange rate positively influences current value of exchange rate. This tends to suggest that the effect of exchange rate in the country follows the partial adjustment distributed – lag mechanism. The proof of the above lies in the evaluation of the adjustment parameter, λ which is defined in terms of λ = 1 – β_z. Thus from the results, λ = 1 – 0.79269 = 0.20731. Furthermore, the analysis cannot exclude the negative effects of timer trends (which is also insignificant at 5% level; T-ratio = 1.6026, Probability = 0.119) and seasonality (which is not significant at 5% level; T-ratio = - 0.95529, Probability = 0.347). The confidence in the model (equation 5) is boosted by the results of the DW statistic of 2.0968 and the Durbin h-statistics of -35677 (probability= .721) indicating that there is no problem of autocorrelation. This can be confirmed from the diagnostic test in Table 3.

Table 2: Diagnostic Tests

```
*******************************************************************************
*   Test Statistics      *      LM Version                *       F Version
*******************************************************************************
* A:Serial Correlation  *CHSQ(1)=   .11510[.734]      *F( 1, 31)=  .094180[.761]
* B:Functional Form     *CHSQ( 1)=   3.3585[.067]*F(1, 31)=   3.0055[.093]
* C:Normality           *CHSQ(2)= 636.6223[.000]     *  Not applicable
* D:Heteroscedasticity *CHSQ(1)=  .11109[.739]       *F(1, 36)=   .10555[.747]
*******************************************************************************
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A:Lagrange multiplier test of residual serial correlation; B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals; D:Based on the regression of squared residuals on squared fitted values

Panel (2A): Test of Serial Correlation of Residuals (OLS case)

```
*******************************************************************************
 Dependent variable is EXR
 List of variables in OLS regression:
EXR(-1)   CPI          INT          C            TS1
 38 observations used for estimation from 1971 to 2010
*******************************************************************************
Regressor            Coefficient      Standard Error       T-Ratio [Prob]
 OLS RES(- 1)           -.059717           .19459          -.30689[.761]
*******************************************************************************
 Lagrange Multiplier Statistic     CHSQ(1)=   .11510[.734]
 F Statistic                       F(1, 31)= .094180[.761]
*******************************************************************************
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Panel 2(B): Autoregressive Conditional Heteroscedasticity Test of Residuals (OLS Case)

```
*******************************************************************************
 Dependent variable is EXR
 List of the variables in the regression:
EXR(-1)       CPI          INT          C            T S1
 38 observations used for estimation from 1971 to 2010
*******************************************************************************
 Lagrange Multiplier Statistic              CHSQ(1)= .010191[.920]
 F Statistic                              F (1, 31)= .0083160[.928]
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Panel (2C): Variable Deletion Test (ARDL case)

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Dependent variable is EXR
List of the variables deleted from the regression:
S1
38 observations used for estimation from 1971 to 2010

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
EXR(-1)	.78609	.088495	8.8829[.000]
CPI	.0028131	.0012405	2.2676[.030]
INT	-.050126	.35300	-.14200[.888]
C	-5.7152	4.4125	-1.2952[.204]
T	.68977	.42670	1.6165[.116]

****

Joint test of zero restrictions on the coefficients of deleted variables:

Lagrange Multiplier Statistic	CHSQ(1)=	1.0536[.305]
Likelihood Ratio Statistic	CHSQ(1)=	1.0685[.301]
F Statistic	F(1, 32)=	.91258[.347]

$$EXR = 0.79EXR_{t-1} + 0.003CPI_t - 0.05INT_t - 5.715_t + 0.69T_t \ \ldots \qquad (6)$$

The global utility of the equation 6 is lent credence by the results of the four diagnostic tests summarized in Table 2. From the results, it can be seen from Panel 2(A), that the serial correlation tests revealed a chi-square value of .11510 with a probability of 0.734 for the Langrangian multiplier test and F-statistic of .094180 with a probability of 0.761 for the F-Test. The associated probabilities indicate the acceptance of the hypothesis of no serial correlation problems. Given these, we have no reason to worry about autocorrelation or serial correlation problems. Secondly, in Panel 2(B), the heteroscedasticity test -recorded similar results. The observed CHSQ for the LM-Test was 0.010191 (probability 0.920), while the F-statistic for the F-test was 0.0083160 (probability = 0.928). These are not significant at 1%, 5%, or even 10%, thus, we cannot reject the null hypothesis of no heteroscedasticity problem. By inference, the assumption of homoscedasticity is hereby sustained. In Panel 2 (B), the functional form was tested with the RAMSEY's Reset Test and the results reveal the Chi-Square value of 1.0536 with probability of 0.305 for the LM-Test. The F-Test recorded an F-statistic of 0.91258 with probability of 0.347. These are not significant at the conventional 1%, 5%, or even 10% levels. Thus, we cannot reject the hypothesis of no appropriate functional form.

However, the normality test is not satisfactory, given the high value of chi square and very low probability of 636.6223 (0.000). Notwithstanding the normality problem, we can confidently say that the model (equation 6) possessed a very good predictive, explanatory, analytical utility. Thus, we can embark on the relative statistical analysis.

Table 3: Estimated Long Run Coefficients using the ARDL Approach

ARDL (1,0,0) selected based on Akaike Information Criterion

****
Dependent variable is EXR
38 observations used for estimation from 1971 to 2010
****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
CPI	.012860	.0052561	2.4466[.020]
INT	-.21135	1.6574	-.12752[.899]
C	-20.8104	21.2403	-.97976[.335]
T	3.3032	1.1757	2.8095[.008]
S1	-14.0919	16.3701	-.86083[.396]

****

Table 4: Error Correction Representation for the Selected ARDL Model

ARDL(1,0,0) selected based on Schwarz Bayesian Criterion

****

Dependent variable is dEXR
38 observations used for estimation from 1971 to 2010

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
d CPI	.0026659	.0012517	2.1298[.041]
dINT	-.043813	.35353	-.12393[.902]
dC	-4.3141	4.6554	-.92669[.361]
dT	.68477	.42730	1.6026[.119]
dS1	-2.9213	3.0581	-.95529[.347]
ecm(-1)	-.20731	.088882	-2.3324[.026]

****

List of additional temporary variables created:
dEXR = EXR-EXR(-1)
d CPI = CPI - CPI (-1)
dINT = INT-INT(-1)
dC = C-C(-1)
dT = T-T(-1)
dS1 = S1-S1(-1)
ecm = EXR -.012860* CPI + .21135*INT + 20.8104*C -3.3032*T + 14.0919*S1

****

R-Squared	.25571	R-Bar-Squared	.13942
S.E. of Regression	9.3408	F-stat. F(5, 32)	2.1988[.079]
Mean of Dependent Variable	3.1016	S.D. of Dependent Variable	10.0691
Residual Sum of Squares	2792.0	Equation Log-likelihood	-135.5616
Akaike Info. Criterion	-141.5616	Schwarz Bayesian Criterion	-146.4743
DW-statistic	2.0968		

****

R-Squared and R-Bar-Squared measures refer to the dependent variable dEXR and in cases where the error correction model is highly restricted, these measures could become negative.

$$\Delta EXR = + 0.003\Delta CPI_t - 0.044\Delta INT_t - \Delta 4.314_t + 0.685\Delta T_t - 2.921\Delta S_t - 0.21ECM_{t-1} \quad (7)$$

Table 3and equation 7 shows the long- run relationship between the exchange rate (dependent), interest rate, inflation and others. The observed beta-coefficient of 0.12860 posts a t-statistic and probability of 2.2466 (0.020) for inflation which is significant at 5% level and beta-coefficient of 0.21135 posts a t-statistic and probability of -0.12752 (0.899) for interest rate, which is insignificant and negative. This shows that the positive and significant relationship which was recorded at the short run between exchange rate and inflation persists even in the long run. Also, the negative and insignificant relationship between exchange rate and interest rate persists in the long-run. This implies that there exist long run equilibrium relationships among the variables. The trend in the economy over time also persists in their effects on the changes in exchange rates. The negative and insignificant effects of seasonality are also sustained in the long run.

The result of error correction representations for the model is summarized in Table 4 above. Casting the variables in their first difference and estimating the arising model shows the effect of first differenced inflation (CPI) on exchange rates is also positive and significant while interest rate is negative and insignificant.Thus, changes in the variables move in the same direction, for both the short run and long run. The error connection model (ECM (-1)) is negative and significant at beta-coefficient of-0.20731 and t-stat of -2.3324 (0.026). All in all, in the face of insignificant and positive time trends, negative and insignificant seasonality and possible partial adjustment effects, changes in exchange rate trends in the Nigerian economy influences inflationary trends positively, but has no significant influence on the interest rate. Equation 6 states that exchange rate (EXR_t) is a positive linear function of inflation (CPI), interest rate, previous level of exchange rate (EXR t-1), time trends and seasonal variations in the economy.

Conclusion

The paper set out to investigate the inter-relationships existing between exchange rates movements, interest rate and inflation in Nigeria. It made of the autoregressive distributed lag (ARDL) approach to co-integrate the variables. Five Linear modelswere specified for the above purpose. Applying the global statistical analysis and relevant diagnostic tests two models were eliminated – the linear – forms for exchange rates. The remaining two equations were found useful for our further analysis.

The results indicated that from the estimation of model 1, the previous year exchange rate and inflation (CPI) variables were revealed as important proxies for explaining variations in exchange rates' levels in Nigeria, while interest rate (INT) has no significant influence. Also, these relationships can be sustained in the long-run as shown by the ARDL estimate result in Table 3 and equation 7.

Recommendations

Following the nature of relationship between exchange rate exchange rates interest rate and inflation in Nigeria, it is indicative that a policy thrust that focuses on only one variable will prove inadequate. Thus, the much trumpeted inflation – targeting becomes grossly deficient for the purposes of developing a sustainable exchange rate regime.In another development, targeting only exchange rates would also prove inadequate.

It is therefore be recommended that Nigeria would be better off, if her monetary authorities consider a policy thrust that targets both exchange rates and inflation, as well as maintain a stable interest rate regime. The advantage of this is not unconnected with the tendency to put both the domestic and international sectors into consideration while crafting the monetary policy of the country.

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