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ASYMMETRIC EXCHANGE RATE EXPOSURE OF FINANCIAL PERFORMANCE: EMPIRICAL EVIDENCE THROUGH ARDL AND NON-LINEAR ARDL

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Abstract

The importance of banking sector in the foreign exchange market cannot be overemphasized because of their central role in financial intermediation. However, exchange rate changes have greatly affected Nigerian banks competitive position with other international banks. Hence, the need to examine the asymmetric exchange rate exposure of deposit money banks in Nigeria. Quarterly data spanning 2002-2018 were extracted and Autoregressive Distributed Lag (ARDL) and non-linear Autoregressive Distributed Lag is employed to check the symmetrical and asymmetrical effect. The empirical results indicate that deposit money banks are asymmetrical exposed to exchange rate changes. Furthermore, inflation hinders bank performance both at the short run and long run. It was recommended that CBN need to consistently be aware of the depreciation and appreciation of currency for each trading partner.

Keywords: *Financial performance, foreign exchange rate exposure, ARDL, non linear ARDL*

JEL Classification Code: *Z23, F31, C22, C22*

1. INTRODUCTION

International trade involves different currencies over the world since no country is self-reliant but instead transact with one another, hence foreign exchange rate become handy. Exchange rate transactions are carried out by the deposit money banks as they are the leading actors and player in foreign exchange market. The role of financial institutions, specifically, the banking sector in establishing an improved economic performance cannot be overlooked in modern economies. The performances of deposit money banks in Nigeria are majorly affected by macro-economic factors. Among the macro-economic factors is the changes of exchange rate. This change could generate significant gains or losses, which in turn may give wrong impression

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of the financial position of the bank concerned and distort its total assets, loan advances, profitability and many more. Thus, these roles have an effect on their performance as its assets and liabilities are exposed to exchange rate volatility (Ahmed, 2015).

Economic theory suggests that firms are subjected to foreign exchange exposure as their cash flows are driven, directly or indirectly, by changes in exchange rates. Notably, exchange rate exposure is the sensitivity of changes in the real domestic currency value (Adler & Dumas, 1984). Exchange rate changes is occasioned as a result of instability in the quantum of exchanging a country's currency to another. These movement occasioned instability in profit margin, capital, liquidity, expected future cash flow as well as losses to organizations. This instability emanated during the collapse of the Bretton-Woods system in the early 1970's. Earlier before the fall, exchange rate of countries is known for certain, but, since the breakdown, countries are allowed to operate on any exchange rate regime of its choice. Nigeria has shifted from a fixed exchange rate to floating exchange rate regime and today we have the managed float with different exchange rate such as nominal exchange rate, interbank exchange rate, bureau de change (BDC) exchange rate. The uncertainty is magnified by the present era of globalization which has enlarged international transaction and currency exposure (Chui, Kuruc & Turner, 2016).

The consequences of this risk are particularly aggravated by the fact that an ever-increasing number of Nigerian banks are having branches and subsidiaries abroad, with the percentage rising close to 60 percent as at 2017 (CBN, 2017) as the United States Dollar (USD) continue to depreciated. Several measures are being formulated by central bank of Nigeria such as fiscal policies. In spite of these measures in regulating the Nigerian financial system, the sector had continued to experience non-correspondent success like continuous profit decline, inability to fulfill both the short term and long-term obligations. Thus, the study attempts to answer the following question i) is exchange rate exposure of deposit money bank liquidity symmetric or asymmetric ii) is exchange rate exposure of deposit money bank capital strength symmetric or asymmetric.

2. LITERATURE REVIEW

The theory adopted in this study is the foreign exchange hypothesis pioneered by Adler and Dumas (1984) which holds that changes in exchange rate fluctuation affects the value of the firm. This would increase the uncertainty of profits on contracts denominated in a foreign currency leading to a reduction in bank performance. Therefore, increase in exchange rate changes reduces international trade and profits tend to be uncertain. Different scholars and researchers have investigated exchange rate exposure and selected firms of the economy. Thus, there have been arguments on the relationship and dynamic linkage between exchange rate exposure and firm value. Also, studies have been done on different countries and the policy implications drawn from these researches have also varied considerably depending on whether the countries involved are developed or developing. However, most prior studies focus on US firms or industries.

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Early research in the area of exchange rate exposure in US is the study of Jorion (1990) who examined the exposure of 287 US multinational firms to foreign currency risk through a simple ordinary Least Square regression analysis. He found significant exposure for only 5. 2 percent of the sample, which he concluded that the relationship between stock returns and exchange rate differs systematically across firms. More specifically, the empirical evidence suggests that firms with no foreign operation exhibit little exchange rate exposure compare to the large firms. However, the methodology applied in the studies would have been more suitable for a cross-sectional dataset rather than the panel datasets that require panel data analysis approaches. Also the low significant could be attributed to the contemporaneous exchange rate measurement.

El-Masry, Abdel-Salam and Alatraby (2007) investigated the exchange rate exposure of 364 non-financial firms in United Kingdom (UK) during the period 1981 to 200. They measured exchange rate using trade-weighted real exchange rate, trade-weighted nominal exchange rate for the major trading currencies. Unlike previous result, they revealed that higher percentage of stock returns of the UK non-financial companies are affected by foreign exchange rate exposure. They also proved a stronger support for equally weighted rate as an economic variable that affects returns. This study failed to consider the financial firms in their study.

Forsberg (2012) investigates exchange rate exposure of four Swedish banks by estimating the sensitivity in stock return to exchange rate changes using weekly data. The study employed capital market approach to isolate the relationship between stock returns and exchange rate changes exposure coefficients. The author further used the estimated coefficients to compare the sensitivity among banks. The first finding revealed that all banks except for Handelbaken, face no significant exposure to any of the individual exchange rate while the Swedbank has the pre-eminently highest average estimated exposure. Helhel (2015) investigates foreign exchange rate risk exposure and its effect on performance of 37 manufacturing Turkish firms traded on Instanbul stock exchange during the period 2005 to 2014 using Jorion (1990) regression model. Unlike, previous studies, they regress ratio of return on capital employed instead of return on firms against both contemporaneous and lagged exchange rate changes to establish a relationship between performance and exchange rate exposure.

In Turkey, Parlak and IIhan (2016) investigated the magnitude of foreign exchange risk on the financial performance of 30 manufacturing and service sector companies spanning from the third quarter of 2012 to the second quarter of 2015. The study measured financial performance according to the four main dimensions which are liquidity, efficiency, leverage, and profitability. The finding of the study revealed that companies with short foreign exchange exposure in the present period had higher liquidity and asset efficiency than companies with long foreign exchange position in the previous period. Cuestas and Tang (2017) study the asymmetric exchange rate exposure of stock returns using monthly returns of Chinese firms. They found that exchange rate exposures of industry are asymmetric.

In Kenya, Ahmed (2105) examined the effect of foreign exchange exposure on commercial bank performance. The study revealed that, inflation has a negative effect on performance of deposit money banks and are exposed to major hard currencies of international

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trade such as US dollar, Euro and Japanese Yen. Luqman and Kouser (2018) study symmetrical relationship between currency exchange and stock markets utilizing daily data from G8 countries and Pakistan from 2000-2016. They used linear and non-linear autoregressive distributed lag (ARDL) to check the symmetric and asymmetric relationship between the variable and the result revealed an asymmetric linkage between currency and equity market. Suhaimi, Wahab and Sum (2019) examines the symmetric and asymmetric exchange rate exposure of 207 Malaysian non-financial firms at both aggregate and firm level for the period 1995 to 2016. As a developing country, their study revealed that high percentages of firms are exposed to exchange rate movement most especially USD. This could be mainly due to the strong US position AS Malaysia's major trading partner and high market uncertainty.

In Nigeria, Asaolu (2011) empirically investigates exchange rate risk exposure of Nigeria listed firms for the period 1998 to 2007 using the Jorion approach of measuring economic exposure as a slope coefficient of the regression of stock returns on exchange rates movement. The study employed three currencies of exchange rate in the likes of US dollar, UK pound and the Euro effective real exchange rates. The study reveals that Nigeria listed firms are exposed to adverse exchange rate risk of the three currencies and with a higher magnitude of exposure to US dollar. The study further investigates the differences in exposure by financial and non-financial firm. The result failed to indicate any significant and thus, provide no evidence to support the study that financial firms possess requisites to hedge exchange rates risks.

Taiwo and Adesola (2013) investigate the impact of unstable exchange rate on bank performance in Nigeria. They measure bank performance using two proxies namely loan loss to total advances ratio and capital deposit ratio while government expenditure, interest rate, real gross domestic product was added to exchange rate as independent variables. The two models showed that the impact of exchange rate on bank performance is sensitive to the type of proxy used for bank performance. Thus, this study failed to mention the state of liquidity, asset quality and liquidity as this will help in establishing the performance of the deposit money banks.

Lambe (2015) assessed the impact of exchange rate risk measured by exchange rate, interest rate, inflation rate and total asset on banks performance measured by profit after tax (PAT) for the period 1997 to 2013. The study revealed that unit increase in exchange rate is driven by an increase in profit after tax (PAT) and equally indicated that real exchange rate is positively related to terms of trade, lagged real exchange rate and real interest rate differential. Isaac study concentrated on exchange rate instead of exchange rate risk.

Osundina, Jayeoba, Ademola and Olayinka (2016), examined the effect of foreign exchange rate fluctuation on the performance of 5 deposit money banks in Nigeria covering the period of 2005 and 2014. Exchange rate fluctuation was measured by return average annual values of US dollar to Naira and performance was proxy by return on asset and loan deposit ratio. The findings of the study revealed that as Naira rate continues to depreciate in relation to US dollar, the liquidity position is at risk which in turn reflects on the overall performance of banks. The study failed to segregate different exchange rate we have in Nigeria. There is no doubt about the fact that empirical literature on exchange rate exposure and financial performance is scarce in the case of developing countries. What is however surprising is that

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from the little readily available evidence, the case of the financial performance in Nigeria is not available. It is important to fill this gap so as to show if exchange rate on bank liquidity symmetric and of course to provide policy implications thereafter. It is our hope that the outcome will serve as important information to the policy makers in the Nigeria

3. METHODOLOGY

The study employed the ex-post facto research design to guide the conduct of the study using secondary data for the period 2002 to 2018. The data were sourced from central bank of Nigeria statistical bulletin and national bureau of statistics fact books. The population of the study comprised of all deposit money banks that were listed on the floor of Nigeria stock exchange (NSE) and have record with CBN for the period under investigation. The study considered 15 deposit money banks (Access bank, Diamond bank, Eco bank, Stanbic bank Sterling bank, UBA, Union bank, Unity bank, Wema bank, Zenith bank, First bank, First city monument bank, Fidelity bank) due to availability of data.

To capture asymmetric exchange rate exposure of deposit banks we employ Shin et.al (2014) NARDL method. The present study modified the method to include ARDL. This approach allows us to assess the short and long run response of exchange rate exposure to bank liquidity and capital strength, increase versus decreases. The method also allows us to gather inference regardless of the variable's integration orders.
Thus, the model specification for the study is:

CST= (NEER, BDCEXR, INTBEXR, INTM, ASI, IFL)……..…….(1)
BLQ= (NEER, BDCEXR, INTBEXR, INTM, ASI, IFL)……..(2)

The model is transformed to an econometric term and the equation gives a multivariate relationship model below:

Model 1:

$$CST_t = \alpha_0+\alpha_1 NEER_1+ \alpha_2 BDCEXR_2+\alpha_3 INTBEXR_3+\alpha_4 INTM_4 + \alpha_5 LASI_5 + \alpha_6 IFL_6 + \varepsilon_t \quad \ldots\ldots(3)$$

Model 2:

$$BLQ_t= \alpha_0 + \alpha_1 NEER_1+ \alpha_2 BDCEXR_2+\alpha_3 INTBEXR_3+\alpha_4 INTM_4 + \alpha_5 LASI_5 + \alpha_6 IFL_6 + \varepsilon_t \quad \ldots\ldots..\ldots(4)$$

Where:
NEER= nominal effective exchange rate
BDCEXR=Bureau de change exchange rate
INTBEXR=Interbank exchange rate
INT=Interest rate
INF=Inflation rate

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SMP=Stock market performance proxied by All Share Index.

Furthermore, the ARDL testing approach of the estimated model can be stated as:

$$\Delta Z_t = \beta_0 + \beta_1 Z_{t-1} + \beta_2 X1_{t-1} + \beta_3 X2_{t-1} + \beta_4 X3_{t-1} + \beta_5 X4_{t-1} + \beta_6 X5_{t-1} + \beta_7 X6_{t-1} + \sum_{i=1}^{m} \beta_8 Z_{t-1} + \sum_{i=0}^{p} \beta_9 X1_{t-1} + \sum_{i=0}^{q} \beta_{10} X2_{t-1} + \sum_{i=0}^{r} \beta_{11} X3_{t-1} + \sum_{i=0}^{s} \beta_{12} X4_{t-1} + \sum_{i=0}^{t} \beta_{13} X5_{t-1} + ECM_{t-1} + \mu_t \ldots\ldots\ldots\ldots (5)$$

Where: Z=financial performance indicators while X1-X6 are nominal effective exchange rate, bureau de change exchange rate, interbank exchange rate, interest rate, inflation rate and stock market performance proxied by All Share Index. ECT is the error correction term and *it* represents the speed of adjustment bank to long run equilibrium after a shock or disturbances. The significance of the long run casual effect is indicated by the t-statistics on the coefficient of the error correction term. The coefficient (β_1, β_2, β_3, β_4, β_5, β_6) are part of the model used for long run while the coefficient (β_8, β_9, β_{10}, β_{11}, β_{12} β_{13},) are dynamics for short run. To test for the existence of a long run relationship among the variables, F-statistic will be used. We compare the F-statistic with the critical value given by Narayan (2005) that is more appropriate for small samples. If the F-statistic is between the upper and lower bound critical values, thus we conclude that the results are inconclusive.

4. FINDINGS AND DISCUSSION

4.1 Descriptive Statistics

Table 1 below shows the descriptive statistics of bank performance namely banks' capital strength, banks' liquidity as compared to exchange rate exposure indicators nominal effective exchange rate, bureau de change exchange rate and interbank exchange rate, interest rate, inflation rate and stock market performance proxied by All Share Index. Notably, banks' capital strength (computed as the ratio of equity to total assets of banks) and banks' liquidity (computed as the ratio of total loan to total deposit) are available as aggregate values for all banks.

Table 1: Descriptive Statistics for aggregated analyses

Variables	Mean	Max.	Min.	Std. Dev.	Skew.	Kurt.	J-B
Bank performance indicators							
CST	0.18	0.29	0.10	0.03	0.63	6.42	113.15***
BLQ	0.72	0.91	0.55	0.09	0.14	2.35	4.29
Exchange rate indicators							
NEER	107.21	167.13	70.63	22.41	1.50	4.17	88.47***
BDCEXR	192.06	494.70	118.70	90.24	1.68	4.50	115.33***
INTBEXR	170.00	309.73	112.99	60.18	1.54	3.94	88.30***
Economic indicators							
INTM	23.94	32.27	17.17	4.18	0.35	2.10	11.08***
ASI	26348.35	65652.38	5752.90	12391.64	0.71	3.53	19.60***

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INF	12.07	28.21	3.00	4.41	0.79	4.01	30.21***

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Note: ***, ** and * indicate rejection of null hypothesis at 1%, 5% and 10% level of significance, respectively. ARCH represents the test for the existence of heteroscedasticy with the null hypothesis of no ARCH effect. A rejection of this hypothesis indicates that ARCH effect exists. This is tested at lags 5 and 10. Similar lags were chosen for the serial correlation test using Ljung-Box Q-statistics with null hypothesis of no serial correlation. A rejection of this null indicates that serial correlation exists.

The descriptive statistics for the aggregate models are presented in Table 1. This contains the mean, minimum and maximum values of the variables. It also contains standard deviation and the measures of normality of the distribution of the variables, such as the skewness, kurtosis and Jarque-Bera statistic. The mean statistic shows that the capital strength of banks in Nigeria is 18 percent on the average between 2007 and 2018. The minimum and maximum values however show that the value ranges between 10 percent and 29 percent during the period. Nigerian banks appear to have high liquidity with the average bank liquidity of 72 percent, with the range falling between 55 percent and 91 percent between 2007 and 2018. The increasing trend from minimum to maximum data for each variable indicates that the data is good enough for analysis

The standard deviation of the exchange rate indicators suggests that bureau de change exchange rate is the most volatile; having the highest variance. It is also the most peaked among the indicators of exchange rate; having the highest kurtosis statistic. The average value of the BDC exchange rate during this period is N192.06/US$, which is higher than that of the interbank rate, N170/US$. The nominal effective exchange rate (NEER) is expressed in index form as a ratio of Nigeria's currency to basket of foreign currency. Like the interbank (INTB) and the BDC exchange rate, higher NEER implies deprecation while lower means appreciation. While the mean value of the BDC and INTB exchange rate is about ₦22different, their maximum value is N185 apart. This indicates the existence of huge premium in the BDC market and supports evidence of high variability in the BDC exchange. This may suggest that banks will be more exposed to BDC exchange rate risk.

In relation to the economic indicators, the descriptive statistics results show that interest rate is 23.94 percent on the average in the period under consideration. The average value for Nigeria's All Share Index (ASI) is 26348.35, while the average value for inflation rate is 12.07 percent. Meanwhile, the table shows that interest rate increased to the maximum of 32.27 percent during this period, and inflation rate rose to the maximum of 28.21 percent. The table shows that, while all variables are positively skewed, exchange rate indicators are more skewed than the bank performance and economic indicators, at they possess skewness statistics greater than greater than 1 for all the indicators. In all, the Jarque-Bera test for normality suggests that all variables, except bank liquidity (BLQ), are not normally distributed. This happens as the null hypothesis of normality is strongly rejected at 1% level of significant, for all variables except BLQ.

4.2 Unit root results

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As time series is being employed in this study, it is expedient to examine the stationarity property of the series to avoid the problem of spurious regression. Table 2 shows the results for the Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) unit root tests. In performing the unit root test with this method, all possible options are considered, namely without constant and trend (with none), with constant only, and with constant and trend, and the test statistic that best rejects the unit root hypothesis is reported.

Table 2: Augmented Dickey Fuller (ADF) and Phillip- Perron (PP) Unit root tests

Variables	ADF test			PP test		
	Level	First Diff.	Remark	Level	First Diff.	Remark
Bank performance indicators						
CST	-3.9080***[b]	-18.153***[a]	I(0)	-3.7054***[b]	-18.292***[a]	I(0)
BLQ	-3.0457**[b]	-15.889***[b]	I(0)	-2.9501**[b]	-16.190***[a]	I(0)
Exchange rate indicators						
LNEER	-1.8436[c]	-12.1756***[b]	I(1)	-1.7500[c]	-12.153***[b]	I(1)
LBDCEXR	-1.6232[c]	-9.9764***[c]	I(1)	-1.5562[c]	-10.079***[c]	I(1)
LINTBEXR	-1.6147[c]	-9.7991***[c]	I(1)	-1.3481[c]	-8.1363***[b]	I(1)
Economic indicators						
INTM	-3.2810*[c]	-14.523***[c]	I(0)	-3.3197*[c]	-14.524***[c]	I(0)
LASI	-2.8204*[b]	-12.409***[c]	I(0)	-2.6976*[b]	-12.653***[c]	I(0)
LCPI	-3.0007[c]	-12.205***[b]	I(1)	-3.1273[c]	-12.199***[b]	I(1)

Author Computation, (2020)

Note: ***, ** and * indicate rejection of unit root hypothesis at 1%, 5% and 10%, respectively. Superscripts a, b & c indicate unit root test with none, with constant only, and with constant and trend, respectively. The remark, I(0), indicates that the series is stationary at level, while the remark, I(1), indicates that the series is stationary after first difference.

Table 2 shows high level of agreement between the results from the ADF and PP tests. Specifically, the unit root results show that both aggregate indicators of bank performance, namely; banks' capital strength (CST) and banks' liquidity (BLQ) are stationary at level. The results further show that indicators or exchange rate, that is, logged nominal effective exchange rate, logged BDC exchange rate and logged interbank exchange rate are stationary at first difference. As regards economic indicators, interest rate and logged all share index (ASI) were found to be stationary at level, I(0), which log of CPI, a proxy for inflation rate was found to be stationary at first difference. Apparently, the unit root results suggest that our variables are of mixed order of integration.

4.3 (ARDL) Regression Analysis

Exchange rate exposure of deposit money banks' liquidity is symmetric or asymmetric?

The ARDL presents one coefficient from exchange rate assuming that exchange rate exposure is symmetric. On the other hand, NARDL presents two separates exchange coefficient

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Table 3: Results of ARDL on banks' liquidity and Nigeria's exchange rate

Variables	Bank liquidity with NEER		Bank liquidity with BDC		Bank liquidity with Interbank	
	Symmetry	**Asymmetry**	**Symmetry**	**Asymmetry**	**Symmetry**	**Asymmetry**
Short run model: Dependent variable - D(BLQ)						
D(LEXR)	0.0178 (0.0181)	-	0.0196 (0.0150)	-	0.0296 (0.0235)	-
D(LEXR_POS)	-	0.1442 (0.0808)*	-	0.0205 (0.0151)	-	0.0320 (0.0361)
D(LEXR_NEG)	-	0.0078 (0.0341)	-	0.0414 (0.0421)	-	0.0197 (0.0862)
D(INT)	0.0024 (0.0011)**	0.0020 (0.0013)	0.0021 (0.0012)*	0.0023 (0.0013)*	0.0022 (0.0012)*	0.0019 (0.0012)
D(LCPI)	-0.0330 (0.0131)**	-0.0421 (0.0490)	-0.0414 (0.0145)***	-0.0273 (0.0293)	-0.0456 (0.0169)**	-0.0472 (0.0513)
D(LASI)	0.0576 (0.0482)	0.0502 (0.0488)	0.0100 (0.0565)	0.0042 (0.0576)	0.0145 (0.0566)	0.0561 (0.0481)
ECM(-1)	-0.1557 (0.0381)***	-0.1587 (0.0411)***	-0.1700 (0.0395)***	-0.1666 (0.0400)***	-0.1724 (0.0404)***	-0.1667 (0.0408)***
Bound Testing						
Optimal ARDL model	1,0,0,0,2	1,1,0,0,0,2	1,0,0,0,3	1,0,0,0,0,3	1,0,0,0,3	1,0,0,0,0,2
Model F-stat	2.9186	2.5764	3.2271	2.7999	3.2041	2.5787
Critical Upper Bounds: Case II – Restricted Constant and No Trend						
Significant	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
10%	3.09	3	3.09	3	3.09	3
5%	3.49	3.38	3.49	3.38	3.49	3.38
1%	4.37	4.15	4.37	4.15	4.37	4.15
Long run model: Dependent variable –BLQ						
LEXR	0.1146 (0.1124)	-	0.1153 (0.0827)	-	0.1718 (0.1218)	-
LEXR_POS	-	0.1321 (0.1796)	-	0.1232 (0.0857)	-	0.1920 (0.2034)
LEXR_NEG	-	0.0493 (0.2179)	-	0.2485 (0.2611)	-	0.1179 (0.5189)
INT	0.0155 (0.0059)***	0.0129 (0.0082)	0.0125 (0.0065)	0.0140 (0.0072)**	0.0126 (0.0064)**	0.0115 (0.0068)*
LCPI	-0.2118 (0.0670)***	-0.2655 (0.2798)	-0.2433 (0.0657)***	-0.1637 (0.1623)	-0.2642 (0.0739)***	-0.2830 (0.2901)
LASI	0.2058 (0.0528)***	0.1864 (0.0572)***	0.1986 (0.0474)***	0.2019 (0.0489)***	0.2046 (0.0468)***	0.1956 (0.0491)***
Constant	-1.2724 (0.6503)*	-0.3279 (1.4349)	-1.0403 (0.4149)**	-0.8446 (0.8198)	-1.2829 (0.5198)**	-0.3000 (1.2699)
Model Diagnostics						
Durbin-Waston	2.0518	2.0679	2.0473	2.0557	2.0420	2.0470
Ljung Box Q(2)						
Ramsey RESET	1.1249	0.6517	0.5996	0.5344	0.8363	0.4980

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Note: ***, ** and * indicate 1%, 5% and 10% significance, respectively. Figures in round parenthesis indicate standard errors while those in square parenthesis indicate probability values. The short run values for the ARDL are determined using Wald test to calculate and obtain standard errors and probability values for the summation of variable lags.

In table 3 the symmetric model shows that exchange rate exposure is not significant both in the short run and in the long run. The implication of these findings is that exchange rate exposure has a significant effect on liquidity which is a proxy for financial performance. This result is consistent irrespective of whether nominal effective exchange rate (NEER), Bureau De Change (BDC) or interbank exchange rate is employed. This conforms to the study of Osundina, et.al (2016). When a bank liquidity is low, such can force the bank to borrow at a high rate from the interbank or central bank depending on its reputation to meet up with its customer request. Thus, this hinder its performance and also delivery of dividend to the shareholders. However, under the asymmetric model of the NARDL, short run asymmetric exchange rate exposure was confirmed using nominal effective exchange rate (NEER).Since NEER comprised on basket of currencies while BDC and interbank exchange rate are bilateral exchange rate of Naira to USD, this suggests that Nigerian banks' liquidity are exposed asymmetrically in the short run to some currencies other than USD**.** This is in line with the study of Inegbedion (2012); Moore and Wang (2014).

The short run coefficient of exchange rate depreciation (LEXR_POS) is statistically significant at 10 percent while the coefficient of exchange rate appreciation is not statistically significant. This suggests that exchange rate depreciation have significant impact on bank liquidity but exchange rate appreciation does not have significant impact on banks' liquidity. In other words, exchange rate exposure of deposit money of banks' liquidity in Nigeria is asymmetric in the short run. While the coefficients of the error correction term (ECM) suggest the presence of long run relationship. The model F-statistic and Bound test result suggest otherwise, except under the symmetric model for BDC and interbank exchange rates, where the F-statistic is greater than upper bound at 10 percent significant level. The result further revealed that inflation rate influences banks' liquidity negatively, while interest rate and stock market development have positive impact on banks' liquidity.

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Exchange rate exposure of deposit money banks' capital strength is symmetric or asymmetric?

Table 4: Results of ARDL on banks' capital strength and Nigeria's exchange rate

Variables	Capital strength with NEER		Capital strength with BDC		Capital strength with Interbank	
	Symmetry	**Asymmetry**	**Symmetry**	**Asymmetry**	**Symmetry**	**Asymmetry**
Short run model: Dependent variable - D(CST)						
D(LEXR)	-0.0374 (0.0215)*	--	0.0064 (0.0046)	--	-0.0594 (0.0311)*	--
D(LEXR_POS	--	-0.0387 (0.0260)	--	0.0062 (0.0047)	--	-0.0575 (0.0331)*
D(LEXR_NEG)	--	0.0060 (0.0111)	--	0.0031 (0.0136)	--	0.0116 (0.0284)
D(INT)	0.0016 (0.0029)	0.0018 (0.0030)	0.0016 (0.0029)	0.0017 (0.0030)	0.0023 (0.0029)	0.0023 (0.0030)
D(LCPI)	-0.1109 (0.0646)*	-0.1125 (0.0663)*	-0.1306 (0.0653)**	-0.1320 (0.0657)**	-0.1143 (0.0646)*	-0.1218 (0.0649)*
D(LASI)	0.0431 (0.0158)***	0.0416 (0.0160)**	0.0383 (0.0155)**	0.0390 (0.0159)**	0.0427 (0.0156)***	0.04225 (0.0157)***
ECM(-1)	-0.2248 (0.0475)***	-0.2221 (0.0482)***	-0.2173 (0.0468)***	-0.2195 (0.0477)***	-0.2315 (0.0472)***	-0.2310 (0.0479)***
Bound Testing						
Optimal model	1,1,4,1,2	1,1,0,4,1,2	1,0,4,1,2	1,0,0,4,1,2	1,1,4,1,2	1,1,0,4,1,2
Model F-stat	2.9775	3.3635	3.9577	3.3845	4.3057	3.6749
Critical Upper Bounds: Case II – Restricted Constant and No Trend						
Significant	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
10%	3.09	3	3.22	2.08	3.09	3
5%	3.49	3.38	3.698	2.39	3.49	3.38
1%	4.37	4.15	4.787	3.06	4.37	4.15
Long run model: Dependent variable – CST						
LEXR	0.0258 (0.0255)	--	0.0292 (0.0213)	--	0.0412 (0.0303)	--
LEXR_POS	--	0.0188 (0.0408)	--	0.0282 (0.0215)	--	0.0385 (0.0482)
LEXR_NEG	--	0.0269 (0.0489)	--	0.0142 (0.0626)	--	0.0501 (0.1215)
INT	0.0021 (0.0014)	0.0021 (0.0020)	0.0006 (0.0017)	0.0005 (0.0018)	0.0011 (0.0015)	0.0011 (0.0017)
LCPI	-0.0539 (0.0152)***	-0.0462 (0.0621)	-0.0564 (0.0165)***	-0.0655 (0.0393)*	-0.0637 (0.0177)***	-0.0591 (0.0683)
LASI	0.0491 (0.0121)***	0.0493 (0.0136)***	0.0428 (0.0122)***	0.0426 (0.0122)***	0.0477 (0.0114)***	0.0477 (0.0118)***
C	-0.2253 (0.1513)	-0.1423 (0.3263)	-0.1472 (0.1091)	0.0370 (0.1999)	-0.2328 (0.1282)*	-0.0524 (0.3018)
Model Diagnostics						
Durbin-Waston	2.0440	2.0547	2.0594	2.0570	2.0408	2.0366
Ljung Box Q(2)						

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Ramsey RESET	0.6802	0.6154	0.5503	0.05813	0.4974	0.5167

Source: Author Computation, (2020)

Note: ***, ** and * indicate 1%, 5% and 10% significance, respectively. Figures in round parenthesis indicate standard errors while those in square parenthesis indicate probability values. The short run values for the ARDL are determined using Wald test to calculate and obtain standard errors and probability values for the summation of variable lags.

Like under the analysis of symmetric and asymmetric nature of exchange rate exposure against Nigerian banks' liquidity, ARDL and NARDL models for symmetric and asymmetric exchange rate exposure was employed. The results of this analysis are presented in Table 4. Except under the symmetric model for NEER, the ECM and F-statistics for bound test agreed on the existence of long run relationship between banks' capital strength and its explanatory variables. From the symmetric model, the result shows that exchange rate exposure is negative and significant in the short run, this result was confirmed using NEER and interbank. The finding disagrees with Muktar (2018) who established a positive correlation between exchange rate changes and performance. This was attributed to the difference between trading currency and financial reporting currency. The asymmetric model using interbank exchange rate however suggests that exchange rate exposure of banks' capital strength is asymmetric in the short run, as the exchange rate exposure short run coefficient is negative and significant for exchange rate depreciation (LEXR_POS) and insignificant for exchange rate appreciation (LEXR_NEG).

Interest rate measure as consumer price index does not have significant impact on banks' capital strength both in the short run and long run. This conforms to the study of Hassan et.al (2017). However, inflation rate was found to have negative and significant impact on liquidity and capital strength in the short run and long run, implying that high inflation reduces liquidity and capital strength. This implies that persistent increase in the inflationary rate in Nigeria has decreasing effect on performance activities as bank will be reluctant to lend out thereby declining the rate of bank profitability/returns. This is in line with the inflation and finance theory that argue that increase in inflation can cause the banks to ration credit and reduced the real rate of return on equity and these lead to fall in financial market activities (Detragiache, Gupta & Tressel, 2005). Whereas, stock market performance was found to have positive and significant effect in the short run and long run, implying that better financial market performance enhances banks' capital strength. The result does not agree with the finding of Ambunya (2012) who argued that exchange rate changes affects stock market performance.

5. CONCLUSION AND RECOMMENDATION

This paper explored the asymmetric exchange rate exposure of performance based on the evidence of deposit money banks in Nigeria. Unlike the previous studies using simple static regression model, this study used the ARDL and the nonlinear approach. It seems by and large that nonlinear ARDL econometric results are statistically more satisfying than the linear ARDL results. The nonlinear ARDL approach allows us separate the impacts of exchange rate changes in terms of appreciations and depreciations. Cointegration among the variables are confirmed and they also have a long-run relationship and short run relationship. To check the asymmetries, either positive or negative changes in performance had the same impact on exchange rate

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exposure, or were different. Result have shown that there is an asymmetrical relationship between financial performance and exchange rate exposure. With regard to inflation, finding shows that inflation negatively affect performance over the entire study period. The study concluded that there is a positive significant relationship between interest rate, stock market and financial performance.

In the light of the above, Nigerian government should be aware of the consequences of asymmetric impacts of exchange rate appreciation and depreciation for each of her trading partner when the trade policies are formed so that domestic banks and foreign subsidiaries does not suffer adversely Also, it is important that deposit money banks in Nigeria with or without subsidiary effectively managed their risk to minimize its exposure to exchange rate risk and asymmetric exchange rate exposure should be closely and well managed. Furthermore, the CBN need go first ensure that there is growth in the economy by maintaining on continuous basis the macroeconomic stability such as the inflation rate.

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