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On the Nexus between Exchange Rate and Stock Price in Nigeria

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Abstract:

Purpose: *This paper investigates the nature and direction of the relationship between exchange rates and stock prices in Nigeria.*
Methodology: *Autoregressive distributed Lag (ARDL) model was employed. While ARDL Bounds test was adopted to determine the short-run and long-run relationship between exchange rates and stock prices, Granger causality test was conducted to determine the direction of causality between the two variables. Time series data spanning 33 years were collected on stock prices, Nominal Exchange Rates (NER), Money Supply (MSS), and Interest Rates (INT) from the Central Bank of Nigeria (CBN) Statistical Bulletin and World Development Indicator (WDI).*
Findings: *We provide empirical evidence that exchange rates, interest rates and the global financial crisis were negatively related to stock prices both in the short-run and long-run while the impact of money supply differs. The Granger causality test revealed a unidirectional causality running from stock prices to exchange rates in the long run.*
Practical implications: *Nigerian authorities should adopt appropriate policies that will enhance the performance of the companies that are listed in the stock market so as to strengthen the exchange rate for Nigeria.*
Originality/value: *The Nigerian stock market plays a significant role in the growth and development process of the Nigerian economy. Even so, the extent to which the stock market contributes to the Nigerian economic progress still depends on the behaviours of the foreign exchange rate. This has prompted researchers to investigate the relationship between stock prices and exchange rates. However, there has been lack of agreement on the nature and direction of the relationship.*

Keywords: *Stock prices, all-share index, nominal exchange rate, Granger causality, Nigeria.*

JEL Codes: *F31, F65, G11.*

Paper type: *Research article.*

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1. Introduction

Globally, capital markets play an important role in the monetary intermediation of an economy. Effective and efficient capital markets stabilize the financial sector and channel excess funds from the surplus spending unit of the economy to the deficit spending unit and, hence, contribute tremendously to the growth and development of the economy (Ahmad *et al.,* 2015). Apparently, the performance of the capital market depends significantly on the activities of the stock market. The stock market, being a critical part of the capital market, boosts investors' confidence, showcases the strength and viability of the productive sectors, and facilitates the mobilization and allocation of fund to the various sectors or activities that aid the achievement of economic progress (Bala and Hassan, 2018).

Thus, the progress of the stock market goes a long way in determining the growth and development of the entire economy. In Nigeria, the stock exchange remains the key participant in the capital market as it provides the environment for companies and government to interact with investors, with the sole aim of raising money for business expansion and project development (Eyisi *et al.,* 2015).

The Nigerian stock market came into being with the establishment of the Lagos Stock Exchange in 1959. However, the Stock Exchange did not begin operation until 1961 (Nwankwo, 1988). The Lagos Stock Exchange was later upgraded to the Nigerian Stock Exchange in 1977, with branches established in different parts of the country. The Nigerian stock exchange is broadly categorized into two, namely the Primary Market and the Secondary Market. The primary market is concerned with the issuance and sale of new securities. In other words, the government and quoted companies raise money for business growth or expansion by issuing new securities in the primary market. The secondary market, on the other hand, is the market where already existing securities are traded through the operations of brokers (Eyisi *et al.,* 2015) and the activities of both markets are regulated by the Securities and Exchange Commission (SEC).

In 1961 when the Nigerian Stock Exchange began operation, the number of tradable securities was 19, grew to 264 securities in 1998, and 301 in 2008 (Ahmad *et al.,* 2015). The ratio of equity to securities exchanged which began with 0.7348 in 1988 rose to 0.9988 in 1998 and then slightly to 0.9998 in 2013.In 1988, the estimation of equity traded as a proportion of total market capitalization stood at 1.2923, and it nosedived to about 0.04371 in 1989. The ratio of the equity exchanged to total market capitalization which was around 1.6092 in 1998 rose to about 1.8371 in 2004 and then skyrocketed to 4.0071 in 2005.

In July 2004, the Central Bank of Nigeria (CBN) introduced a new banking reform which led to the expansion of the Money Deposit Banks' (MDBs') capital base from N2billion to N25billion (Kanu and Hamilton, 2015). This eventually led to the reduction in the number of the commercial banks from 89 to 25 banks, and it

influenced the value of all share index and the quoted securities on the Nigerian Stock Market. The bank recapitalization also increased the fragility and vulnerability of the Nigerian financial system, liberalized the financial system and has a spillover effect on the nexus between stock market and the exchange rate market (Oyinlola and Oloko, 2018). This is evident in the vast increase in the ratio of equity exchanged to market capitalization which stood at 17.0 in 2013 (Ahmad *et al.,* 2015).

The history of foreign exchange in Nigeria, on the other hand, can be traced to the establishment of the CBN in 1958 and the enactment of the Exchange Control Act of 1962. At the inception of the foreign exchange market, Nigeria operated fixed exchange system and, in 1986, it introduced and implemented floating exchange rate system due to the failure of fixed exchange system to achieve the internal balance goal. The implementation of the floating exchange system in 1986 led to the introduction of Second-Tier Foreign Exchange Market (SFEM) where market forces became the determinant of the naira exchange rate and the allocation of foreign exchange.

In 1989, the Bureau de Change (BDC) was introduced by the Nigerian government to stimulate the foreign exchange market. Other reforms that were introduced in 1994 to address the changes in the foreign exchange market include formal pegging of the naira exchange rate, the centralization of foreign exchange in the CBN, the restriction of BDC to buy foreign exchange as agents of the CBN, the reaffirmation of the illegality of the parallel market, and the discontinuation of open accounts and bills for collection as a means of payments (Omokehinde *et al.,* 2017).

In 1995, the Federal Government introduced Autonomous Foreign Exchange Market (AFEM) which led to the liberalization of the Foreign Exchange Market and in 1999, the BDC was recognized as authorized buyers and sellers of foreign exchange. Also, the Federal Government introduced Inter-bank Foreign Exchange Market (IFEM) in 1999 for the sale of foreign exchange to end-users by the CBN through appointed authorized dealers (Omokehinde *et al.,* 2017). In 2002, the Dutch Auction System (DAS) was reintroduced to realign the naira exchange rate, conserve external reserves, enhance market transparency, and curb capital flight from the country.

Although these reforms improved capital mobility and international investment, they are not without problem as exchange rate volatility brings about uncertainty in investors' portfolios and instability in stock prices (Bala and Hassan, 2018). In other words, globalization of the stock market has increased the sensitivity of the stock market to international events and exposes the Nigerian stock market to global financial turmoil (Onuoha and Nwaiwu, 2016). For instance, the 2007/2008 global financial crisis which crumbled the global stock market was attributable to the drastic movement in the foreign exchange rate (Onuoha and Nwaiwu, 2016). It was revealed that naira depreciated against the dollar by 25.6 percent between 2008 and 2009 (Onuoha and Nwaiwu, 2016).

Specifically, the exchange rate of the dollar to naira which stood at 125 naira per dollar between 2006 and 2008 depreciated to 150.3 naira per dollar in 2008. In 2011, the value of naira to dollar hovered around 153.90 naira per dollar and then depreciated to about 156.81 naira per dollar and 305.25 naira per dollar in 2013 and 2017 respectively.

Furthermore, the Nigerian stock market which witnessed a rapid growth before the crisis suddenly crashed in 2008. Between 2007 and 2008 when the crisis was pronounced, the all share index declined by 42.4 percent and then fell by 33.8 percent between 2008 and 2009. Similarly, market capitalization fell by 27.5 and 28.3 percent respectively during the periods (Sanusi, 2011). Besides, the all share index which stood at 65,652.38 points in 2008 nosedived to about 30,000.00 points in 2012. It increased slightly to 31,853.19 points in 2013 and skyrocketed to approximately 41,210.10 points in 2014 before it declined to 31,853.19 points in 2015 and hovered around 35,343.70 as at 2011.

The sensitivity of the stock market to the global financial crisis has led researchers, portfolio investors, financial analysts and authorities to debate on the relationship between stock prices and exchange rates (Oyinlola and Oloko, 2018). The debate, which is underpinned by flow-oriented theory and stock-oriented theory, has received considerable attention in the empirical literature. The predictions of the two major theories are contradictory. On the one hand, the flow theory, which was proposed by Dornbusch and Fischer (1980), suggests a positive correlation between stock prices and nominal exchange rates with the direction of causality running from exchange rates to stock prices. On the other hand, the stock theory postulates a negative relationship between the two variables and posits a one-way causality running from stock prices to exchange rates (Branson, 1983; Frankel, 1983).

The empirical literature on the direction of causality between stock prices and exchange rates is inconclusive. While some studies (Charles *et al.*, 2011; Boako *et al.*, 2015; Elhendawy, 2017; Bala and Hassan, 2018) found a unidirectional causality running from either stock prices to exchange rates or exchange rates to stock prices, some such as Aliyu (2009), Acikalin *et al.* (2008), Chkili (2012) reported a bidirectional causality and a few other studies (Zubair, 2013) reported an absence of a causal relationship between the two variables.

Regarding the correlation between stock prices and exchange rates, the empirical findings are also contradictory. Oyinlola *et al.* (2012), Umoru and Asekom (2013), Ogbole and Aladejare (2015), Abimbola and Olusegun (2017) and Bala and Hassan (2018) have reported that exchange rates are positively correlated with stock prices while others Subair and Salihu (2013), Salisu and Oloko (2015), Nkoro and Uko (2016), and Elhendawy (2017) found negative correlations.

This lack of agreement on the nature and direction of the relationship, therefore, justifies the need to further investigate the nature and direction of the relationship

between the exchange rate and stock prices in Nigeria. Given this inconsistency in the empirical findings, this study, therefore, sought to further investigate the nature and direction of the relationship between exchange rates and stock prices in Nigeria. Specifically, the paper examines the impact of the 2007/2008 Global Financial Crisis on stock prices in Nigeria.

This study provides stakeholders or participants in the foreign exchange market with the information that could help them know the extent to which stock prices affect the the exchange rate. The inclusion of the impact of the global financial crisis on stock market prices would provide a motivation for future researchers to consider the impact of global financial crisis in their analysis of the relationship between stock prices and exchange rate in Nigeria. The findings arising from this study would help the policy makers to formulate appropriate policy to stabilize the exchange rate.

This paper consists of four sections. Section 1 covers the introduction which includes the background to the study, statement of the problem, objectives of the study, scope of the study, and plan of the study. In section 2, we discuss the methodology and the theoretical framework adopted, while results and discussion are contained in section 3, section 4 presents the conclusion, policy recommendation, limitation of the study, and suggestions for further studies.

2. Research Methodology

This section explains the methodology adopted to analyze the nature and direction of the relationship between exchange rates and stock market performance in Nigeria. It consists of the theoretical framework, model specification, estimation techniques, and the data used for the study.

2.1 Theoretical Framework

The *flow-oriented theory*, also known as the *traditional approach*, underlies this study. The theory posits that changes in the exchange rate lead changes in the stock price. This is because changes in the exchange rate affects firm's value via changes in international competitiveness and the value of firm's assets and liabilities denominated in foreign currency. Further, the theory posits that devaluation or depreciation could either raise or lower a firm's stock price, depending on whether the firm is an exporting firm or heavy user of imported inputs. For exporting firms, the theory argues that devaluation or depreciation would create price advantages against other trading partners of the country under consideration which would lead to an increase in firms' sales, profits, and stock prices (Dornbusch and Fisher, 1980).

Thus, devaluation or depreciation is expected to have a positive effect on exporting firms, increases their income, and consequently, boosts the level of stock prices. In other words, flow-oriented theory posits a positive relationship between stock prices

and exchange rates with direction of causation running from exchange rates to stock prices. The mathematical format of the flow-oriented theory is as follows:

$$ASI = f(NER)$$

$$\mathrm{ASI_t} = \alpha + \beta \mathrm{NER_t} + \mu_t \quad (1)$$

where ASI_t = stock market index at time t, NER_t = nominal exchange rate (an upward movement of which connotes depreciation of the domestic currency) at time *t*, μ = error term, α and β = intercept and slope parameters respectively. The flow-oriented theory implies that the slope parameter be positively signed, that is, ASI_t, α, βNER_t, $\mu_t > 0$.

2.2 Model Specification

To investigate the relationship between exchange rates on stock price in Nigeria, we specified an empirical model implied by the flow-oriented theory and incorporate into the model (Equation 1) some other variables postulated to be crucial in explaining the relationship between the exchange rate and stock price in Nigeria. These variables included were money supply, interest rate and financial crisis, typified by global financial crisis and proxied by the dummy variable D_GFC. The resulting model is specified as follows:

$$\mathrm{ASF} = \mathrm{f(NER, MSS, INT, D_GFC)} \quad (2)$$

The econometric model of Equation 2 is expressed in natural logarithm as

$$\mathrm{LOGASI_t} = \beta_0 + \beta_1 \mathrm{LOGNER_t} + \beta_2 \mathrm{LOGMSS_t} + \beta_3 \mathrm{INT_t} + \beta_4 \mathrm{D_GFC_t} + \varepsilon_t \quad (3)$$

where ASI is the dependent variable and it represents the all share index (a measure of stock prices), NER stands nominal effective exchange rates (an upward movement of which connotes depreciation of the domestic currency), MSS is money supply, INT represents interest rate, D_GFC is the dummy variable for global financial crisis, $ß_i$ are the regression parameters and Ɛ stands for the stochastic error term. LOG stands for natural logarithm. The variables were logged to reduce the influence of outliers and eliminate the possible problem of heteroscedasticity.

The postulated variables were defined and measured as follows:

1. *All Share Index (ASI)*

This is a measure of stock prices and it is the all-encompassing index of the Nigerian stock market. The calculation of ASI is based on the values of each of the market's listings. The ASI data is obtained from the 2017 CBN Statistical Bulletin.

2. *Nominal Effective Exchange Rates (NER)*

The NER refers to the relative value of a country's currency against the value of the currency of its trading partners. This is an unadjusted weighted average rate at which one country's currency exchanges for a basket of multiple foreign currencies. Nkoro and Uko (2016) have reported that exchange rate has negative impact on stock market price volatility in Nigeria. On the contrary, Abimbola and Olusegun (2017) and Bala and Hassan (2018) revealed a positive relationship between exchange rate and stock prices in Nigeria. However, following the flow-oriented theory, this study postulated a positive relationship ASI and NER.

3. *Money Supply (MSS)*

This is the total stock of money circulating in an economy, which includes the currency, printed notes, money in the deposit accounts and in the form of other liquid assets. It was measured by the broad money supply. Money supply was expected to be positively related to stock prices. This is because an increase in the volume of money in circulation should lead to an increase in the price of goods and services in the economy. In a similar manner, an increase in money supply increases the stock market liquidity which, in turn, leads to an upward movement of stock prices. Bala and Hassan (2018) and Ahmad *et al.* (2015) have found that money supply has negative impact on stock market in Nigeria. This study, therefore, postulated a negative relationship between money supply and stock prices in Nigeria.

4. *Interest Rate (INT)*

Interest rate is the commercial bank lending rate (in percentage) that is used to meet the short- and medium-term financing needs of the private investors. Interest rate movement causes speculation in the stock market and affects the efficiency of the market. Specifically, higher interest rate lowers the efficiency of the stock market. This is because investors would invest larger percentage of their resources in bond and treasury bills that yield higher returns than stock. Going by the findings by Pilinkus and Boguslauskas (2009) and Usman and Adejare (2014), we predicted a negative relationship between interest rate and stock price in Nigeria.

5. *Dummy Variable for Global Financial Crisis (D_GFC)*

The Nigerian stock market is heavily integrated into the global stock market, and hence, highly sensitive to international events, including the global financial crisis. The 2007/2008 global financial crisis is a very good example of financial crisis and the implication of the globalization of the stock market. The crisis adversely affected the Nigerian stock market prices and crumbled the global stock market. The dummy variable for global financial crisis takes the values of 0 before the pronouncement of global financial crisis in Nigeria and 1 from 2008 onward. $ß_5$ which is the coefficient for the dummy variable denotes the rate of change in stock prices after the pronouncement of global financial crisis in Nigeria. If $ß_5$ (which is the coefficient of dummy variable is negative and statistically significant, it means stock prices decreases on the average during and after the global financial crisis in

Nigeria and if it is positive and significant, it implies that stock prices increase on the average during and after the global financial crisis in Nigeria.

2.3 Estimation Techniques

The preliminary analysis was conducted using descriptive statistics and trend analysis. Having found that the series are not volatile, the study adopted the ARDL model developed by Pesaran, Shin, and Smith (2001) to estimate the long-run and short-run impact of nominal exchange rates on stock prices. Besides the ARDL, the Vector Error Correction Model (VECM) Granger causality test was used to investigate the direction of causality between exchange rates and stock prices in Nigeria both in the short and long run.

We carried-out post estimation tests such as Ramsey RESET test, Normality test, Breusch-Godfrey serial correction LM test, Breuch-Pagan-Godfrey test of heteroscedasticity, multicollinearity test and Correlogram-Q-Statistics and stability tests (the CUSUM and CUSUM Square) on the model.

2.3.1 Autoregressive Distributed Lag (ARDL) Bounds Test

The study used ARDL Bounds test developed by Pesaran *et al.* (2001) to analyze the short-run and long-run relationship between exchange rates and stock prices in Nigeria. This technique is unique in that it assumes that all the variables are endogenous. Besides, the ARDL bounds test was employed because it is suitable for variables that are integrated of order zero I(0), order one I(1) or a combination of both orders (Pesaran *et al.*, 2001).

The ARDL representation of Equation 3, which combines both the short-run and long-run estimates, is expressed as follows:

$$\begin{aligned}\Delta \mathrm{LOGASI}_t = \beta &+ \sum_{i=1}^{k} \alpha_1 \Delta \mathrm{LOGNER}_{t-i} + \sum_{i=1}^{k} \alpha_2 \Delta \mathrm{LOGMSS}_{t-i} + \sum_{i=1}^{k} \alpha_3 \Delta \mathrm{INT}_{t-i} \\ &+ \sum_{i=1}^{k} \alpha_4 \Delta \mathrm{D_GFC}_{t-i} + \sum_{i=1}^{k} \alpha_5 \Delta \mathrm{LOGASI}_{t-i} + \beta_1 \mathrm{LOGNER}_{t-1} \\ &+ \beta_2 \mathrm{LOGMSS}_{t-1} + \beta_3 \mathrm{INT}_{t-1} + \beta_4 \mathrm{D_GFC}_{t-1} + \beta_5 \mathrm{LOGASI}_{t-1} \\ &+ \varepsilon_t \qquad (4)\end{aligned}$$

where Δ is the difference operator, α_i are the short-run components while β_i are the long-run components. The decision rule is that variables are co-integrated if the computed F-statistic is greater than the upper bounds critical values and not co-integrated if the computed F-statistic is less than both the upper and lower bounds critical values. The test is said to be inconclusive if the computed F-statistic is greater than the lower bounds critical values but less than the upper bounds critical values.

The following error correction (ECM) model was specified to estimate the short-run relationship between exchange rates and stock prices in Nigeria:

$$\Delta LOGASI_t = \beta + \sum_{i=1}^{k} \alpha_1 \Delta LOGNER_{t-i} + \sum_{i=1}^{k} \alpha_2 \Delta LOGMSS_{t-i} + \sum_{i=1}^{k} \alpha_3 \Delta INT_{t-i} + \sum_{i=1}^{k} \alpha_4 \Delta D_GFC_{t-i} + \sum_{i=1}^{k} \alpha_5 \Delta LOGASI_{t-i} + \varphi ECM_{t-1} + \varepsilon_t \quad (5)$$

where φ is a measure of the speed of adjustment and it is expected to be negative, less than unity and statistically significant. ECM_{i-1} is error correction term lagged one time and $\mathcal{E}_t$ is white noise error term.

2.3.2 The VECM Granger Causality Test

Having found that all the series were stationary at first difference and co-integrated, we estimated the VECM Granger causality test instead of the Engle-Granger causality test, because the former is more appropriate in the presence of a long-run relationship to determine the short- and long-run direction of causality. The VECM equations for causality test were expressed as follows:

$$\Delta LOGNER_t = \alpha_0 + \sum_{k=1}^{p} \alpha_k \Delta LOGNER_{t-k} + \sum_{j=1}^{q} \pi_j \Delta LOGASI_{t-j} + \varphi_1 ECM_{t-1} + \varepsilon_t \quad (6)$$

$$\Delta LOGASI_t = \psi_0 + \sum_{k=1}^{p} \psi_k \Delta LOGASI_{t-k} + \sum_{j=1}^{q} \varphi_j \Delta LOGNER_{t-j} + \varphi_2 ECM_{t-1} + \varepsilon_t \quad (7)$$

where α_0 and ψ_0 are constants, φ_1 and φ_2 are the measures of long run causality, ECM_{i-1} is error correction term while $\mathcal{E}_t$ and υ_t are usual disturbance terms with zero means and finite variances. The decision rules for this model (Equations 6 and 7) are as follows:

1. The null hypothesis that $LOGASI_{t-j}$ in Equation 6 does not Granger-cause $LOGNER_t$ in the short run is rejected if π_j (the coefficient of $LOGASI_{t-j}$) is statistically different from zero while α_k (the coefficient of the $LOGNER_{t-k}$) is not statistically different from zero.
2. The null hypothesis that $LOGNER_{t-j}$ in Equation 7 does not Granger-cause $LOGASI_t$ in the short run is rejected if the coefficient of $LOGNER_{t-j}$, φ_j is

statistically different from zero while the coefficient of the $LOGASI_{t-k}$ ψ_k is not statistically different from zero.

3. If the coefficients of the $LOGNER_{t-j}$ and $LOGASI_{t-j}$ in Equation 6 and 7 respectively are both statistically different from zero, then there is a bidirectional relationship between the two variables in the short run.
4. However, there is said to be no causal relationship between the two variables in the short run if the coefficients of $LOGNER_{t-j}$ and $LOGASI_{t-j}$ in Equation 6 and 7 respectively are both not statistically different from zero.
5. Finally, there is evidence of long-run causality running from $LOGASI_{t-j}$ to $LOGNER_t$, and from $LOGNER_t$to $LOGASI_{t-j}$ if φ_1 and φ_2 are negative and statistically significant, respectively.

2.4 Data and Data Sources

This study was conducted with time series data spanning 33 years from 1985 to 2017. The choice of this period was informed by the paucity of data and the fact that it encompassed some major financial policies (such as financial sector liberalization and bank recapitalization) and events such as the global financial crisis and economic recession. The data available on ASI from the sources consulted by the study starts from 1985 and ends in 2017.

The data on money supply is obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin. The study obtains the interest rate data from World Development Indicators (WDI) database updated in 2018. The nominal exchange rate data were obtained from the 2017 CBN Statistical Bulletin.

3. Results and Discussion

This section presents the results and discussion of this study. The section is structured into five sections: preliminary analysis, the ADF and Phillips-Perron (PP) unit root tests and the ARCH effect, ARDL Bounds test, ARDL Granger causality test, and diagnostic tests.

3.1 Preliminary Analysis

Table 1 presents the results of the preliminary analysis of the natural log of stock prices (LOGASI), exchange rates (LOGNER), money supply (LOGMSS), and interest rates (INT). For stock prices, exchange rates and money supply, the mean values were less than the median value whereas the mean value of interest rate was greater than its median value. This is further confirmed by the values of skewness which revealed that stock prices, exchange rates and money supply were negatively skewed while interest rate was skewed to the right. Furthermore, the mean and maximum values of stock prices were greater than the average and maximum values

of exchange rates, respectively. This suggests that stock prices had the highest value during the period of study.

The values of Kurtosis suggested that exchange rates and interest rates were Leptokurtic as their values were greater than 3 while the Kurtosis values of stock prices and money supply showed that the series are platykurtic as their values were less than 3. Furthermore, the results reveal that stock prices and exchange rates exhibited lower volatility (i.e., lower standard deviation) in their distribution compared to money supply and interest rates. This implies that stock prices and exchange rates are not as volatile as money supply, and interest rates. Finally, the Jarque-Bera statistic which combines both properties of kurtosis and skewness failed to reject the normality assumption for stock prices and money supply. Hence, the study concludes that stock prices and money supply (or, at least, their log values) followed a normal distribution in Nigeria.

Table 1. *Descriptive Statistics of the Variables*

	LOGASI	**LOGNER**	**LOGMSS**	**INT**
Mean	8.617	3.647	6.917	18.727
Median	9.228	4.398	7.146	17.950
Maximum	10.828	5.063	10.091	31.650
Minimum	4.764	-0.298	3.104	9.430
Std. Dev.	1.935	1.401	2.327	4.226
Skewness	-0.742	-1.206	-0.172	0.555
Kurtosis	2.151	3.355	1.706	4.768
Jarque-Bera	4.023	8.182	2.464	5.993
Probability	0.133	0.016	0.291	0.049
Obs.	33	33	33	33

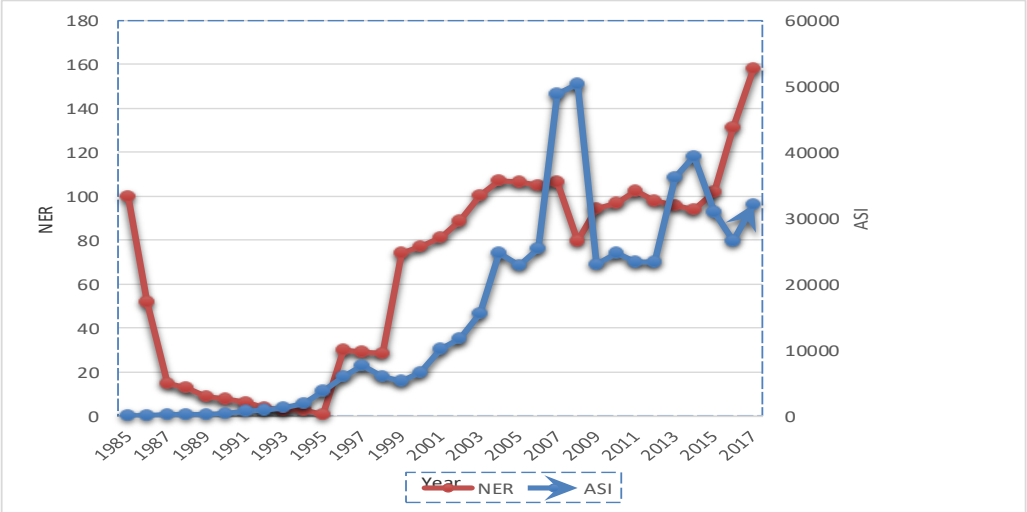
Source: *Own study.*

Figure 1 depicts the trends of stock prices and nominal exchange rates in Nigeria from 1985 to 2017. The trend analysis is necessary to show the connectivity between stock prices and exchange rates, especially how they co-vary. As depicted in Figure 1, there is no stable relationship between stock prices and exchange rates in Nigeria. The exchange rate which stands at about 99.9 in 1985 nosedived to the lowest value ever in 1995. During this period, stock prices were relatively stable though fluctuated in the subsequent periods, and there was a negative relationship between stock price and exchange rate.

3.2 Unit Root Test and ARCH Effect Results

The ARDL bounds test is based on the assumption that the series are integrated either at level I(0), at first difference I(1) or combination of the two. On the basis of this, the study employs ADF and PP tests to determine the order at which the series were stationary.

Figure 1. *Trend of Stock Prices and Exchange Rates in Nigeria*



Source: *Own study.*

Using 1 and 5 percent significance levels, Table 2 shows that all the series are stationary at first difference except interest rates that was stationary at level for ADF test. However, the PP test suggests that interest rate was stationary at first difference. We, therefore, conclude that all the series—stock prices, exchange rates, money supply, and interest rates—were integrated of order 1. The decision criterion is that a series is stationary or has no unit root problem if the test statistic (ADF) is greater than the critical value in absolute terms.

Table 2. *ADF and PP Stationarity Test Results*

Test	Variables	Level	First Difference	Order of Integration
ADF	LOGASI	-0.699	-4.957*	I(1)
	LOGNER	-3.078	-6.722*	I(1)
	LOGMS	0.340	-3.838**	I(1)
	INT	-4.402*	-	I(1)
	Test Critical Values	1% level: –4.416345	5% level: –3.622033	
PP	LOGASI	-0.435	-5.175*	I(1)
	LOGNER	-3.088	-6.666*	I(1)
	LOGMS	-0.113	-3.813**	I(1)
	INT	-3.180	-6.437*	I(1)
	Test Critical Values	1% level: –4.284	5% level: –3.562	

Note: *** and * indicated stationary at 5 and 1 percent level of significance.*
Source: *Own study.*

Having established the stationary properties of the variables, we proceeded to estimate an OLS model and then checks the resulting squared residual for heteroscedasticity using the ARCH effect. This procedure helps to choose between volatility and non-volatility techniques. The results of the ARCH effect reported in Table 3 reveals that the p-values of the F-statistic are greater than 5 percent. This suggests that the null hypothesis of no heteroscedasticity in the residuals cannot be rejected at 5 percent. By implication, heteroscedasticity is not present in the residuals. Hence, we used non-volatility technique (ARDL model).

Table 3. *Heteroscedasticity Test: Estimated ARCH Effect Results*

F-statistic	0.001363	Prob. F(1, 200)	0.9708
Obs*R-squared	0.001454	Prob. Chi-Square(1)	0.9696

Source: *Own study.*

3.3 ARDL Bounds Test Results

The long-run relationships among the variables were investigated using Bounds test and the results are presented in Table 4. The results indicate that the value of F-statistics is greater than the lower and upper bound at 1 percent level of significance. This suggests that the series—stock prices, exchange rates, money supply, and interest rates—were co-integrated. In other words, there were long-run relationships among the variables. This finding is in line with the work of Subair and Salihu (2013), Salisu and Oloko (2015), Nkoro and Uko (2016), Elhendawy (2017), Abimbola and Olusegun (2017), and Bala and Hassan, (2018).

Table 4. *Bounds Tests for the Existence of Co-integration*

Variables	**Critical value**	F-statistic = 7.139594	K = 4
		Lower bound	Upper bound
LOGASI, LOGNER, LOGMSS, INT, GFC	10%	2.2	3.09
	5%	2.56	3.49
	2.5%	2.88	3.87
	1%	3.29	4.37

Note: *The F-statistic, critical values (10%, 5%, 2.5%, and 1%),*
Source: *Own study.*

3.4 Diagnostic Results

The results of the diagnostic tests—adjusted R-Squared, Ramsey RESET test, Jarque-Bera normality test, Breusch-Godfrey LM serial correction, Breusch-Pagan-Godfrey (BPG) heteroscedasticity test, and multicollinearity test—are presented and discussed in this section. Due to the spatial constraint, most of our results tables are not included in the text. However, the tables are available on demand.

The value of the adjusted R-squared of the short-run estimate presented in Table 5 reveals that the explanatory variables explained about 82 percent of total variation in stock market prices in the short-run. The probability value of F-statistic suggests that

the overall model is highly significant. For the long-run estimate, the probability value of F-statistic in Table 6 indicates that the overall model is highly significant while the values of adjusted R-squared indicate that exchange rates, money supply, interest rates, and global financial crisis dummy explained 97 percent variation in the Nigerian stock prices. The implication of the results is that the model is of a good fit.

The study employed Ramsey RESET technique to test the null hypothesis of linearity against the alternate hypothesis of non-linearity. The results showed that the null hypothesis of linearity of the model could not be rejected at 5 percent level of significance. This suggests that the ARDL model did not suffer from linearity problem.

Jarque-Bera normality test was adopted to check the error term for normal distribution. The results revealed that the error term of the ARDL model was free from the problem of normality as the p-value of the Jarque-Bera statistic was greater than 5 percent. In other words, the null hypothesis that the error term is normally distributed could not be rejected at 5 percent level of significance.

The Breusch-Godfrey LM test with the null hypothesis of no serial correlation among the error terms was used to check if the error terms across observations were correlated or not. We found that the p-values associated with the F-statistic and Obs*R-squared were greater than 5 percent. By implication, the ARDL model is free from the problem of serial correlation.

For the results of the Breusch-Pagan-Godfrey (BPG) test of heteroscedasticity, p-values associated with F-statistic, Obs*R-squared and Scaled explained were greater than 5 percent. This implies that the error variance was constant. In other words, the error term associated with the ARDL model was homoscedastic.

The results of the multicollinearity test showed that the coefficients of the relationship among the independent variables were less than 0.8. This suggests that the explanatory variables did not suffer from multicollinearity problem.

The CUSUM and CUSUM Square were graphed. We found that the CUSUM and CUSUM Squares were within the critical boundaries of 5 percent significance level. This suggests that the coefficients of the estimated ARDL model were stable.

3.5 Performance of Study's Explanatory Variables

3.5.1 Short-Run Parameters

This study employed ARDL model to analyze the short-run effect of nominal exchange rates on Nigerian stock prices, and the results are presented in Table 5. The results show that the first lag of stock prices was positive and statistically significant at 5 percent while the second lag exerted a significant adverse effect on stock prices. Exchange rate exerted an insignificant negative effect on stock prices at

5 percent level of significance. Ceteris paribus, the results imply that stock prices decreased by 0.1 percent for every 1 percent increase in exchange rates in the short-run. In other words, a one percent increase in exchange rate depreciation of naira against dollar led to 0.014 percent decrease in stock prices. Although this finding negates the prediction of the flow-oriented theory, it supports the postulation of the stock-oriented theory which suggests a negative relationship between stock prices and nominal exchange.

Further, the findings lend credence to the work of Subair and Salihu (2013), Salisu and Oloko (2015), Nkoro and Uko (2016) and Elhendawy (2017) who submitted that exchange rates negatively induce stock prices in Nigeria. Besides, the results also revealed that the first lag of the exchange rates has a significant positive effect on stock prices in the short run, which is in line with the prediction of the flow oriented theory.

Furthermore, the coefficients of the money supply were statistically insignificant though positively related to stock prices in Nigeria. On the contrary, interest rate had negative impact on stock prices in the short-run. Both money supply and interest rate conformed to the theoretical prediction. The coefficient of the global financial crisis was negative and statistically significant. This suggests that stock prices decrease on the average by 0.51 in Nigeria during and after the global financial crisis.

Moreover, the coefficient of the error correction term conforms to the *a priori* expectation as it was negative, less than unity and statistically significant at 1 percent. This indicates that there was a long-run relationship between the variables and suggests that the speed of adjustment to long-run equilibrium after a temporary 66 percent approximately.

Table 5. *Short-Run Coefficients of ARDL (3, 2, 1, 0, 3)*

Variables	**Coefficients**	**Std. Error**	**t-Statistic**	**Prob.**
D(LOGASI(-1))	0.423	0.165	2.557	0.021*
D(LOGASI(-2))	-0.227	0.127	-1.787	0.092*
D(LOGNER)	-0.014	0.049	-0.279	0.783
D(LOGNER(-1))	0.116	0.044	2.614	0.019**
D(LOGMSS)	0.079	0.368	0.215	0.832
D(INT)	-0.012	0.010	-1.121	0.279
D(GFC)	-0.514	0.211	-2.439	0.027**
D(GFC(-1))	-0.288	0.287	-1.004	0.330
D(GFC(-2))	0.565	0.218744	2.583	0.020**
ECM_{t-1}	-0.664	0.134142	-4.946	0.000***
R-squared	0.869	F-statistic	261.643	
Adjusted R-squared	0.819	Prob(F-statistic)	0.000	

Note: ****, ** and * denote significance at 1, 5 and 10 percent respectively.*
Source: *Own study.*

3.5.2 Long-Run Parameters

Table 6 presents the estimates of the long-run relationships between exchange rates and stock prices as well as stock price and money supply in Nigeria. The results reveal that exchange rate was negatively and significantly related to stock prices. This indicates that a one percent a one percent increase in exchange rate depreciation of naira against dollar brought about 0.22 percent decline in stock prices. Even though this finding contradicts that of Umoru and Asekom (2013) and Usman and Adejare (2014) and the postulation of the flow-oriented theory, it is consistent with the prediction of the stock-oriented theory. Besides, this result corroborates the findings of Adaramola (2012), Olugbenga (2012), and Subair and Salihu (2013) who reported a negative relationship between exchange rates and stock prices in Nigeria.

Table 6. *Long-Run Coefficients of ARDL (3, 2, 1, 1, 1, 3)*

Variables	**Coefficients**	**Std. Error**	**t-Statistic**	**Prob.**
LOGNER	-0.227	0.079	-2.851	0.011**
LOGMSS	1.1538	0.060	19.152	0.000***
INT	-0.018	0.015	-1.144	0.269
GFC	-2.250	0.260	-8.639	0.000***
C	2.648	0.468	5.660	0.000***
R-squared	0.971	F-statistic	179.295	
Adjusted R-squared	0.965	Prob(F-statistic)	0.000	

Note: **** and ** denote significance at 1 and 5 percent level of significance respectively.*
Source: *Own study.*

The estimates of the long-run relationship between money supply and stock prices were positively and statistically significant at 1 percent. This suggests that, ceteris paribus, stock prices increase by 1.15 percent for every 1 percent increase in money supply. Interest rate is negative and statistically insignificant at 5 and 10 percent, respectively. Just like the short-run estimate, the estimate of the dummy variable for the global financial crisis is negative and statistically significant at 1 percent. The implication is that stock prices decrease on the average by 2.25 during and after the global financial crisis became pronounced in Nigeria. It is important to know that the fall in stock prices, in the long run, is far higher than the long run.

3.6 VECM Granger Causality Results

The results of the estimates of the short- and long-run causal relationship between exchange rates and stock prices are presented in Table 7. As shown in Table 7, the null hypothesis of no short-run causality flowing from exchange rate to stock prices[a] and from stock prices to exchange rates[b] cannot be rejected at 5 percent level. In other words, there was no short-run causal relationship between stock prices and exchange rates in Nigeria. This finding contradicts the evidence provided by Elhendawy (2017) who found a unidirectional causality running from stock prices to exchange rates. The disparity in the result may be attributed to the difference in the techniques of analysis or the scope covered.

Table 7. *VECM Granger Causality Results*

Variables	**Short Run Causality**		**Long Run Causality**
	ΔLOGASI	ΔLOGNER	ECT_{t-1}
ΔLOGASI	-	0.110394 (0.1865)[a]	-0.031684 (0.5458)
ΔLOGNER	-0.012055 (0.9889)[b]	-	-0.436921 (0.0208)**

Note: *Probability values are in parenthesis, ** indicate rejection of the null hypothesis at 5 percent level of significance and the lag length used for the two models is 3.*
Source: *Own study.*

Furthermore, the result of the long run causal relationship flowing from exchange rates to stock prices revealed that the null hypothesis of no long run causal relationship could not be rejected at 5 percent level of significance. However, the null hypothesis of no long run causality running from stock prices to exchange rates was rejected at 5 percent level of significance. By implication, there is a one-way causal relationship flowing from Nigerian stock prices to exchange rates in the long run.

4. Conclusion

Although the literature is replete with the dynamics of the relationship between exchange rates and stock prices, not much has been done in developing countries. Besides, few studies that attempted to investigate the relationship between the two variables, particularly in Nigeria, ignored the impact of the 2007/2008 Global Financial Crisis. On the basis of this, the study concludes that there are gaps in the literature that, therefore, need to be filled by investigating the effect of exchange rates on stock prices in Nigeria. Also, the study explores the direction of causality between exchange rates and stock prices in Nigeria.

The results of the descriptive analysis revealed that stock prices, exchange rates and money supply are negatively skewed. In addition, stock prices and exchange rates are less volatile compared to money supply, and interest rates. The results of the ARDL model suggested that exchange rates, interest rates and the dummy variable for global financial crisis are negatively related to stock prices both in the short-run and long-run while the impact of money supply differs. Granger causality results indicated a one-way causality flowing from Nigerian stock prices to exchange rates in the long run and the post estimation/diagnostic tests suggested that the models are reliable for statistical inferences.

It is obvious from the result of the short-run analysis that exchange rate has a negative impact on stock price. However, the relationships between the two variables are negative and significant in the long-run. Consequent upon these findings, the study concludes that an increase in exchange rates in Nigeria will only lead to a significant decrease in stock prices in the long-run. Importantly, the empirical evidence revealed that exchange rates exert more negative effect on stock prices in the long-run than short-run.

Furthermore, the study concludes that the global financial crisis has negative impact on stock prices in Nigeria. This suggests that increase in exchange rate depreciation of naira against dollar will lead to a decline in stock prices in Nigeria. Further, stock prices decreased on the average during and after the global financial crisis in Nigeria. The empirical findings also suggest a unidirectional causality running from Nigerian stock prices to exchange rates in the long run. As a result, the study argues that the variations in the exchange rate are driven by the changes in stock prices in Nigeria. Finally, the study concludes based on the findings of the diagnostic tests, that the ARDL models are suitable for statistical inference and future prediction.

Given these findings, Nigerian authorities should adopt appropriate policies that will enhance the performance of the companies that are listed in the stock market so as to strengthen the exchange rate for Nigeria.

Two limitations of this study can be identified. One, the study is limited by using annual time series data and naira-dollar exchange rates to examine the relationship between exchange rate and stock prices. Two, the study did not consider the impact of financial liberalization on stock market prices in Nigeria. In the light of these limitations, subsequent researchers should use daily, weekly, monthly or quarterly data to probe the relationship between exchange rates and stock prices in Nigeria. Future researchers should look at the impact of the financial liberalization in their analysis by using a dummy variable to distinguish the pre-financial liberalization period from the post-financial liberalization period.

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