DBN Development Bank of Nigeria
...Financing Sustainable Growth

DBN JOURNAL OF ECONOMICS & SUSTAINABLE GROWTH
VOLUME 4, ISSUE 2, 2021

EXCHANGE RATE AND STOCK PRICE LINKS IN NIGERIA: A VECTOR ERROR CORRECTION MODEL AND GRANGER CAUSALITY APPROACH

MOREMI SOLOMON
DEPARTMENT OF ACCOUNTING
FACULTY OF ECONOMICS AND MANAGEMENT SCIENCES
UNIVERSITY OF IBADAN, IBADAN, NIGERIA
(MOREMISOLOMON91@GMAIL.COM)

AND

SEBIL. OLALEKAN OSHOTA
NIGERIAN INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH
IBADAN, OYO STATE, NIGERIA
(OSHOTA4REAL@GMAIL.COM)

Abstract

This study examines the impacts of exchange rate on stock prices in Nigeria using the Vector error correction model (VECM), and granger causality approaches for the period between 1980 and 2018. The magnitude of the estimated coefficients shows that the exchange rate has a significant but negative impact on stock prices.

The VECM results also show that the speed of adjustment of about 8.5% of the previous period's disequilibrium in the stock exchange market is corrected annually. This indicates that it takes some years for any disequilibrium in the stock market to spread to the foreign exchange market. The granger causality test shows that the direction of causality between stock prices and exchange rate runs from exchange rate to stock prices.

This implies that appreciation (depreciation) in the exchange rate leads to an increase (decrease) in stock prices in Nigeria. As a policy option, policymakers in Nigeria should be interested in a more stable exchange rate policy.

Also, economic reforms must target macroeconomic stability, removal of structural distortions and creation of a business-friendly environment to enhance domestic production capacity.

Keywords: Exchange Rate, Stock Prices, Nigeria, VECM,

1. Introduction

Issues concerning the relation between stock prices and exchange rates have preoccupied the minds of economists, particularly in a country like Nigeria, where the capital market is still evolving. The theoretical and empirical literature has shown that stock prices and exchange rates play essential roles in influencing the development and prosperity of a country's economy (Afshan, *et al*. 2017). Exchange rates can affect stock prices not only for multinational and export-oriented firms but also for domestic firms. For a multinational company, changes in exchange rates will result in an immediate change in the value of its foreign operations as well as a continuous change in the profitability of its overseas operations reflected in successive income statements (Demitrova, 2005; Lin, 2012; and Adeniyi and Kumeka, 2019). Therefore, the changes in the economic value of the firm's foreign operations may influence stock prices. Changes in exchange rates can also affect domestic firms since they may import part of their inputs and export their outputs. According to Mitra (2017), depreciation (appreciation) of the domestic currency tends to increase (reduce) the demand for a nation's exports and boosts (worsens) its trade balance and thereby improves (depresses) stock prices.

Most developing countries have now recognized the useful role that stock markets can play in enhancing the efficiency of domestic financial systems. The global financial crisis, precipitated by the United States Mortgage crises, liberalization of global financial regulations, the boom and burst in the housing market, as well as continuous fall in the international price of crude oil and its attendant effect on a resource-dependent county like Nigeria, necessitates the need for an empirical study of this nature. Evidence in Nigeria shows that between 2008 and 2009, the stock market collapsed by 70% point (Sanni and Hassan, 2018). Additionally, the All-Share Index (ASI) as a measure of stock market performance has persistently declined from 65,652.38 in 2008 to less than 30,000.00 points in 2012. It, however, increases from 31,853.19 to 41,210.10 points between 2013 and

2014, after which it continuously declined to less than 31,853.19 points from 2015 to date (Sanni and Hassan, 2018).

Empirical studies on the relationship between stock prices and exchange rates have remained an inconclusive debate in economic literature. Previous studies on stock prices and exchange rates have concentrated almost exclusively on developed nations, and very few have been on transition countries of which Nigeria is one. Some of the works in Nigeria include Opara and Odinoye (2012), Umoru and Asekome (2012), Fowowe (2015), Effiong (2017), Tute, Dogo, and Uzonwanne (2018), Bala Sanni and Hassan (2018) and Adeniyi and Kumeka (2019). Most of these studies either examined the impact of stock prices on the exchange rate or the impact of the exchange rate on stock prices. In contrast, some that consider causality issues such as Zubair (2013) are devoid of more in-depth analysis on the direction of causality and often contain simultaneity bias. Therefore, this study employed the VAR model, transformed into a vector error correction mechanism (VECM). The choice is made because it is one of the models that are not vulnerable to simultaneity bias. It offers an easy solution in explaining, predicting and forecasting the values of a set of economic variables at any parameter restrictions. It also assumes there is no priory direction of causality among variables. Again, this study improves on the earlier studies in Nigeria in terms of the variables used. We introduce some selected macroeconomics variables such as domestic expenditure and net export, all of which have not been considered in previous work.

The next section reviews past literature on the subject matter, including studies from Nigeria, followed by the model specification and methodology. Estimation procedures and empirical results are presented in section four, while section five concludes the paper.

2. Empirical Literature

In recent years and due to the shift of trend towards emerging economies with more progressive econometric methods and accessibility of data, the debate on the link between stock prices and exchange rates has continued to be relevant and discussed widely in the literature (Afshan, et al. 2017). Several studies conducted to verify the relationship have returned mixed results. The earlier studies on the link between stock price and exchange rate were motivated by the theoretical proposition of Dornbusch and Fischer (1980) where changes in exchange rates were established as an important factor that affects the international competitiveness of an economy. Some empirical studies have confirmed exchange rate as the main predictor of stock market fundamentals (Zubair, 2013; Sui and Sun, 2015; Zivkov *et al.,* 2016).

The relationship between stock price and exchange rate has produced mixed results with regards to whether the impact is noticeable in the short run or in the long run. While studies such as Bahmani-Oskooee and Saha, 2015), Huang, *et al.* (2016), Jain and Biswal (2016) and Heimonen et al. (2017) found a short-run effect, others like Paterson (2013), Al-Shboul and Anwar (2014), Tuncer and Turaboglu (2014), and Mitra (2017) establish a long-run relationship between the two variables. Yet some other studies (Oyinlola, *et al.* 2012; Du and Hu, 2012; Boonyanam, 2014; and Balcilar *et al.,* 2015) found no long-run cointegrating relationship between stock prices and the exchange rate. A growing body of literature has equally found the relationship between exchange rate and stock prices to be asymmetric rather than the symmetric assumption of the earlier findings (see Chkili Nguyen, 2014; Bahmani-Oskooee and Saha, 2016; Azher and Iqbal, 2016; Salisu and Ndako, 2018; Effiong and Bassey, 2018; Kumar, 2019), while Adeniyi and Kumeka (2019) found an insignificant relationship between exchange rate and stock prices using both the symmetric and asymmetric methods.

Some studies on the topic related to the Nigerian economy are also available in the literature. Most of these studies have examined the relationship between stock price and exchange rate through different methodologies such as the cointegration approach, autoregressive distributed lag (ARDL), vector error correction model and/or Granger causality approach. The results from these studies are far from being uniform. Okpara and Odionye (2012) examined the causal relationship between exchange rate and stock prices in Nigeria for the period of 1990 to 2009. Three different stock exchange indicators were used as proxies for stock prices to test the direction of causality between the variables. The vector error correction model (VECM) result suggested long-run equilibrium relationship between exchange rate and stock prices and strong unidirectional causality running from stock prices to exchange rate. The result supports the Stock Oriented Model (SOM). In another development, Umoru and Asekome (2013) examined the interaction between stock prices and the exchange rate of Nigeria using co-integration and the Granger-Sim causality methodology. The results reveal that whenever there was a change in the Naira-US$ exchange rate, stock prices react in tandem. The results accordingly lend support to the predictions of the flow and stock theories.

In terms of the direction of causality, Sani and Hassan (2018) reveal that a unidirectional causality running from exchange rate to stock market exists between the two variables in Nigeria. Other studies on the granger causality reveal a unidirectional relationship running from exchange rate to stock prices (Fowowe, 2015); a bi-directional relationship between stock prices and exchange rate (Effiong, 2017) and Tute, Dogo, and Uzonwanne (2018) in a multivariate GARCH model (VARMA-AGARCH) find a unidirectional transmission of spillover shocks from the stock market to the foreign exchange market.

3. Data, Model Specification and Methodology

The data employed in this study is collected from the World Bank, World Development Indicators and the Central Bank of Nigeria (CBN) Statistical Bulletin. Annual data covering the period ranging from 1980 to 2018 are utilized to examine the relationship between stock price and exchange rate in Nigeria. In this study, the All Share Index (ASI) is used to represent the stock price (ST) and EX captures movements in the nominal exchange rate act which acts as the main explanatory variable. *INF, RIR, DE, and NX* were used as proxies for inflation, real interest rate, domestic expenditure and net exports while serving as control variables

Following the work of Zietz and Pemberton (1990) and Demistrova (2005), the functional model linking stock price to the exchange rate and other macroeconomic variables is specified as follows:

$$ST = f(\,EX, INF, RIR, DE, NX) \qquad 1$$

Where: ST = Stock prices EX = Exchange rate, INF = Inflation, RIR = Real interest rate,

DE = Domestic expenditure, and NX = Net export

The econometric specification of eq. 2 is re-specified as follows:

$$STP = \alpha_1 + \alpha_2 EX - \alpha_3 INF \; + + \alpha_4 RIR + \alpha_5 DE + \alpha_6 NX + \Omega \qquad 2$$

Where **Ω** is the error term with the entire standard attributes of stochastic term. All variables except for RIR are in their logarithmic form.

In estimating equation 2, the vector autoregression (VAR) approach is adopted. The VAR model is used to capture the linear interdependencies among the variables. In the VAR framework, all variables are treated symmetrically in a structural sense with each variable having an equation explaining its evolution based on its own lags and the lags of the other model variables. Unlike the structural models with simultaneous equations, VAR model does not require prior knowledge of the forces influencing a variable. The only prior knowledge required is a list of variables which can be hypothesized to affect each other intertemporally.

The model in its general form is:

$$Y_{1T} = \alpha_i + \beta_i \sum_{J=1}^{K} Y_{T-1} + \omega_i \sum_{J-1}^{K} X_{iT-1}\, \mu_i \qquad 3$$

Where:

$Y_{1T} = 6 \times 1$ vector of endogenous variables (i.e $Y_{1T} = ST_T, EX_T, INF_T, RIR_T, DE_T, \text{ and } NX_T$)

$\alpha_i =$ 6 × 1 vector of constant terms

$\beta_i = 6 \times 6$ coefficient matrix of the autoregressive terms

$\omega_i = 6 \times 6$ coefficient matrix of the explainatory variables (vector coefficient)

μ_i = vector of innovations.

Equation (3) can be fully specified as follows:

$$ST_T = \alpha_0 + \alpha_1^1 \sum_{J-1}^{K} ST_{T-1} + \alpha_2^1 \sum_{J-1}^{K} EX_{T-1} + \alpha_3^1 \sum_{J-1}^{K} INF_{T-1} + \alpha_4^1 \sum_{J-1}^{K} RIR_{T-1} + \alpha_5^1 \sum_{J-1}^{K} DE_{T-1} + \alpha_6^1 \sum_{J-1}^{K} NX_{T-1} + \varepsilon_{1T}$$

4

$$EX_T = \beta_0 + \alpha_1^1 \sum_{J-1}^{K} EX_{T-1} + \alpha_2^1 \sum_{J-1}^{K} ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} INF_{T-1} + \alpha_4^1 \sum_{J-1}^{K} RIR_{T-1} + \alpha_5^1 \sum_{J-1}^{K} DE_{T-1} + \alpha_6^1 \sum_{J-1}^{K} NX_{T-1} + \varepsilon_{2T}$$

5

$$INF_T = \gamma_0 + \alpha_1^1 \sum_{J-1}^{K} INF_{T-1} + \alpha_2^1 \sum_{J-1}^{K} ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} EX_{T-1} + \alpha_4^1 \sum_{J-1}^{K} RIR_{T-1} + \alpha_5^1 \sum_{J-1}^{K} DE_{T-1} + \alpha_6^1 \sum_{J-1}^{K} NX_{T-1} + \varepsilon_{3T}$$

6

$$RIR_T = \delta_0 + \alpha_1^1 \sum_{J-1}^{K} RIR_{T-1} + \alpha_2^1 \sum_{J-1}^{K} ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} EX_{T-1} + \alpha_4^1 \sum_{J-1}^{K} INF_{T-1} + \alpha_5^1 \sum_{J-1}^{K} DE_{T-1} + \alpha_6^1$$

7

$$DE_T = \varphi_0 + \alpha_1^1 \sum_{J-1}^{K} DE_{T-1} + \alpha_2^1 \sum_{J-1}^{K} ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} EX_{T-1} + \alpha_4^1 \sum_{J-1}^{K} INF_{T-1} + \alpha_5^1 \sum_{J-1}^{K} RIR_{T-1} + \alpha_6^1 \sum_{J-1}^{K} NX_{T-1} + \varepsilon_{5T}$$

8

$$NX_T = \vartheta_0 + \alpha_1^1 \sum_{J-1}^{K} NX_{T-1} + \alpha_2^1 \sum_{J-1}^{K} ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} EX_{T-1} + \alpha_4^1 \sum_{J-1}^{K} INF_{T-1} + \alpha_5^1 \sum_{J-1}^{K} RIR_{T-1} + \alpha_6^1 \sum_{J-1}^{K} DE_{T-1} + \varepsilon_{6T}$$

9

Where j is the lag length, K is the maximum distributed lag length α_0, $\beta_0, \gamma_0, \delta_0, \varphi_0, and\, \vartheta_{0,}$ are the constant terms ε_T is dependent and an identically distributed error term in matrix form. The above can be compactly specified as:

$$\begin{bmatrix} ST_T \\ EX_T \\ INF_T \\ RIR_T \\ DE_T \\ NX_T \end{bmatrix} = \begin{bmatrix} \alpha_0 \\ \beta_0 \\ \gamma_0 \\ \delta_0 \\ \varphi_0 \\ \vartheta_0 \end{bmatrix} + \sum_{J-1}^{K} \times \begin{bmatrix} ST_{T-1} & EX_{T-1} & INF_{T-1} & RIR_{T-1} & DE_{T-1} & NX_{T-1} \\ EX_{T-1} & ST_{T-1} & ST_{T-1} & ST_{T-1} & ST_{T-1} & ST_{T-1} \\ INF_{T-1} & INF_{T-1} & EX_{T-1} & EX_{T-1} & EX_{T-1} & EX_{T-1} \\ RIR_{T-1} & RIR_{T-1} & RIR_{T-1} & INF_{T-1} & INF_{T-1} & INF_{T-1} \\ DE_{T-1} & DE_{T-1} & DE_{T-1} & DE_{T-1} & RIR_{T-1} & RIR_{T-1} \\ NX_{T-1} & NX_{T-1} & NX_{T-1} & NX_{T-1} & NX_{T-1} & DE_{T-1} \end{bmatrix} \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \\ \alpha_6 \end{bmatrix} \begin{bmatrix} \varepsilon_{1T} \\ \varepsilon_{2T} \\ \varepsilon_{3T} \\ \varepsilon_{4T} \\ \varepsilon_{5T} \\ \varepsilon_{6T} \end{bmatrix}$$

Transforming the VAR equations into VECM specifications correspond to:

$$\Delta ST_T = \alpha_0 + \alpha_1^1 \sum_{J-1}^{K} \Delta ST_{T-1} + \alpha_2^1 \sum_{J-1}^{K} \Delta EX_{T-1} + \alpha_3^1 \sum_{J-1}^{K} \Delta INF_{T-1} + \alpha_4^1 \sum_{J-1}^{K} \Delta RIR_{T-1} + \alpha_5^1 \sum_{J-1}^{K} \Delta DE_{T-1} + \alpha_6^1 \sum_{J-1}^{K} \Delta NX_{T-1} + \Psi ECM_{T-1} + \varepsilon_{1T}$$

10

$$\Delta EX_T = \beta_0 + \alpha_1^1 \sum_{J-1}^{K} \Delta EX_{T-1} + \alpha_2^1 \sum_{J-1}^{K} \Delta ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} \Delta INF_{T-1} + \alpha_4^1 \sum_{J-1}^{K} \Delta RIR_{T-1} + \alpha_5^1 \sum_{J-1}^{K} \Delta DE_{T-1} + \alpha_6^1 \sum_{J-1}^{K} \Delta NX_{T-1} + \Omega ECM_{T-1} + \varepsilon_{2T}$$

11

$$\Delta INF_T = \gamma_0 + \alpha_1^1 \sum_{J-1}^{K} \Delta INF_{T-1} + \alpha_2^1 \sum_{J-1}^{K} \Delta ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} \Delta EX_{T-1} + \alpha_4^1 \sum_{J-1}^{K} \Delta RIR_{T-1} + \alpha_5^1 \sum_{J-1}^{K} \Delta DE_{T-1} + \alpha_6^1 \sum_{J-1}^{K} \Delta NX_{T-1} + \mu ECM_{T-1} + \varepsilon_{3T} \quad 12$$

$$\Delta RIR_T = \delta_0 + \alpha_1^1 \sum_{J-1}^{K} \Delta RIR_{T-1} + \alpha_2^1 \sum_{J-1}^{K} \Delta ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} \Delta EX_{T-1} + \alpha_4^1 \sum_{J-1}^{K} \Delta INF_{T-1} + \alpha_5^1 \sum_{J-1}^{K} \Delta DE_{T-1} + \alpha_6^1 \sum_{J-1}^{K} \Delta NX_{T-1} + \rho ECM_{T-1} + \varepsilon_{4T}$$

13

$$\Delta DE_T = \varphi_0 + \alpha_1^1 \sum_{J-1}^{K} \Delta DE_{T-1} + \alpha_2^1 \sum_{J-1}^{K} \Delta ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} \Delta EX_{T-1} + \alpha_4^1 \sum_{J-1}^{K} \Delta INF_{T-1} + \alpha_5^1 \sum_{J-1}^{K} \Delta RIR_{T-1} + \alpha_6^1 \sum_{J-1}^{K} \Delta NX_{T-1} + \phi ECM_{T-1} + \varepsilon_{5T}$$

14

$$\Delta NX_T = \vartheta_0 + \alpha_1^1 \sum_{J-1}^{K} \Delta NX_{T-1} + \alpha_2^1 \sum_{J-1}^{K} \Delta ST_{T-1} + \alpha_3^1 \sum_{J-1}^{K} \Delta EX_{T-1} + \alpha_4^1 \sum_{J-1}^{K} \Delta INF_{T-1} + \alpha_5^1 \sum_{J-1}^{K} \Delta RIR_{T-1} + \alpha_6^1 \sum_{J-1}^{K} \Delta DE_{T-1} + \Pi ECM_{T-1} + \varepsilon_{6T}$$

15

Where α^s are parameter to be estimated, Δ is the difference operator, ε_T, k, are as defined above. The parameter estimates of $\Psi, \Omega, \mu, \rho, \phi, and\, \Pi$ should be negative (< 0). Equation 10-15 can be summarized thus;

$$Y_{1T} = \alpha_0 + \beta_T \sum_{J-1}^{K} Y\pi_{T-1} + \omega_T \sum_{J-1}^{K} X_{iT-1} + \phi ECM_{T-1} + \varepsilon_{\text{C}}$$

The choice of a VAR model to be transformed into a vector error correction mechanism (VECM) is made because it is one of the models that is not vulnerable to simultaneity bias. A good attribute of the VAR model is that it obviates a decision as to what contemporaneous variables are exogenous with only lagged variables on the right hand, and all variables are endogenous. It also offers an easy solution in explaining, predicting and forecasting the values of a set of economic variables at any point in time.

4. Estimation and Discussion of Empirical Results

4.1 Stationarity and Cointegration Tests

4.1.1 Stationarity

In line with the developments in time series modeling, unit root tests of the variables in the model were performed to determine their time-series properties/characteristics. As a preliminary step for testing for cointegration, we employed Augmented Dickey-Fuller and Phillips-Perron (PP) tests statistics to confirm the stationarity or otherwise of the variables used. The ADF test assumes that the residuals from the test equation are normal while the PP test does not make any assumption about the residuals of the test equation. The results of the unit root tests are provided in Table 1.

Table 1: Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) Results

	ADF Values			PP Values		
	Level	1st diff	Decision	Level	1st diff	Decision

LOG(ST)	-1.3710	-6.1258*	I(1)	-1.4038	-5.8091*	I(1)
LOG(EX)	-0.2893	-6.1489*	I(1)	-0.2515	-6.1510*	I(1)
LOG(INF)	2.5797	-6.4696*	I(1)	9.2233*	-9.3673*	I(1)
RIR	-2.2721	-6.4105*	I(1)	-2.2501	-6.4210*	I(1)
LOG(DE)	-0.2664	-6.4031*	I(1)	-0.3865	-6.4169*	I(1)
LOG(NX)	-0.2900	-5.4157*	I(1)	-0.2900	-5.4168*	I(1)

*Note: * shows significant at 1%: Extracted from E-Views 10 Output*

The results of Table 1 shows that all the variables are non-stationary in level form since their ADF and PP values are less than the critical values at 1% significant level. The null hypothesis of no unit root was accepted for all the variables but was rejected in 1st difference. Thus, we conclude that the variables under investigation are integrated of order one I(1). We, therefore, moved to examine their co-integrating relationship using Johansen's full information maximum likelihood.

4.1.2 Co-integration

To establish the existence or otherwise of a long-run relationship among the series, a cointegration test was performed using the Johansen Maximum Likelihood procedure (Johansen and Juselius, 1990). The optimal lag lengths of the related Vector Auto-regression (VAR) were first conducted. This method preceded estimating a VAR model which must have the appropriate lag length. The Likelihood ratio (LR) test, Akaike Information Criterion (AIC), Schwartz Information Criterion (SIC), Hannan Quin (HQ) test and Final Prediction Error (FPE) test were used in the lag length selections. The lag length supported by more of the four criteria was chosen as the appropriate lag length. To save the degrees of freedom, one lag length in the testing–down procedure of the lag-length tests was taken for each of the variables. Table 2 shows the result of optimal lag selection in the VAR model.

Table 2: Lag Order Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-808.0767	NA	2.52e+13	47.88687	48.15622	47.97872

1	-602.6750	326.2262*	1.23e+09*	37.92206*	39.80756*	38.56507*

Source: Extracted from E-Views 10 Output * indicates lag order selected by the criterion

Table 3: Johansen's Cointegration Test Results

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
r = 0 *	0.734839	120.5444	95.75366	0.0004
r ≤ 1 *	0.545698	76.73959	69.81889	0.0126
r ≤ 2 *	0.481534	50.70283	47.85613	0.0264
r ≤ 3	0.409788	29.02574	29.79707	0.0612
r ≤ 4	0.247511	11.62572	15.49471	0.1758
r ≤ 5	0.065671	2.241564	3.841466	0.1343
Trace test indicates 3 cointegrating eqn(s) at the 5% level				
*Note: * denote the rejection of the null hypothesis at 5% significance level*				
***MacKinnon-Haug-Michelis (1999) p-values*				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
r = 0 *	0.734839	43.80485	40.07757	0.0182
r ≤ 1	0.545698	26.03676	33.87687	0.3185
r ≤ 2	0.481534	21.67709	27.58434	0.2374
r ≤ 3	0.409788	17.40003	21.13162	0.1540
r ≤ 4	0.247511	9.384152	14.26460	0.2556
r ≤ 5	0.065671	2.241564	3.841466	0.1343
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 5% level				
*Note: * denote the rejection of the null hypothesis at 5% significance level*				
***MacKinnon-Haug-Michelis (1999) p-values*				

Source: Extracted from E-Views 10

The Johansen procedure tests the null hypothesis of no cointegration, and rejection of the null hypothesis implies the data series are cointegrated. The result of the Johansen tests is shown in Table 3.

4.2 Empirical Findings

4.2.1 The Relationship between Stock Prices and Exchange Rate

Since there is co-integration, the vector error correction model was estimated. The results are presented in Table 4. The VECM result shows that there is a significant negative long-run relationship between stock prices and exchange rate suggesting that an appreciation in exchange rate impacts negatively on stock prices. That is, a naira appreciation in the exchange rate will lead to N15.199 naira fall in stock prices. While Real interest rate (RIR) Interest rate, Domestic expenditure (DE) had significant positive impact on stock prices. Inflation rate (INF) had a negative and insignificant impact on stock prices. Finally, net export (NX) had significant negative impact on stock prices. This is consistent with "a priori" expectation.

The vector error correction term for ST is -0.0085. This speed of adjustment suggests that about 8.5% of the previous period's disequilibrium in the stock exchange market is corrected annually. The vector error correction term for exchange rate (EXR) is 0.29832. This implies that about 29.83% of the previous period's imbalance is corrected annually. The vector error correction term for real interest rate (RIR) is -0. 2403 implying that about 24.0% of the past period's deviation in the model will converge in the current period. The error correction term for inflation rate (INF) is -0. 0.0994 implying that the speed of adjustment is about 0.9.94%. For Domestic expenditure, the vector error correction is 0.0002 implying that about 0.02% of the disequilibrium in Domestic expenditure corrected annually. For net export, the vector error correction is 0.2403 this implies that about 24.03% of the previous period's imbalance is corrected annually. The optimum lag length of one (1) was selected based on AIC and SBC information criteria. This means that the convergence between the variables is not instantaneous.

Considering the error correction modeling results, lag one (-1) of stock prices (ST) when it is the dependent variable, the Exchange Rate (EX) and Net Export (NX) are significant in determining ST while Domestic Expenditure (DE), Inflation Rate (INF) and Real Interest Rate (RIR) are not significant in determining stock prices (ST) in Nigeria. For the lag (-1) exchange rate, on the other hand, Domestic Expenditure (DE) and Net Export (NX) are the only variables that are significant in determining the exchange rate in Nigeria. Taking the lag(-1) of Domestic Expenditure (DE) and Net Export (NX) as dependent variables and other variables as Independent variables, none of the variables are significant in determining domestic expenditure (DE) and Net export (NX), respectively, in Nigeria. For lag (-1) Inflation rate (INF), Domestic Expenditure (DE) and Real Interest Rate (RIR) are the only significant variables determining inflation rate (INF) in Nigeria. Lastly, when considering the lag (-1) of Real interest rate (RIR), exchange rate (EX) is the only variable significant in determining Real interest rate (RIR) in Nigeria.

Analyzing the VECM vertically, the result reveals that last year- lag (-1) of ST, EX, INF, NX are not significant in determining stock prices in current year while DE is significant. It is reveal that lag (-1) of ST, EX and RIR in previous year are significant in determining the EX in current year while DE, IN and NX are not significant in determine it. Also lag (-1) of DE and INF are the only variables significantly determine DE while lag (-1) of ST, EX, NX and RIR are not significant in determining DE. In another vein lag (-1) of INF is the only variable in previous year that is significant in determining INF while lag (-1) of other variables are not. Also lag (-1) ST is significant in determining the NX while other variables are not. Finally lag of RIR only INF is significant in determining RIR while other variables like ST, EX, DE, NX and RIR in previous years are not significant in determining RIR.

Table 4: Vector Error Correction Model (VECM) Result

Cointegrating Eq:	CointEq1
ST(-1)	1.0000
LOG(DE(-1))	14.5546*
	(3.1795)

	[4.5776]					
LOG(EX(-1))	-15.1999					
	(12.2039)					
	[-1.24549]					
LOG(INF(-1)	-9.6629*					
	(3.0805)					
	[-3.1369]					
LOG(NX(-1))	-4.0477*					
	(1.0147)					
	[-3.9892]					
RIR(-1)	8.7892*					
	(1.4218)					
	[6.1818]					
C	-36.9779					
Error Correction:	D(ST)	D(LOG(DE))	D(EX)	D(INF)	D(LOG(NX))	D(RIR)
CointEq1	-0.0085*	0.7344*	0.29832*	-0.0994	0.0002	-0.2403*
	(0.0031)	(0.3427)	(0.0767)	(1.0405)	(3.3367)	(0.0807)
	[-2.2749]	[2.1430]	[3.8904]	[-0.0955]	[0.70736]	[-2.9773]
D(LOG(ST(-1))	0.0428	1.8253	-0.0005**	1.7798	-3.3906*	-6.9705
	(0.2154)	(4.6210)	(0.0002)	(5.7357)	(1.1245)	(8.3055)
	[0.1989]	[0.3950]	[-2.5045]	[0.3103]	[-3.0152]	[-0.8393
D(LOG(DE(-1)))	4.9858*	-0.6242**	3.0959	5.5779***	-1.3136	6.9959
	(1.2244)	(0.2601)	(12.521)	(3.2631)	(6.4875)	(4.7224)
	[4.0720]	[-2.3998]	[0.2472]	[1.7093]	[-0.2025]	[1.4814]
D(LOG(EX(-1))	16.5639	-0.0002	-0.2933***	0.0273	0.0015***	0.0362
	(14.4300)	(0.0003)	(0.1475)	(0.0384)	(0.0076)	(0.0556)
	[1.1479]	[-0.6667]	[-1.9884]	[0.7109]	[0.1974]	[0.6508]
D(LOG(INF(-1))	-4.4416	0.0022*	0.3557	0.8508*	0.0181	-0.4844*
	(4.1093)	(0.0008)	(0.4202)	(0.1095)	(0.0217)	(0.1584)
	[-1.0809]	[2.7500]	[0.8465]	[7.7698]	[0.8341]	[-3.0580]
D(LOG(NX(-1)))	-5.5376	0.0147	6.6243	-1.4476	0.0344	0.3951
	(4.5733)	(0.0097)	(4.6767)	(1.2188)	(0.2423)	(1.7638)
	[-0.1211]	[1.5146]	[1.4165]	[-1.1877]	[0.1414]	[0.2240]
D(RIR(-1))	1.9486	-0.0012	-2.2650*	0.0181	-0.0322	-0.00919
	(5.1555)	(0.0011)	(0.5272)	(0.1373)	(0.0273)	(0.1988)
	[0.3789]	[-0.0909]	[-4.2962]	[0.1318]	[-1.1794]	[-0.0462]
C	16.3924	-0.0052	5.3619*	0.7188	-0.0154	1.9033**
	(19.9373)	(0.0042)	(2.0388)	(0.5313)	(0.1056)	(0.7689)
	[0.8222]	[-1.2415]	[2.6299]	[1.3529]	[-0.1458]	[2.4753]
R-squared	0.5049	0.2746	0.6692	0.8280	0.1208	0.4019
Adj. R-squared	0.4956	0.0715	0.5766	0.7798	-0.1253	0.2345

Source: Extracted from E-Views 10 Output; One, two and three asterisk denotes rejection of the null hypothesis at 1%, 5% and 10% respectively; ( ) & [ ] represent Standard errors and t-statistics respectively.

The import from the above findings is that exchange rate (EX) exerts significant negative impact on stock prices (ST) and that a unidirectional causal relationship exists between exchange rate and stock prices. Furthermore, appreciation (depreciation) in the exchange rate leads to increase (decrease) in stock prices in Nigeria. Evidence from the VECM shows that the speed of adjustment is 0.085. The speed of adjustment suggests that about 8.5% of the previous period's disequilibrium in the stock exchange market is corrected annually.

4.2.2 Causality among Stock Prices, Exchange Rate and Other Variables

The direction of causality between exchange rate and stock prices were tested using the pair-wise Granger causality test. The null hypothesis of no direction of causality was tested against the alternative that there exists a direction of causality amongst the variables. The results are presented in Table 5. The causality test revealed that ST granger cause DE, EX granger cause ST, NX granger cause ST, EX granger cause DE, INF granger cause DE, NX granger cause DE, RIR granger cause DE, EX granger cause NX, INF granger cause NX and RIR granger cause INF.

Table 5: Pair wise Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.	Conclusion
DE does not Granger Cause ST	34	0.08717	0.7698	Do not reject Ho
ST does not Granger Cause DE	34	5.00984	0.0325	Reject Ho
EX does not Granger Cause ST	34	7.73749	0.0091	Reject Ho
ST does not Granger Cause EX	34	0.14982	0.7013	Do not reject Ho
INF does not Granger Cause ST	34	2.70134	0.1104	Do not reject Ho
ST does not Granger Cause INF	34	0.60663	0.4420	Do not reject Ho
NX does not Granger Cause ST	34	3.22929	0.0821	Do not reject Ho
ST does not Granger Cause NX	34	5.00984	0.0325	Reject Ho
EX does not Granger Cause ST	34	7.73749	0.0091	Reject Ho
ST does not Granger Cause EX	34	0.14982	0.7013	Do not reject Ho
INF does not Granger Cause ST	34	2.70134	0.1104	Do not reject Ho
ST does not Granger Cause INF	34	0.60663	0.4420	Do not reject Ho
NX does not Granger Cause ST	34	3.22929	0.0821	Do not reject Ho
ST does not Granger Cause NX	34	2.61930	0.1157	Do not reject Ho
RIR does not Granger Cause ST	34	0.61334	0.4395	Do not reject Ho
ST does not Granger Cause RIR	34	0.28293	0.5986	Do not reject Ho
EX does not Granger Cause DE	34	6.51518	0.0158	Reject Ho
DE does not Granger Cause EX	34	0.02431	0.8771	Do not reject Ho
INF does not Granger Cause DE	34	6.08977	0.0193	Reject Ho
DE does not Granger Cause INF	34	0.49396	0.4874	Do not reject Ho
NX does not Granger Cause DE	34	9.23467	0.0048	Reject Ho
DE does not Granger Cause NX	34	0.01032	0.9197	Do not reject Ho

RIR does not Granger Cause DE	34	6.29349	0.0176	Reject Ho
DE does not Granger Cause RIR	34	1.38476	0.2482	Do not reject Ho
INF does not Granger Cause EX	34	0.01630	0.8992	Do not reject Ho
EX does not Granger Cause INF	34	2.34384	0.1359	Do not reject Ho
NX does not Granger Cause EX	34	0.76980	0.3870	Do not reject Ho
EX does not Granger Cause NX	34	12.1646	0.0015	Reject Ho
RIR does not Granger Cause EX	34	1.13882	0.2941	Do not reject Ho
EX does not Granger Cause RIR	34	0.33304	0.5680	Do not reject Ho
NX does not Granger Cause INF	34	0.05956	0.8088	Do not reject Ho
INF does not Granger Cause NX	34	6.94007	0.0130	Reject Ho
RIR does not Granger Cause INF	34	5.04530	0.0320	Reject Ho
INF does not Granger Cause RIR	34	0.37957	0.5423	Do not reject Ho
RIR does not Granger Cause NX	34	1.16903	0.2879	Do not reject Ho
NX does not Granger Cause RIR	34	0.14818	0.7029	Do not reject Ho

Source: Extracted from E-Views 10 Output: Note: lag length used is one (1)

There is no causality between RIR and INF, RIR and EX and RIR, EX, RIR and ST and INF. The conclusion was arrived based on the fact that their F-statistics were statistically significant at 5% as indicated by their p- values. With regards to the variables of interest, the result indicates that there is a unidirectional causality between exchange rate and stock prices. This implies that the exchange rate influences the stock price movement in Nigeria and not in other way round. The outcome supports the Flow oriented theory which posits that any changes in exchange rate lead to fluctuation in stock prices.

5. Conclusion and Policy Recommendations

This study analyzed the impact of exchange rate on stock prices in Nigeria for the periods 1980 to 2018. The study was conducted to answer the following questions: To what extent does an exchange rate fluctuation affect the stock price in Nigeria? Do other selected macroeconomic variables have a relationship with stock prices? In achieving the objectives, the Vector Error Correction Model (VECM) and granger causality approaches were adopted.

The findings from this study revealed that exchange rate has significant impact on stock prices. As such, participants in the foreign exchange market can use the information content of the exchange rate provided by the vector error correction model to improve the forecast and prediction of stock prices in Nigeria. For instance, a sharp decline in the exchange rate will trigger a more than proportionate decline in the stock market, all things being equal. The result of the pairwise granger causality test revealed a unidirectional causality running from exchange rate to stock prices. This shows that changes that lead to appreciation (depreciation) in exchange rate would lead to increase (decrease) stock prices in Nigeria. The unidirectional causality showed that a collapse in the stock market will trigger exchange rate appreciation and cause a rebound in the stock market. Thus, the unidirectional relationship between the two markets aids self-recovery during a financial crisis.

Based on the findings of this study, to promote stable and sustainable growth in stock prices, policy makers should be interested in a more stable exchange rate policy. Also, anti- inflationary policies like non-expansionary monetary and fiscal policies as well as inflation-adjusted interest rate policies should be pursued to attract foreign investors and discourage capital flight from the country. The spending habits of the government should also be well managed to avoid inflationary or deflationary problems in the economy.

References

Adeniyi, O. and T. Kumeka (2019) "Exchange Rate and Stock Prices in Nigeria: Firm-Level" *Evidence Journal of African Business*

Afshan, S., A. Sharif, N. Loganathan, and R. Jammazi (2017) "Time-frequency causality between stock prices and exchange rates: Further evidences from cointegration and wavelet analysis" *Physica A: Statistical Mechanics and its Applications* Volume 495, Pages 225-244

Al-Shboul, M. and S. Anwar (2014) "Time-varying exchange rate exposure and exchange rate risk pricing in the Canadian equity market" *Economic Modelling,* 37, 451–463.

Azher, S. and J. Iqbal (2016) "Pricing of foreign exchange risk and market segmentation: Evidence from Pakistan's equity market" *Journal of Asian Economics* 43, 37–48

Bahmani-Oskooee, M. and S. Bahmani (2015) "Nonlinear ARDL approach and the demand for money in Iran" *Economics Bulletin* 35, 381–391

Bahmani-Oskooee, M. and S. Saha (2016) "Asymmetry cointegration between the value of the dollar and sectoral stock indices in the US" *International Review of Economics and Finance* 46, 78–86.

Bala Sani, A.R. and A. Hassan (2018) "Exchange Rate and Stock Market Interactions: Evidence from Nigeria" *Arabian J Bus Manag Review* 8: 334.

Balcilar, M., R. Gupta, and S.M. Miller (2015) "Regime switching model of US crude oil and stock market prices: 1859 to 2013" *Energy Economics* 49, 317–327

Boonyanam, N. (2014) "Relationship of stock price and monetary variables of Asian small open emerging economy: Evidence from Thailand" *International Journal of Financial Research*, 5, 52–63.

Chkili, W. and D.K. Nguyen (2014) "Exchange rate movements and stock market returns in a regime-switching environment: Evidence for BRICS countries" *Research on International Business and Finance* 31, 46–56

Demitrova, D. (2005) "The Relationship between Exchange Rates and Stock Prices: Studied in a Multivariate Model" *Issues in Political Economy*, Vol. 14.

Dornbusch, R. and S. Fischer (1980) "Exchange rates and the current account. *The American Economic Review*, *70*(5), 960-971

Du, D. and O. Hu (2012) "Exchange rate risk in the US stock market" *Journal of International Financial Markets, Institutions & Money*, 22, 137–150

Effiong, E. L. (2017) "Nonlinear Dependence between Stock Prices and Exchange rate in Nigeria". *Economics Research*, Vol 39, 205–227

Effiong, E.L. and G.B. Bassey (2018) "Stock prices and exchange rate dynamics in Nigeria: An asymmetric perspective" *The Journal of International Trade & Economic Development*

Fowowe, B. (2015) "The Relationship Between Stock Prices and Exchange Rates in South Africa and Nigeria: Structural Breaks Analysis" *International Review of Applied Economics* 29 (1): 1–14

Heimonen, K., J. Junttila, and S. Karkkainen (2017) "Stock market and exchange rate information in the Taylor rule: Evidence from OECD countries" *International Review of Economics and Finance*, 51, 1–18.

Huang, S., H. An, X. Gao, S. Wen, and X. Hao (2016) "The multiscale impact of exchange rates on the oil-stock nexus: Evidence from China and Russia. *Applied Energy*

Jain, A. and P.C. Biswal (2016) "Dynamic linkages among oil price, gold price, exchange rate, and stock market in India" *Resources Policy*, 49, 179–185.

Johansen, S. and K. Juselius (1990) "Maximum likelihood estimation and inference on cointegration, with applications to the demand for money" *Oxford Bulletin of Economics and Statistics*, 52, 169-210

Mitra, R. (2017) "Stock market and foreign exchange market integration in South Africa" *World Dev. Perspect* 6, 32–34.

Okpara G. C. and J.C. Odionye (2012) "Analysis of the Relationship between Exchange rate and Stock Prices: Evidence from Nigeria" *International Journal of Current Research*, 4(3), 175-183

Rahman, M., and J. Uddin (2009) "Dynamic Relationship between Stock Prices and Exchange Rates: Evidence from three Asian Countries", *International Business Research,* Vol.2 (2), pp 23-36

Salisu, A.A. and U.B. Ndako (2018) "Modelling stock price–exchange rate nexus in OECD countries: A new perspective" *Economic Modelling* xxx, *1–19*

Salisu, A. A. and T. F. Oloko (2015) "Modelling Spillovers Between Stock Market and FX Market: Evidence for Nigeria" *Journal of African Business* 16 (1–2): 84–108.

Sui, L. and L. Sun (2016) "Spillover effects between exchange rates and stock prices: Evidence from BRICS around the recent global financial crisis" *Research in International Business and Finance*, 36, 459-471.

Tule,M., M. Dogo, and G. Uzonwanne (2018) "Volatility of Stock Market Returns and the Naira Exchange Rate" *Global Finance Journal* 35: 97–105.

Tuncer, I. and T. T. Turaboglu (2014) "Relationship between stock prices and economic activity in Turkish economy" *Actual Problems of Economics*, 152, 111–121.

Umoru, D. and M.O. Asekome (2013) "Stock Prices and Exchange Rate Variability in Nigeria: Evidence from Econometrics Analysis" *European Scientific Journal* 9: 261-285.

Zietz, J. and D. Pemberton (1990) "The U.S. Budget and Trade Deficits: A Simultaneous Equation Model" *Southern Economic Journal 57*

Zubair, A. (2013) "Causal Relationship between Stock Market Index and Exchange Rate: Evidence" *CBN Journal of Applied Statistics* 4 (2): 87–110.