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Article

Exchange Rate Shocks and Sectoral Stock Returns in Nigeria: Do Asymmetry and Structural Breaks Matter?

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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Exchange Rate Shocks and Sectoral Stock Returns in Nigeria: Do Asymmetry and Structural Breaks Matter?

Ismail O. Fasanya^{1*} and Oluwafunmilayo A. Akinwale²

Abstract: This study examines the effect of exchange rate shocks on ten (10) sectoral stock returns in Nigeria from January 2007 to December 2018. The autoregressive distributed lag and nonlinear autoregressive distributed lag are employed to examine symmetric and asymmetric relationship between exchange rate and sectoral stock returns. The result shows that only financial service sector moves in an asymmetric fashion in the short and long period without taking account of structural breaks and with structural breaks, none of the sectoral stock returns were asymmetric. The result shows that exchange rate movement affects the sectors differently. Therefore, this study concludes that a single model cannot fit all the sectoral stock returns because all sectors respond differently to exchange rate movements and the information about a particular sector cannot be used to forecast other sectors. These results offer important insights for investors, regulators and policymakers.

Subjects: Economics; Economics; Finance

Keywords: Exchange rate; stock returns; Asymmetry; structural breaks

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PUBLIC INTEREST STATEMENT

This research offers insight for investors, policy analysts and relevant stakeholders in the financial and commodities markets. With the recent developments in asset price movements, we are presented with a new opportunity to investigate co-movements between exchange rate and sectoral stocks in the Nigeria considering their inherent characteristics. To this end, it is important to find approaches to examine the risks exchange rate may pose, but more consequentially, to characterize the asymmetry behaviour of exchange rate on sectoral stocks which will inform potential investors on diversification strategies in building their portfolios. In this study, we considered techniques that can help investors achieve this by addressing the behaviour of these assets and other relevant macroeconomic fundamentals that align with the nature of investor preferences. We find that exchange rate movement affects the sectors differently, hence, a single model cannot fit all the sectoral stock returns, and information about a particular sector cannot be used to forecast other sectors.

1. Introduction

Fluctuations generate overall sense of uncertainty about future consumption and firms' revenue for market participants, which are because of asset demand in the foreign exchange market that has the trend of destabilizing the activities of the real economy (Obstfeld & Rogoff, 1998). A shock is an unforeseen and unpredictable event that affects an economy positively or negatively. It is an unexpected change that occurs in external factors that are not explained by economics, which may influence internal economic variables like economic growth, unemployment and inflation. Exchange rate shock is a term that depicts the fluctuation of a value of a currency relative to another in an extremely short period.

Since most economies opened up to external stakeholders after the 1980s, financial crisis has become a global occurrence. Meanwhile, two financial crises have occurred in the world economy in the last decade: the 2008 global financial crisis and the Eurozone sovereign debt crisis. It is noticed that exchange rate and stock prices act as indicators to the financial sector as they are very delicate to shifting market conditions (Akdogu & Birkan, 2016).

Furthermore, exchange rate has been excessively volatile in African countries such as Nigeria, South Africa, Kenya and so on, since its adoption of the floating exchange rate regime (a regime where value of currency is allowed to fluctuate in response to foreign exchange market dynamics—demand and supply) with negative effects on investment, trade and growth (Emenike, 2017). An African country like Nigeria adopted the floating exchange rate regime in 1986 by the exchange rate liberation policy under the Structural Adjustment Programme Framework. Policies were made to ensure Exchange rate stabilization such as first and Second tier foreign exchange rate market, single foreign exchange markets in July 1987, autonomous foreign exchange market in 1988, inter- bank foreign exchange market in January 1989, the Bureau de change in 1989, Retail Dutch Auction system in December, 1990, autonomous Foreign Exchange Market reintroduced in 1995, There was also the reintroduction of retail Dutch Auction System in 2002 by Central Bank of Nigeria (CBN) which was replaced by Wholesale Dutch Auction System in February, 2006 (Central Bank of Nigeria, 2016).

After the global financial crisis in 2008 that caused a drastic fall in the exchange rate, Central Bank of Nigeria reintroduced the retail Dutch Auction System with the aim of easing demand pressure. Wholesale Dutch Auction System was later reintroduced in July 2009 due to the persistent demand pressure and the continuous fall of exchange rate in all market segments. Finally, Retail Dutch Auction System was brought back in October 2013 that was later taken back in 17 February 2015 due to reforms in market. Even with the policies to sustain exchange rate, Naira continues to be unstable against US Dollar (Central Bank of Nigeria, 2016).

However, there are 12 Sectors listed on the Nigeria Stock Exchange, they include: Agriculture, Construction/Real Estate, Consumer Goods, Financial Services, Healthcare, Industrial Goods, Information and Communications Technology, Natural Resources, Oil and Gas, Services, Utilities and Conglomerates. The Nigerian Stock market grew and gained financial strength as there was boom and investors, regulators, market analysts and other economic agents were certain and pleased with the market between 1999 to 2008 (Central Bank of Nigeria, 2016).

It is essential, therefore, for investors to be conversant with how changes in the variance of exchange rates relates to changes in the variance of stock prices and vice versa when selecting an optimal investment portfolio and managing risk effectively. Assets from markets where volatility in one financial market spillover to another cannot be involved in the same portfolio when diversifying risk (Mun, 2007). It is therefore of importance to study the nexus between exchange rate and sectoral stock returns in Nigeria.

This potential linkage between exchange rate and stock returns has stimulated researchers to search for more understanding of the dynamic relationships between foreign exchange and stock markets, hence, the literature is proliferated with studies on exchange rate-stock returns nexus from different countries. There are two strands of theoretical arguments regarding the direction of the linkage between these two markets by Dornbusch and Fisher (1980) and Branson and Henderson (1985). In the case of Nigeria, it is pathetically observed that Naira exchange rate has not been stable. Although immediate periods following the adoption of the Structural Adjustment Programme after the breakdown of the Bretton Wood system of exchange rate, there was relative stability in the dynamics of exchange rate from 1970 to 1985 with the highest exchange rate value of 0.8938 naira to 1 US dollar (Obinwata et al., 2016). In the recent decades however, Naira has been volatile relative to US Dollar and the stock market was not stable as well. In January 1999, Naira was ₦86.00 and All Share Index (ASI) on the Nigerian Stock Exchange was 5,494.8. In December 2000, Naira depreciated further to ₦106.71 while ASI appreciated to 8,111.0. Further depreciation (appreciation) led Naira (ASI) to be ₦132.79 (42,092.7) in December 2004. In December 2007 however, both Naira and ASI appreciated to ₦118.20 and 57,990.2 respectively. Following the period of global financial crisis (GFC) in 2008 and 2009, Naira and ASI correspondingly depreciated to ₦149.69 and 20,827.2 in December, 2009. After the crisis however, the depreciation rate in Naira persisted making average exchange rate of Naira to hover around ₦305.22 in December, 2016, while ASI persistently increased and oscillated around 6874.6 in the same period (Central Bank of Nigeria, 2016). From the behavior of Naira and ASI, it is observed that in the pre-GFC as Naira depreciates, ASI appreciates which confirms the goods market theory by Dornbusch and Fisher (1980). However, in the GFC and post-GFC, devaluation in Naira was symmetrical to depreciation in ASI, which vindicates the claim of portfolio balance approach by Branson and Henderson (1985). This phenomenon is also observed from 2010 to 2016: exchange rate depreciated and ASI declined too.

In this regard, financial markets cannot be disentangled from the movements in exchange rate. There are plethora of evidence in the literature that show credence to likely spillovers between exchange rates and the equity markets (see inter alia, Salisu & Ndako, 2018; Bahmani-Oskooee & Saha, 2018; Raheem et al., 2021). Apart from the issue surrounding the lack of consensus, another interesting puzzle arose among the studies that conclude significant effect, and that is whether the response of stock prices to exchange rate shocks is symmetric or asymmetric. The need to determine this spurs from how large or small the risks or gains of asymmetric tendencies in the response of stock prices to currency shocks may be to investors. Motivated by the above discussion, we examine the effect of exchange rate shocks on sectoral stocks in Nigeria, and whether these effects, if any, are asymmetric. More explicitly, we empirically address the following issues: How does exchange rates affect sectoral stock returns? Is this effect, if any, asymmetric? And what role do structural breaks/events play on the link between exchange rate and sectoral stocks?

Against this background, this paper contributes to the scarce literature on the effects of exchange rate shocks on sectoral stocks in the following ways. Examining this nexus for Nigeria is particularly of utmost importance for certain reasons. The Nigerian Stock Exchange (NSE) has recorded a phenomenal growth lately, as high economic performance is driven by the rise in initial public offering (Fowowe, 2015). With this her outstanding economic activities, she has maintained a giant stand in the African continent. Therefore, we extend the existing knowledge by making make certain additions. Firstly, majority of the studies carried out for Nigeria considered the aggregate stock market through the use of the All Share Index as proxy for stock prices (see for example, Bala & Hassan, 2018; Fowowe, 2015). To the best we know, the comprehensiveness of this study ranks it highest among the few notable studies in Nigeria that consider sectoral analyses, as it is the first to capture as high as ten individual sectoral stock prices in a single study. This does not only enable clear-cut policy by investors having understood the heterogeneous nature of each sector, but also leads to optimization of cross-sector investment decisions and possible gains.

Secondly, we take a departure from the common methodology engaged by most studies. Rather than the GARCH-type and SVAR models often adopted (Bala & Hassan, 2018; Emenike, 2017; Fowowe, 2015; Maku & Atanda, 2010; Obinwata et al., 2016), we consider the non-linear Autoregressive Distributed Lag

(NARDL) proposed by Shin et al. (2014) which proves its superiority by accounting for both short- and long-run asymmetries in each sectoral analysis. In achieving this, we allow for structural breaks using the Bai—Perron unit root test, which endogenously determines up to five possible breaks. Disregarding these breaks when they exist may bias regression results (see, inter alia, Salisu & Mobolaji, 2013; Fasanya et al., 2018a; Fasanya et al., 2018b; 2021a; Fasanya et al., 2021b). We later decompose the data to account for possible currency asymmetric responses of the stock market. The NARDL approach has some intrinsic worth as it allows modelling the cointegration relation that could exist between the endogenous and exogenous variables and more especially testing both the linear and nonlinear cointegration. These aforementioned merits of the NARDL approach may also be valid for nonlinear threshold Vector Error Correction Models (VECM) or smooth transition models; however, these models may suffer from the convergence problem due to the proliferation of the number of parameters that is unlike the NARDL model. In all, unlike other error correction models where the order of integration of the considered time series should be the same, the NARDL model relaxes this restriction and permits combining data series having different integration orders (see inter alia, Shin et al., 2014). Meanwhile, the short- and long-run symmetric models will also be estimated in order to test if asymmetry matters. This also appears to be the first notable study to consider this approach for exchange rate shocks-sectoral stock nexus in Nigeria.

The remainder of the paper is as follows—the next section reviews existing literature. Section 3 describes the data and methodology. Section 4 details empirical results, and section 5 concludes the paper with policy implications.

2. Review of relevant literature

There is little or no study on exchange rate shock and sectoral stock returns in Nigeria. However, there are several studies that have been carried out with results of unidirectional causality, bi directional causality and no causality between exchange rate and the activities of the stock market. Studies like Kpughur et al. (2017), Okpara and Odionye (2012), Chowdhury et al. (2014), Alley (2018), Sui and Sun (2016), Bala and Hassan (2018), Blau (2018), Jayasinghe and Tsui (2008), and Karagedikli et al. (2015), and Fapetu et al. (2017) observe a uni directional causality between exchange rate and stock prices. While studies like Yinusa (2008), Sikhosana and Aye (2018), A. A. Salisu and Mobolaji (2013), Lim and Sek (2014), Wong (2017), Afshan et al. (2017), Sharma (2017), Umoru and Asekome (2013), and Tursoy (2017) deduce that there is the presence of bi directional relationship between exchange rate and stock prices. Moreover, Ho and Huang (2015), Zubair (2013), Rahman and Uddin (2009), and Zia and Rahman (2011) observe that there is no relationship between exchange rate and stock price.

Sikhosana and Aye (2018) used monthly data from 1996 to 2016 and employed EGARCH, GJR-GARCH and APARCH as the estimation techniques and deduced that there is a bi directional relationship between exchange rate and stock prices. Kpughur et al. (2017) employed Multivariate Vector Autoregressive Moving Average—Asymmetric Generalized Autoregressive Conditional Heteroscedasticity model (VARMA-AGARCH) as the estimation technique and deduced that there is a uni directional relationship following from stock market to the foreign exchange market.

However, Sui and Sun (2016) employed Vector Autoregressive (VAR) and Vector Error Correction model (VECM) as estimation techniques and found that there is a unidirectional relationship between exchange rate and stock prices occurring from exchange rate shocks to stock returns. Karagedikli et al. (2015) applied factor- augmented vector auto regression (FAVAR) for estimation techniques and deduced that an unexpected exchange rate shock has significant effect on almost transactional sectors of the New Zealand economy.

The results from past studies are insightful, however, majority of the studies done in Nigeria have not empirically examined the effect of (i) exchange rate shock and sectoral stock returns with structural breaks, (ii) role of asymmetry on exchange rate- sectoral stock returns relationship, which is a major force of this study. Therefore, this study is an unassertive attempt in this regard to fill the gap.

3. Data and methodology

3.1. Data description

This study employs exchange rate (EXR), Index of Industrial production (IPI), Consumer price index (CPI), Measure of nominal money supply (M2) and returns of 10 sectoral stock prices. These sectors consist of Agriculture (AGR); Consumer goods (CGD); Conglomerate (CGL); Construction (CON); Financial Services (FIN); Health (HLH); Industrial goods (IND); Natural resources (NTR); Oil and Gas (OGS); Service (SVS). All variables are measured in logarithms. The period for study is from January 2007 to December 2018. Data on the monthly sectoral stock prices is sourced from (<http://www.cashcraft.com/plistorder.php>) while data on Index of Industrial production (IPI), Consumer price index (CPI), Measure of nominal money supply (M2), and Exchange rate (EXR) is obtained from Central Bank of Nigeria statistical bulletin.

3.2. Methodology

This study rests on the portfolio balance theory that describes a negative correlation between stock prices and exchange rates expressed in a direct quotation form where variations in the former influence the latter's movements via portfolio rebalancing (see, Cenedese et al., 2015 for details of the theory). To analyze the short run and long run asymmetrical effects of exchange rate shocks on sectoral stock returns in Nigeria and to observe the link among the variables in the model, the nonlinear autoregressive distributed lag of Shin et al. (2014) is employed in this study. Indeed, the NARDL model is employed to disentangle the hidden cointegration. In addition, the NARDL model has the advantage of testing cointegration between data series with different orders of integration, in that it allows combining I(0) and I(1) data. Furthermore, it provides a nice framework to test for the long- and short-run transmission of exchange rate to stock returns. However, since the NARDL model imposes an exogenous zero threshold, the Quantile nonlinear autoregressive distributed lag (QNARDL) may come handy to characterize the distributional asymmetry, both in the long and short run according the position of the dependent variable within its own distribution. However, in this present study, we depart completely from the distributional asymmetry of the variables since asymmetries observed in the relationships between data series are not caused by the complex systems and sudden events that may likely arise, have been captured by the structural dummies in the models. Therefore, an econometric model is put forward as:

$$Lns_t^i = \alpha + \beta \ln EXR_t + \phi \ln IPI_t + \theta \ln CPI_t + \phi \ln M2_t + \varepsilon_t \quad (1)$$

Where: s_t^i = the sectoral stock returns (where i represent each of the sectors); EXR = the effective exchange rate; IPI = an index of industrial production used as a measure of domestic economic activity; CPI = Consumer Price Index as a measure of price level; $M2_t$ = nominal money supply; ε_t = White noise error term

Moreover, there emerge to be signs of some significant shifts in the time series; hence, this study adjusts the Shin et al. (2014) model to take into account structural breaks. To show if positive shock and negative shock affect the sectoral stock returns differently or similarly, four models are brought forward. The study considers both linear and nonlinear autoregressive distributed lag with or without structural breaks.

3.2.1. MODEL I: Linear autoregressive distributed lag without structural breaks

This can be specified as:

$$\begin{aligned} \Delta s_t^i = & \vartheta_0 + \sum_{\tau=1}^m \alpha_{\tau} \Delta Lnsr_{t-\tau}^i + \sum_{\tau=0}^p \beta_{\tau} \Delta \ln EXR_{t-\tau} + \sum_{\tau=0}^q \varphi_{\tau} \Delta \ln IPI_{t-\tau} + \sum_{\tau=0}^s \theta_{\tau} \Delta \ln CPI_{t-\tau} + \sum_{\tau=0}^u \phi_{\tau} \Delta \ln M2_{t-\tau} \\ & + \vartheta_1 Lnsr_{t-1}^i + \vartheta_2 \ln EXR_{t-1} + \vartheta_3 \ln IPI_{t-1} + \vartheta_4 \ln CPI_{t-1} + \vartheta_5 \ln M2_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

Where s_t^i denotes the of sectoral stock returns; EXR_t denotes the real exchange rate; IPI_t denotes an index of industrial production used as a measure of domestic economic activity; CPI_t denotes Consumer Price Index as a measure of price level and $M2_t$ is a measure of nominal money supply, ε_t is white noise error term; $-\frac{\vartheta_0}{\vartheta_1}$, $-\frac{\vartheta_2}{\vartheta_1}$, $-\frac{\vartheta_3}{\vartheta_1}$, $-\frac{\vartheta_4}{\vartheta_1}$, and $-\frac{\vartheta_5}{\vartheta_1}$ are the long run coefficients for the intercept and the slope, respectively; and α_i , β_i , φ_i , θ_i , and ϕ_i are the short run coefficients. m , p , q , s , and u are the optimal lags on the first differenced variables. The linear method between exchange rate and sectoral stock returns for the long run is centered on the Wald test (F statistics), by having limitations on the long run estimated coefficients of one period lagged level of exchange rate, sectoral stock returns, index of industrial production, consumer price index and nominal money supply to be tantamount to zero. The error correction term λ is put across in model (2) in order for the rate of alteration to be attained.

$$\Delta s_t^i = \vartheta_0 + \sum_{\tau=1}^m \alpha_\tau \Delta \ln s_{t-\tau}^i + \sum_{\tau=0}^p \beta_\tau \Delta \ln EXR_{t-\tau} + \sum_{\tau=0}^q \varphi_\tau \Delta \ln IPI_{t-\tau} + \sum_{\tau=0}^s \theta_\tau \Delta \ln CPI_{t-\tau} + \sum_{\tau=0}^u \phi_\tau \Delta \ln M2_{t-\tau} + \lambda_{ecm_{t-1}} + v_t \quad (3)$$

3.2.2. MODEL II: Linear ARDL with structural breaks

We broaden the model in equations (1) and equations (2) to take account for endogenous structural breaks. The model is stated below:

$$\Delta s_t^i = \vartheta_0 + \sum_{\tau=1}^m \alpha_\tau \Delta \ln s_{t-\tau}^i + \sum_{\tau=0}^p \beta_\tau \Delta \ln EXR_{t-\tau} + \sum_{\tau=0}^q \varphi_\tau \Delta \ln IPI_{t-\tau} + \sum_{\tau=0}^s \theta_\tau \Delta \ln CPI_{t-\tau} + \sum_{\tau=0}^u \phi_\tau \Delta \ln M2_{t-\tau} + \vartheta_1 \ln s_{t-1}^i + \vartheta_2 \ln EXR_{t-1} + \vartheta_3 \ln IPI_{t-1} + \vartheta_4 \ln CPI_{t-1} + \vartheta_5 \ln M2_{t-1} + \sum_{r=1}^s X_r D_{rt} + \varepsilon_t \quad (4)$$

The addition of $\sum_{r=1}^s X_r D_{rt}$ portrays the structural breaks, where D_{rt} represents a dummy variable for each of the structural breaks denoted as $D_{rt} = 1$ for $t \geq T_D$, if not $D_{rt} = 0$. t represents the time; structural breaks date are T_D where $r = 1, 2, 3, 4, \dots, \kappa$ and X_r is the constant of break dummy. Furthermore, the results gotten are put side by side with those from equation (1) to attain if taking account for structural breaks in the regression is vital. The Wald test is used to test for mutual importance of structural breaks in equation (3) to be exact, we test $\sum_{r=1}^s X_r = 0$ counter to $\sum_{r=1}^s X_r \neq 0$. Not accepting null hypothesis shows that structural breaks are essential and should be added in the model therefore proposing the acceptance of equation (4).

3.2.3. MODEL III: NARDL without structural breaks

The co integrating NARDL is of great interest because we seek to study the role of asymmetries in the model. This model employs the breakdown of the independent variable EXR_t into its positive exchange rate changes and negative exchange rate changes. This is due to the fact that economic agents react differently to positive and negative changes in exchange rate. The broken-down exchange rate partial sums for increases and decreases for example,

$$EXR_t^+ = \sum_{j=1}^t \Delta EXR_j^+ = \sum_{j=1}^t \max(\Delta EXR_j, 0) \quad (5a)$$

$$EXR_t^- = \sum_{j=1}^t \Delta EXR_j^- = \sum_{j=1}^t \min(\Delta EXR_j, 0) \quad (5b)$$

Shin et al. (2014) put on view that linear autoregressive distributed lag model (1) can be adjusted to account for asymmetries to generate the following nonlinear autoregressive distributed lag model:

$$\Delta s_t^i = \vartheta_0 + \sum_{\tau=1}^m \alpha_\tau \Delta s_{t-\tau}^i + \sum_{\tau=0}^p (\beta_\tau^+ \Delta \ln EXR_{t-\tau}^+ + \beta_\tau^- \Delta \ln EXR_{t-\tau}^-) + \sum_{\tau=0}^q \varphi_\tau \Delta \ln IPI_{t-\tau} + \sum_{\tau=0}^s \theta_\tau \Delta \ln CPI_{t-\tau} + \sum_{\tau=0}^u \phi_\tau \Delta \ln M2_{t-\tau} + \vartheta_1 \Delta s_{t-1}^i + \vartheta_2^+ \ln EXR_{t-1}^+ + \vartheta_2^- \ln EXR_{t-1}^- + \vartheta_3 \ln IPI_{t-1} + \vartheta_4 \ln CPI_{t-1} + \vartheta_5 \ln M2_{t-1} + \varepsilon_t \quad (5)$$

Equation can be modified to add in the error correction term as:

$$\Delta sr_t^i = \vartheta_0 + \sum_{\tau=1}^m \alpha_{\tau} \Delta sr_{t-\tau}^i + \sum_{\tau=0}^p (\beta_{\tau}^{+} \Delta \ln EXR_{t-\tau}^{+} + \beta_{\tau}^{-} \Delta \ln EXR_{t-\tau}^{-}) + \sum_{\tau=0}^q \varphi_{\tau} \Delta \ln IPI_{t-\tau} + \sum_{\tau=0}^s \theta_{\tau} \Delta \ln CPI_{t-\tau} + \sum_{\tau=0}^u \phi_{\tau} \Delta \ln M2_{t-\tau} + \psi ecm_{t-1} + \mu_t \quad (6)$$

Where $ecm_{t-1} = sr_{t-1}^i - \omega^{+} \ln EXR_{t-1}^{+} - \omega^{-} \ln EXR_{t-1}^{-}$ is the non-linear error correction term; the parameter δ is the speed of adjustment, though the basic long-run parameters are explained as $\omega^{+} = -\frac{\vartheta_2^{+}}{\vartheta_1^{+}}$ and $\omega^{-} = \frac{\vartheta_2^{-}}{\vartheta_1^{-}}$ and related short-run adjustments to positive and negative shocks in exchange rate are described by β_{τ}^{+} and β_{τ}^{-} respectively.

The non-linear autoregressive distributed lag also includes bounds test that is F distribution. However, in this case, null hypothesis of no cointegration put across as $H_0 : \vartheta_1 = \vartheta_2^{+} = \vartheta_2^{-} = 0$ is tested against the alternative hypothesis of cointegration represented as $H_1 : \vartheta_1 = \vartheta_2^{+} = \vartheta_2^{-} \neq 0$. Moreover, we test for the long-run and short-run symmetry employing Wald test. The relevant null hypothesis of no asymmetries is defined as $H_0 : \vartheta_2^{+} = \vartheta_2^{-} = 0$ tested against the alternative (presence of asymmetries) $H_1 : \vartheta_2^{+} \neq \vartheta_2^{-} \neq 0$ for long-run symmetry. The short-run additive symmetry can also be tested with the null hypothesis (no asymmetries) $H_0 : \sum_{\tau=0}^q \beta_{\tau}^{+} = \sum_{\tau=0}^q \beta_{\tau}^{-} = 0$ which is tested against the alternative presence of asymmetries $H_1 : \sum_{\tau=0}^q \beta_{\tau}^{+} \neq \sum_{\tau=0}^q \beta_{\tau}^{-} \neq 0$.

3.2.4. MODEL IV: NARDL with structural breaks

Introducing structural breaks into the NARDL structure, we extend equation to add in the relevant break dummies:

$$\Delta sr_t^i = \vartheta_0 + \sum_{\tau=1}^m \alpha_{\tau} \Delta sr_{t-\tau}^i + \sum_{\tau=0}^p (\beta_{\tau}^{+} \Delta \ln EXR_{t-\tau}^{+} + \beta_{\tau}^{-} \Delta \ln EXR_{t-\tau}^{-}) + \sum_{\tau=0}^q \varphi_{\tau} \Delta \ln IPI_{t-\tau} + \sum_{\tau=0}^s \theta_{\tau} \Delta \ln CPI_{t-\tau} + \sum_{\tau=0}^u \phi_{\tau} \Delta \ln M2_{t-\tau} + \vartheta_1 \Delta sr_{t-1}^i + \vartheta_2^{+} \ln EXR_{t-1}^{+} + \vartheta_2^{-} \ln EXR_{t-1}^{-} + \vartheta_3 \ln IPI_{t-1} + \vartheta_4 \ln CPI_{t-1} + \vartheta_5 \ln M2_{t-1} + \sum_{\tau=1}^n \delta_{\tau} D_{\tau t} + \varepsilon_t \quad (7)$$

The meaning of the parameters still adapts the order of previous models. Structural break test is carried out to determine the importance of taking account of breaks in the nonlinear autoregressive distributed lag model. To affirm the existence of long run relationship, F-distributed Bound test is incorporated and to confirm the role of asymmetry in the existence of structural breaks.

4. Empirical analysis

4.1. Preliminary results

A statistical analysis of the returns and other variables is done in an attempt to reveal the statistical properties of the returns and other variables. The Table 1 shows some statistical properties of the employed variables for this study over the period of 2007M01 to 2018M012. The variables include the returns of the selected sectors in Nigeria, Effective Exchange Rate, Consumer Price Index, Industrial Production Index and Nominal Money Supply. The descriptive statistics include mean, minimum and maximum values of the observations along with the measure of dispersion and distribution of the series.

The description statistics from the table makes known that all the sectors employed observe negative stock returns in their average except natural resources and oil and gas. This is a sign that natural resources, oil and gas, seem to bring forth compared to others. Losses in the remaining sectors float between 0.13% and 6.88%. Furthermore, the average percentage of effective exchange rate, consumer price index, industrial production index and nominal money supply is approximately 4.67%, 4.93%, 4.81% and 15.63%. On the other hand, there exist a high difference between the minimum and maximum values of all sectoral stock returns, EEXR, CPI, IPI, and MS. The insinuation is that the sectoral stock markets are expose to high level of alterations without certainty of stability over time. The standard deviation values show the degree at which the observations are dispersed around the corresponding means. Taking into account the skewness statistics whose threshold value for symmetry (or normal distribution) is zero, it can be inferred that while MS, R_AGR, R_CON, R_FIN, R_HLH, and R_IND are negatively skewed because their skewness is less than zero but EEXR, CPI, IPI, R_CGL, R_CGD,

R_NTR, R_OGS, R_SVS are positively skewed since their skewness is greater than zero. Furthermore, the kurtosis value whose level is three points that all the sectoral stock returns and MS leptokurtic (greater than 3) while EEXR, CPI, IPI are platykurtic (lowly peaked). However, Jarque-Bera merges the properties of skewness and kurtosis as it presents more comprehensive information about the returns series. The table highlights that all variables except IPI, and R_CGD are less than 5%, it therefore suggests that the hypothesis of normal distribution is rejected for them. Hence, they are not normally distributed. Furthermore, IPI, and R_CGD are normally distributed because their probability is greater than 5%.

Table 2 shows the ADF unit root test results on the employed sectoral returns and exchange rate, consumer price index, industrial production index and money supply. The model follows the Schwartz Information Criterion (SIC). All three conditions (with intercept, with intercept and trend and with none) defined in ADF were evaluated to confirm a robust conclusion. From the ADF result, exchange rate, consumer price index, industrial production index, R_CONS, R_IND, and R_OGS are stationary at their first difference while money supply, R_AGR, R_CGD, R_FIN, R_HLH, R_NTR, and R_SVS are stationary at their level form. The result conforms to the PP test result. Table 3 shows the unit root test taking account of structural breaks and the result shows that all sectoral returns and exchange rate are stationary at I (0) while the remaining variables are stationary at I (1).

4.2. Discussion of result

The study commences with the estimation of the symmetric ARDL. As a standard, the study performs the analysis of the linear ARDL model employing linear measure of exchange rate, consumer price index, industrial production index and money supply computed as the first difference of the logarithm of exchange rate, consumer price index, industrial production index and money supply.

The initial stage in estimating the ARDL model is ascertaining the long run relationship between the variables. This is achieved by testing the null hypothesis of no co integration against the alternative of co integration using the F-test proposed by Pesaran et al (2001). The optimal number of lags on each first differenced variable is chosen by Schwarz Criterion (SIC) assuming a maximum of 4 lags. The results stated in Tables 4 and 5 providing short run dynamics and some diagnostic checks and providing the long run estimates.

Furthermore, the diagnostic checks suggest the absence of serial correlation in all but R_FIN (asymmetry), R_HLH (symmetry), R_IND (symmetry) and R_OGS (symmetry) and the presence of heteroscedasticity in all but R_AGR (symmetry), R_CONS (symmetry), R_FIN (symmetry), R_HLH (symmetry) and R_OGS (symmetry).

The Bound test puts forward the evidence of co integration in all except construction, natural resources and service sectoral returns indicating that construction, natural resources and service sectors have no long run relationship. In the short run as shown in Table 4, there exist a positive relationship between exchange rate and all sectoral returns except construction, agricultural and service sectors. The result shows that past exchange rates events has a negative influence on the service sector. Noticeably, it is significant at 5% in conglomerate sector that is a percentage change in exchange rate will lead to 10.17% increase in conglomerate sector. There is the presence of a negative relationship between consumer price index and sectoral returns except financial service and natural resources sectors. However, consumer goods and industrial sectors are significant at 10% while conglomerate is significant at 1%. Furthermore, the most significant is conglomerate showing that a percentage change in consumer price index will result to 13.89% decrease in conglomerate. This corroborates the findings of Ahmed (2020) for a study on the Egyptian stock market.

Furthermore, Industrial production index has a negative relationship with all sectoral returns except for agricultural, financial and the oil and gas sectors. The result also shows that for every one-percentage increase in Industrial production index lagged in one year, returns in service sector in the current year decreases by 40.16%. Hence, there is a negative relationship between industrial production index and returns on the service sector. Consumer goods, construction and health

Table 1. Descriptive statistics

	MEAN	MAXIMUM	MINIMUM	Standard Deviation	SKEWNESS	KURTOSIS	J-B (PROB.)	OBS
LEEXR	4.673	5.118	4.257	0.214	0.930	2.714	21.275 (0.000)	144
LCPI	4.939	5.615	4.288	0.378	0.0414	1.975	6.340 (0.042)	144
LIPI	4.812	5.091	4.642	0.092	0.192	2.147	5.250 (0.072)	144
LMS	15.634	16.280	14.482	0.419	-0.767	3.610	16.367 (0.000)	144
R_AGR	-0.131	40.787	-81.965	13.684	-1.997	16.155	1134.097 (0.000)	144
R_CGD	-0.4278	17.250	-15.737	6.091	0.043	3.392	0.969 (0.616)	144
R_CGL	-1.350	26.718	-20.196	7.995	0.495	4.345	4.345 (0.000)	144
R_CONS	-6.884	32.035	-106.506	20.208	-2.385	10.644	487.111 (0.000)	144
R_FIN	-1.392	64.019	-69.713	10.835	-0.507	22.330	2248.173 (0.000)	144
R_HLH	-2.427	24.536	-33.158	9.225	-0.297	5.057	27.510 (0.000)	144
R_IND	-5.556	14.960	-93.935	17.142	-2.878	12.506	741.017 (0.000)	144
R_NTR	1.351	49.258	-24.471	7.466	2.653	16.943	1335.284 (0.000)	144
R_OGS	8.649	146.067	-30.676	25.927	3.156	13.927	955.351 (0.000)	144
R_SVS	-2.241	32.923	-30.005	7.775	0.434	7.186	109.655 (0.000)	144

Table 2. Unit root test results

AUGMENTED DICKEY-FULLER (ADF)				PHILLIP PERRON (PP)			
	LEVEL	FIRST DIFFERENCE.	I (d)	LEVEL	FIRST DIFFERENCE	I(d)	
EEXR	-2.125	10.254 ***	I(1)	-2.247	-10.259***	I(1)	
CPI	-2.182	-14.193***	I(1)	-2.036	-14.378***	I(1)	
IPI	-1.881	-6.240***	I(1)	-0.870	5.876***	I(1)	
MS	-3.326*	-9.875***	I(0)	-3.219***	-3.219***	I(0)	
R_AGR	-10.286***	-10.589*	I(0)	-10.193***	-49.541***	I(0)	
R_CGD	-6.648***	-8.833***	I(0)	-6.766***	-37.622***	I(0)	
R_CGL	-6.765***	-8.286***	I(0)	-6.653***	-32.605***	I(0)	
R_CONS	1.906	-10.494*	I(1)	-8.682*	-17.769*	I(0)	
R_FIN	-9.914***	-9.686***	I(0)	-9.779*	-58.042*	I(0)	
R_HLH	-3.919***	-8.366***	I(0)	-7.014*	-32.943*	I(0)	
R_IND	2.644	-16.891***	I(1)	-7.055*	-17.469***	I(0)	
R_NTR	-6.745***	-9.296***	I(0)	-6.911***	-33.299***	I(0)	
R_OGS	3.585	-14.131***	I(1)	-5.888*	-14.032***	I(0)	
R_SVS	5.902***	-10.741***	I(0)	-5.902***	-23.167***	I(0)	

Note: ***, ** and * imply significance at 1%, 5% and 10% respectively

Table 3. nit root test with structural breaks

VARIABLES	LEVELS				FIRST DIFFERENCE				I(d)
	CONSTANT	CONSTANT & TREND	TREND		CONSTANT	CONSTANT & TREND	TREND		
EEEXR Break Date	-6.547*** (2016M05)	-5.839*** (2016M05)	-3.178 (2014M06)		-11.007*** (2016M06)	-10.821*** (2016M02)	-10.455*** (2016M07)		I(0)
CPI Break Date	-3.317635 (2012M012)	-3.685179 (2013M07)	-3.011051 (2015M08)		-18.298*** (2010M08)	-18.228*** (2010M08)	-14.234*** (2013M10)		I(1)
IPI Break Date	-4.524 (2015M01)	-2.911 (2015M01)	-1.926 (2010M10)		-12.806*** (2018M10)	-10.256*** (2018M06)	-10.534*** (2018M08)		I(1)
MS Break Date	-3.883 (2012M12)	-4.384 (2008M07)	-4.215 (2008M07)		-10.771*** (2008M07)	-10.733*** (2008M07)	-10.641*** (2009M05)		I(1)
R_AGR Break Date	-10.933*** (2009M08)	-10.937*** (2009M08)	-10.645*** (2016M09)		-13.624*** (2008M07)	-13.677*** (2008M07)	-10.645*** (2016M09)		I(0)
R_CGD Break Date	-8.870 (2009M02)	-9.420*** (2009M02)	-8.074*** (2017M08)		-16.852*** (2015M05)	-16.798*** (2015M05)	-8.924 (2017M09)		I(0)
R_CGL Break Date	-8.218*** (2008M05)	-8.183*** (2016M01)	-8.221*** (2018M02)		-13.904*** (2015M03)	-13.339*** (2008M08)	-13.080*** (2008M08)		I(0)
R_CONS Break Date	-1.575 (2018M04)	-8.070*** (2017M08)	-8.048*** (2017M09)		-12.109*** (2009M05)	-12.255*** (2016M11)	-12.311*** (2017M08)		I(0)
R_FIN Break Date	-11.668*** (2010M06)	-11.712*** (2010M06)	-10.003*** (2008M07)		-14.882*** (2010M06)	-10.404*** (2010M04)	-9.755*** (2009M06)		I(0)
R_HLH Break Date	-9.350*** (2018M05)	-9.710*** (2017M11)	-9.770*** (2017M12)		-10.180*** (2008M07)	-10.374*** (2008M11)	-10.127*** (2008M10)		I(0)
R_IND Break Date	-1.175*** (2018M04)	-7.712*** (2017M08)	-7.623*** (2017M09)		-17.996*** (2014M11)	-17.753*** (2010M06)	-17.527*** (2011M07)		I(0)
R_NTR Break Date	-8.998*** (2008M08)	-9.046*** (2008M08)	-8.248*** (2009M10)		-11.111*** (2008M08)	-14.070*** (2009M03)	-9.293*** (2017M10)		I(0)
R_OGS Break Date	-1.392 (2018M04)	-6.392*** (2017M08)	-6.235*** (2017M09)		-16.543*** (2010M05)	-16.537*** (2010M05)	-15.825*** (2015M04)		I(0)
R_SVS Break Date	-1.392 (2018M04)	-6.392*** (2017M08)	-6.235*** (2017M09)		-16.543*** (2010M05)	-16.537*** 2010M05	-15.825*** (2015M04)		I(0)

Note: ***, ** and * imply significance at 1%, 5% and 10% respectively

Table 4. Short run estimation without break											
VARIABLES	R_AGR	R_CGD	R_CGL	R_CONS	R_FIN	R_HLH	R_IND	R_NTR	R_OGS	R_SVS	
	Symmetry	Symmetry	Symmetry	Symmetry	Asymmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	
DLEEXR	-1.829 (0.850)	4.127 (0.2720)	10.171 (0.038)**	-0.980 (0.891)	-	2.474 (0.648)	2.110 (0.658)	5.462 (0.234)	7.632 (0.172)	-0.990 (0.929)	
DLEEXR_NV	-	-	-	-	2.543 (0.744)	-	-	-	-	-	
DLEEXR_PV	-	-	-	-	3.309 (0.667)	-	-	-	-	-	
DLEEXR(-1)	-	-	-	-	-	-	-	-	-	-3.704 (0.819)	
DLEEXR(-2)	-	-	-	-	-	-	-	-	-	-32.390** (0.046)	
DLEEXR(-3)	-	-	-	-	-	-	-	-	-	-316.032 (0.144)	
DLCPI	-8.008 (0.502)	-7.662 (0.092)*	-13.892 (0.017)***	-14.048 (0.108)	4.155 (0.658)	-7.805 (0.233)	-10.288* (0.070)	3.273 (0.561)	-0.630 (0.925)	-6.414 (0.206)	
DLIPI	12.231 (0.393)	-40.337 (0.012)***	-34.250 (0.137)	-95.689*** (0.003)	10.024 (0.374)	-86.878*** (0.000)	-47.308** (0.035)	-0.109 (0.987)	6.219 (0.429)	-29.926 (0.128)	
DIP1(-1)	---	---	---	---	---	---	---	---	---	-40.163* (0.066)	
DLMS	5.929 (0.520)	3.798 (0.274)	5.994 (0.180)	10.401 (0.152)	-5.032 (0.486)	0.443 (0.930)	7.253 (0.112)	-6.150 (0.161)	0.396 (0.941)	16.714 (0.060)*	
DR_CONS(-1)	---	---	---	-0.523*** (0.000)	---	---	---	---	---	---	
DR_CONS(-2)	---	---	---	-0.441*** (0.000)	---	---	---	---	---	---	
DR_CONS(-3)	---	---	---	-0.319*** (0.000)	---	---	---	---	---	---	
DR_IND(-1)	---	---	---	---	---	---	-0.556*** (0.000)	---	---	---	

(Continued)

Table4. (Continued)

VARIABLES	R_AGR	R_CGD	R_CGL	R_CONS	R_FIN	R_HLH	R_IND	R_NTR	R_OGS	R_SVS
	Symmetry	Symmetry	Symmetry	Symmetry	Asymmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry
DR_IND(-2)	— — — —	— — — —	— — — —	— — — —	— — — —	— — — —	-0.341*** (0.000)	— — — —	— — — —	— — — —
DR_OGS(-1)	— — — —	— — — —	— — — —	— — — —	— — — —	— — — —	— — — —	— — — —	-0.438*** (0.000)	— — — —
DR_OGS(-2)	— — — —	— — — —	— — — —	— — — —	— — — —	— — — —	— — — —	— — — —	-0.234*** (0.014)	— — — —
ECM	-0.885 (0.000)***	-0.607 (0.000)***	-0.691 (0.000)***	— — — —	-0.819 (0.000)***	-0.732 (0.000)***	0.067 (0.252)	— — — —	0.120 (0.006)***	— — — —
LM (5)	1.890 (0.155)	0.925 (0.399)	0.713 (0.491)	2.042 (0.134)	2.224 (0.112)	2.630* (0.076)	3.043** (0.051)	1.002 (0.370)	3.255*** (0.042)	0.209 (0.812)
ARCH (5)	0.985 (0.4831)	1.662** (0.040)	3.844*** (0.001)	1.351 (0.108)	0.418 (0.993)	1.732 (0.118)	2.728*** (0.008)	6.162*** (0.000)	1.159 (0.280)	2.612*** (0.0038)
(BOUND-F TEST)	22.747***	12.307***	15.765***	1.1269	16.647***	8.328***	0.978	10.922***	2.857	10.521***
R ² Adjusted	0.005	0.288	0.328	0.780	0.031	0.346	0.866	0.367	0.919	0.347
CUSUM	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable
CUSUM SQR	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable

Note: ***, ** and * imply significance at 1%, 5% and 10% respectively

sectors are significant at 1% and industrial sector at 5%. However, the most significant reflects that a percentage change in industrial production index will lead to a 95.69% decrease in construction sector. Intuitively, this contradicts the theoretical expectation of a positive effect and is averse to the findings in the literature (see for instance, Bahmani-Oskooee & Saha, 2018).

Money supply has a positive relationship with all the sectoral returns. The past influence returns tend to be negative in the case of construction, industrial and oil and gas sectors. Interestingly, it is significant at 1% in the service sector reflecting that a percentage change in money supply will lead to 16.71% increase in service sector.

The negative and significant estimate of the error correction model in R_AGR , R_CGD , R_CGL , R_FIN and R_HLH reflects that there is the presence of a short run relationship. The Error Correction Coefficient signifies the speed of adjustment from short run dynamics to long run equilibrium. The negative sign indicates that there will be a convergence of disequilibrium towards long run equilibrium.

The long run results stated in Table 5, the study deduces a positive exchange rate influence in all sectoral results except agricultural, industrial and oil and gas sectors. However, conglomerate sector is significant at 1% showing that a percentage change in exchange rate will lead to a 14.71% increase in conglomerate sector. Consumer price index has a negative effect on consumer goods, conglomerate and health sectors. Moreover, it is consumer goods and conglomerate sectors are significant at 1% showing that a percentage change in consumer price index will lead to 20.09% decrease in conglomerate sector. There is the existence of a negative relationship between Industrial production index and industrial and oil and gas sectors. However, consumer goods and health sectors are significant at 10% and conglomerate at 1% reflecting that a percentage change in industrial production index will lead to a 22.83% increase in conglomerate sector. While for money supply, there exist a negative relation between money supply and financial, industrial and oil and gas sectors.

Interestingly, out of all the sectors, the financial sector reacts to changes in exchange rate shocks. Hence, this study finds out that exchange rate asymmetry only counts for the returns on financial service sector. This also corroborates the findings in the literature (see, Fowowe, 2015; Salisu & Ndako, 2018; Bahmani-Oskooee & Saha, 2018, Ahmed, 2020). It consists both long run and short run. To be precise, positive and negative shocks of exchange rate are seen to be present in the short run and long run for the financial service sector and this can be as a result of the events of global financial crisis that negatively affected the financial service sector of Nigeria by creating scarcity of funds for the financial service sector and also crashing the capital market. Not forgetting, the recession period of 2016, had a negative impact on the financial service sector.

Part of the study and focal point is to test for asymmetry using the Wald test. In doing this, two scenarios are conducted which are the role of structural breaks and the role without structural breaks. Without structural breaks, only financial service sector reacts to differences in news either positive or negative news.

The result suggests that we only consider the nonlinear ARDL for financial service sector while symmetric ARDL for the other nine sectors. Interestingly, three out of these ten sectors show no long run relationship. Hence, we only consider their short run estimate without the adjustment parameter, which is the ECM parameter.

To implement the asymmetric ARDL model, the same procedures employed in the linear ARDL model are followed. The initial procedure is to test for the existence of the nonlinear long run relationship (cointegration) between the variables. The results presented in Tables 4, 5 and 6 shows that only the financial service sector is asymmetric because it responds to differences in news be it positive or negative news. Hence, the nonlinear ARDL is employed for financial service

Table 5. Long-run estimation without break							
VARIABLES	R_AGR	R_CGD	R_CGL	R_FIN	R_HLH	R_IND	R_OGS
	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry
CONSTANT	-117.046 (0.473)	-145.929 (0.118)	-216.259 (0.047)**	-5.951 (0.966)	-69.787 (0.533)	1646.538 (0.331)	564.896 (0.440)
LEEXR	-2.066 (0.850)	6.799 (0.270)	14.711** (0.036)		3.380 (0.650)	-31.372 (0.647)	-63.415 (0.265)
DLEEXR_NV	-	-	-	3.103 (0.743)	-	-	-
DLEEXR_PV	-	-	-	4.039 (0.666)	-	-	-
LCPI	13.819 (0.392)	-12.622 (0.091)*	-20.092 (0.016)*	5.071 (0.658)	-10.661 (0.233)	152.947 (0.342)	5.233 (0.925)
LIPI	13.819 (0.392)	16.279 (0.091)*	22.829 (0.045)***	12.234 (0.371)	19.735* (0.089)	-115.785 (0.441)	-51.675 (0.463)
LMS	6.699 (0.519)	6.257 (0.275)	8.670 (0.182)	-6.141 (0.486)	0.605 (0.930)	-107.830 (0.344)	-3.290 (0.941)
Note: ***, ** and * imply significance at 1%,5% and 10% respectively							

Note: ***, ** and * imply significance at 1%, 5% and 10% respectively

sector. Positive and negative news of exchange rate affect the financial sector positively both in the short and long periods without breaks.

The evaluation of the significance of structural breaks in the exchange rate, consumer price index, industrial production index and money supply and sectoral stock returns relationship. The study initial defines the break endogenously using Bai—Perron test then employs the break dummies as fixed repressors in both the symmetric and asymmetric ARDL models and lastly incorporating Wald test to jointly the statistical significance of the breaks. The Bai- Perron results are stated in [Table 7](#) and at least a break is recorded for each of the sectoral returns analyzed. The dates recognized coincide with the 2008 and 2009 series of global financial crisis, 2011 Arab springs and the emergence from recession in Nigeria in 2017.

An advantage of employing Bai—Perron test is that it produces regression results for each of the break ranges notable including the sign, size and statistical significance of the relevant variables. The result in [Tables 8 and 9](#) shows that positive relationship between all sectoral returns except agricultural and health sectors and exchange rate. However, the relationship is positive and significant at 1% on consumer goods and conglomerate sectors. Hence, a percentage change in exchange rate will lead to a 13.10% increase in consumer goods sector. There is also the existence of a negative relationship between consumer price index and all sectoral returns except natural resources sector. There is a positive and significant relationship between consumer price index and consumer goods and conglomerate sectors at 1% and construction at 10%. However, a percentage change in consumer price index will lead to 33.14% decrease in consumer goods sector.

Industrial production index negatively influences all sectoral returns in all sectoral returns except agricultural, oil and gas and natural resources sectors. However, the relationship is positive and significant at 1% on construction, health and service sector. However, a percentage change in industrial production index will lead to 109.95% decrease in construction, money supply is positive in all sectoral returns except oil and gas sector and conglomerate is significant at 1% reflecting that a percentage change in money supply will lead to 9.45% increase in conglomerate. Construction sector lagged in year one, year two and year three has a negative effect on the current year of construction sector and is significant at 1%. Health sector lagged in year one has a negative effect on the current year of health sector, industrial sector lagged in year one and year two has a negative impact on the current year of industrial sector and is significant at 1%, natural resources lagged in year one has a negative significance on the current year of R_ natural resources and its significant at 1% and oil and gas sector lagged in year one has a negative effect on the current year of oil and gas sector and its significant at 1%.

The break points are positive for R_ AGR, R_ CDG and significant at 1%, R_ CONS, R_ HLH, R_ OGS and significant at 1%, R_ SVS and significant at 1%, first break point of R_IND and second break point for R_CGL. While the break points are negative for the second break point of R_IND, first breakpoint of R_CGL and its negative and significant at 1% for R_NTR.

The F statistics (Bound test) reveals that there is a long run relationship in all sectoral stock returns except construction, industrial and oil and gas sectors. For the long run, the result shows that positive relationship between all sectoral returns except agricultural sector. Though there is a positive relationship between exchange rate and significant at 1% on consumer goods sector and conglomerate sector. However, a percentage change in exchange rate will lead to 20.42% increase in consumer goods. There is also the existence of a positive relationship between consumer price index and all sectoral returns except natural resource sector. There is a positive and significant relationship between consumer price index and consumer goods, conglomerate and service sectors at 1%. However, an increase in consumer price index will result to 39.82 decreases in consumer goods sector. Industrial production index positively influences all sectoral returns in all sectoral returns except consumer goods and service sectors. However, the relationship is negative and significant at 1% on service sector and a percentage change in industrial production index will lead to 29.87% decrease in service sector. Money supply is positive in all sectoral returns except service sector, it is

Table 6. Asymmetry Wald test without structural breaks

Sectoral returns	Wald Statistic		Any Presence of Asymmetry?	
	Short run W_{SR}	Long run W_{LR}	Short run	Long run
R_AGR	0.205 (0.652)	0.204 (0.652)	NO	NO
R_CGD	1.226 (0.270)	1.226 (0.270)	NO	NO
R_CGL	1.175 (0.280)	1.114 (0.293)	NO	NO
R_CONS	0.981 (0.329)	0.001 (0.973)	NO	NO
R_FIN	3.782** (0.054)	3.782** (0.054)	YES	YES
R_HLH	0.364 (0.548)	0.364 (0.548)	NO	NO
R_IND	0.908 (0.342)	0.428 (0.514)	NO	NO
R_NTR	0.077 (0.781)	0.077 (0.782)	NO	NO
R_OGS	0.009 (0.925)	0.009 (0.926)	NO	NO
R_SVS	2.457 (0.119)	2.457 (0.119)	NO	NO

Note: ***, ** and * imply significance at 1%, 5% and 10% respectively

negative and significant at 5%, and conglomerate sector is positive and significant at 10% reflecting that a percentage change in money sector will lead to 12.68% increase in conglomerate.

However, the breakpoints are positive R_AGR and significant at 5%, R_CGD and significant at 1% R_HLH and R_SVS and significant at 1% and the second breakpoint of R_CGL and its negative for the first breakpoint of R_CGL, R_NTR and significant at 1%.

This study also determines the behaviour of asymmetries in the existence of breaks for all selected sectoral stock returns. Table 10 shows that, with the inclusion of breaks, asymmetry modelling of pass through effect of exchange rate, consumer price index, industrial production index and money supply are not valid for all sectoral stock returns because there is no presence of asymmetry in short run and long run with breaks. Noticeably, it is only the financial sector that responds to exchange rate shock in an asymmetry manner. Hence, asymmetry is relevant to ascertain the relationship between financial sector and exchange rate shock.

4.3. Conclusion and implications for policy

This study evaluates exchange rate shock and sectoral returns in Nigeria, using a monthly data source from Central Bank of Nigeria Statistical Bulletin and (<http://www.cashcraft.com/plistorder.php>) covering the periods of 2007–2018. The variables on which the data were sourced include Effective exchange rate, Consumer Price Index, Industrial Production Index, Money supply and prices of ten sectors in Nigeria which are Agriculture, Consumer goods, Conglomerates, Construction, Finance, Health care, Industrial goods, Natural resources, Oil and Gas and Services. This study incorporated the Augmented Dickey- Fuller Test and Phillip Perron Test (PP) as well as unit root test with structural breaks to define the stationary conditions of the variables used for the study. The test shows that the series are integrated of order zero and one. Ten models were estimated using Autoregressive Distributed Lag Model. Moreover, given the significance of structural breaks in behaviour of these series overtime in Nigeria, a multiple structural break test to be exact Bai- Perron (2003) was adopted. This study analysis draws upon the

Table 7. Bai- Perron (2003) structural break date

Models	Breaks	Range	Signs
$r_{agr} = (leexr, lcpi, lipi, lms)$	2009M04	2007M02-2009M03 2009M04-2018M12	-/- -/-
$r_{cgd} = (leexr, lcpi, lipi, lms)$	2009M03 2012M07	2007M02-2009M02 2009M03-2012M06 2012M07-2018M12	-/- -/- +/-
$r_{cgl} = (leexr, lcpi, lipi, lms)$	2008M11 2012M04	2007M02-2008M10 2008M11-2012M03 2012M04-2018M12	-/- +/- +/-
$r_{cons} = (leexr, lcpi, lipi, lms)$	2009M04 2017M04	2007M02-2009M03 2009M04-2017M03 2017M04-2018M12	-/- -/- +/-
$r_{fin} = (leexr, lcpi, lipi, lms)$	NO BREAKPOINTS		
$r_{hlh} = (leexr, lcpi, lipi, lms)$	2009M01 2013M07	2007M02-2008M12 2009M01-2013M06 2013M07-2018M12	-/- -/- +/-
$r_{ind} = (leexr, lcpi, lipi, lms)$	2009M03 2017M04	2007M02-2009M02 2009M03-2017M03 2017M04-2018M12	+/- -/- +/-
$r_{ntr} = (leexr, lcpi, lipi, lms)$	2008M11	2007M02-2008M10 2008M11-2018M12	-/- +/-
$r_{ogs} = (leexr, lcpi, lipi, lms)$	2009M04 2016M11	2007M02-2009M03 2009M04-2016M10 2016M11-2018M12	-/- +/- -/-
$r_{svs} = (leexr, lcpi, lipi, lms)$	2009M05 2011M10	2007M02-2009M04 2009M05-2011M09 2011M10-2018M12	-/- +/- +/-

Note: ***, ** and * imply significance at 1%,5% and 10% respectively

linear and Non Linear Autoregressive Distributed Lag (ARDL and NARDL) approach to evaluate these relationships, which is found to be suitable with the use of mixed non-stationary nature of the data.

Cointegration analysis was employed and long run equilibrium occurred among of the sectoral returns. Furthermore, this study checks the significance of these breaks in the symmetric and asymmetric relationship that may be present between Exchange rate, Consumer Price Index, Industrial Production Index, Money supply and returns of the selected sectors. The Wald test result shows clear evidence of asymmetry between exchange rate and financial service sector without breaks but with breaks, there is no asymmetry relationship between the returns and exchange rate. Exchange rate has an impact on all the employed sectoral stock returns in Nigeria whether positively or negatively and be it in the long or short run (with or without breaks). However, financial service sector return is found to be asymmetric and is positively influenced by both negative and positive exchange rate shock in the short run and long run without break. Therefore, this study concludes that a single model cannot fit all the sectoral stock returns because all sectors respond differently to exchange rate movements and the information about a particular sector cannot be used to forecast other sectors.

Following the findings of this study, there are a number of implications for policy in Nigeria. First, instability in exchange rate often causes investors to lose confidence in investing in the stock market, which in turn reduces the level of investment. Importation of goods especially consumer goods makes Nigeria dependent on other nation's resources, economic and political power. Second, sectors apart from financial service sector are insensitive to asymmetric trends in exchange rate fluctuations. This enables investors that are risk averse to invest in those sectors although the consequence involved consists of lesser returns from the sectors. This can also contribute to stock market experts in enabling them to take account of risk inclination when predicting future activities of stock returns. In addition,

Table 8. Short run estimation with breaks

VARIABLES	R_AGR	R_CGD	R_CGL	R_CONS	R_HLH	R_IND	R_NTR	R_OGS	R_SVS
	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry
DLEEXR	-0.647 (0.946)	13.307 (0.001)***	15.233 (0.007)***	2.2736 (0.713)	-18.619 (0.012)	4.630 (0.353)	0.719 (0.863)	5.132 (0.433)	5.827 (0.211)
DLCPI	-10.584 (0.374)	-33.146 (0.000)***	-29.270 (0.001)***	-15.440 (0.076)*	-12.089 (0.239)	-9.670 (0.089)	1.931 (0.705)	-1.255 (0.847)	-20.244 (0.006)
DLIPI	2.748 (0.855)	-7.502 (0.144)	-50.461 (0.02)	-109.959 (0.001)***	-78.431 (0.001)***	-57.521 (0.011)	2.073 (0.741)	6.637 (0.429)	-19.932 (0.008)***
DLMS	1.232 (0.896)	4.936 (0.160)	9.459 (0.063)*	4.982 (0.490)	2.992 (0.627)	4.587 (0.329)	2.461 (0.570)	-0.185 (0.972)	10.540 (0.259)
D1_ARG	8.867 (0.057)	-	-	-	-	-	-	-	-
D1_CGD	-	11.493 (0.000)***	-	-	-	-	-	-	-
D2_CGD	-	20.345 (0.000)***	-	-	-	-	-	-	-
D1_CGL	-	-	-1.543 (0.531)	-	-	-	-	-	-
D2_CGL	-	-	6.096 (0.147)	-	-	-	-	-	-
D1_CONS	-	-	-	8.569 (0.015)	-	-	-	-	-
D2_CONS	-	-	-	1.082 (0.853)	-	-	-	-	-
D1_HLH	-	-	-	-	3.612 (0.168)	-	-	-	-
D2_HLH	-	-	-	-	4.0334 (0.356)	-	-	-	-
D1_IND	-	-	-	-	-	2.958 (0.197)	-	-	-

(Continued)

Table8. (Continued)

VARIABLES	R_AGR	R_CGD	R_CGL	R_CONS	R_HLH	R_IND	R_NTR	R_OGS	R_SVS
	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry
D2_IND	-	-	-	-	-	-2.302 (0.554)	-	-	-
D1_NTR	-	-	-	-	-	-	-27.159 (0.000)***	-	-
D1_OGS	-	-	-	-	-	-	-	23.540 (0.000)***	-
D2_OGS	-	-	-	-	-	-	-	5.868 (0.248)	-
D1_SVS	-	-	-	-	-	-	-	-	7.346 (0.001)***
D2_SVS	-	-	-	-	-	-	-	-	18.187 (0.000)***
DR_CONS(-1)	-	-	-	-0.462 (0.000)***	-	-	-	-	-
DR_CONS(-2)	-	-	-	-0.415 (0.000)***	-	-	-	-	-
DR_CONS(-3)	-	-	-	-0.317 (0.000)***	-	-	-	-	-
DR_HLH(-1)	-	-	-	-	-0.183 (0.030)	-	-	-	-
DR_IND(-1)	-	-	-	-	-	-0.503 (0.000)***	-	-	-
DR_IND(-2)	-	-	-	-	-	-0.325 (0.000)***	-	-	-
DR_NTR(-1)	-	-	-	-	-	-	-27.159 (0.000)***	-	-
DR_OGS(-1)	-	-	-	-	-	-	-	-0.357 (0.000)***	-

(Continued)

Table8. (Continued)

VARIABLES	R_AGR	R_CGD	R_CGL	R_CONS	R_HLH	R_IND	R_NTR	R_OGS	R_SVS
	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry
ECM	-0.911 (0.000)***	-0.832 (0.000)***	-0.746 (0.000)***	-----	-0.595 (0.000)***	-----	-0.754 (0.000)***	-----	-0.667 (0.000)***
LM (5)	2.323 (0.102)	0.247 (0.782)	1.076 (0.344)	1.663 (0.194)	0.677 (0.510)	3.692 (0.028)	3.925 (0.022)	3.811 (0.025)	2.050 (0.133)
ARCH (5)	3.078 (0.007)	1.071 (0.384)	3.201 (0.00)	1.723 (0.012)	4.774 (0.000)	2.581 (0.000)	11.513 (0.000)***	1.537 (0.042)	2.879 (0.000)***
F_STATS (BOUNDS)	19.186	13.073	11.273	2.238	12.136	1.416	10.027	1.689	9.314
R ² Adjusted	0.024	0.430	0.342	0.794	0.343	0.870	0.365	0.925	0.418
CUSUM	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable
CUSUM SQR	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable

Note: ***, ** and * imply significance at 1%, 5% and 10% respectively

Table 9. Long run estimation with breaks

VARIABLES	R_AGR	R_CGD	R_CGL	R_HLH	R_NTR	R_SVS
	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry	Symmetry
CONSTANT	16.982 (0.921)	55.099 (0.392)	-142.560 (0.176)	-98.058 (0.360)	-69.456 (0.443)	354.641 (0.001)
LEEXR	-0.710 (0.946)	15.987 (0.001)***	20.420 (0.006)***	6.652 (0.523)	0.954 (0.863)	8.732 (0.208)
LCPI	-11.623 (0.373)	-39.821 (0.000)***	-39.236 (0.001)***	-20.301 (0.242)	2.561 (0.704)	-30.338 (0.004)***
LIPI	3.018 (0.855)	-9.013 (0.142)	7.780 (0.463)	16.786 (0.260)	2.750 (0.740)	-29.870 (0.006)***
LMS	1.353 (0.896)	5.930 (0.160)	12.680 (0.058)*	5.025 (0.629)	3.265 (0.570)	-7.876 (0.218)
D1_AGR	9.738 (0.054)**	-	-	-	-	-
D1_CGD	-	13.807 (0.000)***	-	-	-	-
D2_CGD	-	24.442 (0.000)***	-	-	-	-
CGL1	-	-	-2.068 (0.530)	-	-	-
CGL2	-	-	8.171 (0.142)	-	-	-
D1_HLH	-	-	-	6.065 (0.179)	-	-
D2_HLH	-	-	-	6.773 (0.360)	-	-
D1_NTR	-	-	-	-	-12.434 (0.000)***	-
D1_SVS	-	-	-	-	-	11.009 (0.001)***
D2_SVS	-	-	-	-	-	27.256 (0.000)***

Source: Authors Computation

Note: ***, ** and * imply significance at 1%,5% and 10% respectively

Table 10. Asymmetry Wald test with structural breaks

Sectoral returns	Wald Statistic		Any Presence of Asymmetry?	
	Short run W_{SR}	Long run W_{LR}	Short run	Long run
R_AGR	0.446 (0.506)	0.446 (0.506)	NO	NO
R_CGD	0.033 (0.856)	0.033 (0.856)	NO	NO
R_CGL	0.324 (0.570)	0.324 (0.570)	NO	NO
R_CONS	0.682 (0.410)	0.550 (0.460)	NO	NO
R_FIN	NO BREAK POINT			
R_HLH	0.247 (0.620)	0.247 (0.620)	NO	NO
R_IND	0.876 (0.351)	0.219 (0.641)	NO	NO
R_NTR	0.000 (0.983)	0.000 (0.983)	NO	NO
R_OGS	0.583 (0.447)	0.523 (0.471)	NO	NO
R_SVS	1.065 (0.304)	1.065 (0.304)	NO	NO

Source: **Authors Computation**

Note: ***, ** and * imply significance at 1%, 5% and 10% respectively

the investors must look into relevant currency hedging strategies to reduce depreciation risks and protect investments expected rate of return that are dominated in foreign currency since the domestic currency depreciation shows some inverse effects on the stock returns. In this regard, potential investors are encouraged to lay hold on studies as this, which elicit the role of asymmetries on the exchange rate-stock returns nexus. With the exposed asymmetric impact of exchange rate shocks on the stock market returns, as well as the differing magnitude of impacts across periods and sectors, the investors are presented with the choice of determining when and where to invest. This is because stock returns' response to currency changes varies in the short and long run and across different sectors.

From a policymaking perspective, market regulators could benefit from a better interpretation of exchange rate-sector stocks dynamics. Due to the sizeable susceptibility of the sector stocks to exchange rate shocks, portfolio managers should be attentive to the movements of the Nigerian Naira exchange rates, in search of clues about the future course of equity prices. Nigeria adopts the multiple exchange-rate regime to avoid an outright devaluation of the naira by keeping a stronger pegged rate for official transactions and weaker exchange for non-government related transactions, which has been criticized by International Monetary Fund (IMF). However, the purposive decision to managed-float the Naira appears to have produced some of its aspiring goals, which include reducing the activities of the parallel market, improving trade exports through reduction in trade deficits and more importantly improving the confidence of investors. Despite these positive outcomes, the idea to managed-float the local currency has come with its own side effects, as the spiral inflation with a double-digit value has taken a heavy toll on the Nigerian economy. In essence, to attenuate inflationary pressures, the relevant authorities must implement appropriate policy measures, such as raising interest rates, stabilizing fiscal policies, and clearing out excess liquidity. Holistically, the monetary authority could consider implementing a flexible inflation targeting monetary policy, which is intended to both lower the actual inflation toward an announced target rate and to stabilize economic growth. Additionally, fiscal stability can be achieved by simultaneously broadening government revenues and consolidating public expenditures. As part of future research, rather than focusing

on the effects of various macroeconomic fundamentals on stock returns, it would be interesting to extend the diversification options and strategies of the sector stocks, particularly examining the effects of policy uncertainties such as health-based crisis, political risks and economic policy uncertainty will further enrich the extant literature.

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