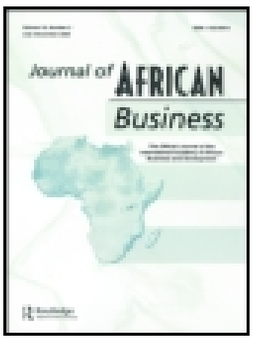

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Exchange Rate and Stock Prices in Nigeria: Firm-Level Evidence

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ABSTRACT

This study examined the symmetry and asymmetry of the exchange rate-stock price nexus for 54 firms listed on the Nigerian Stock Exchange (NSE). We employed asymmetric Auto Regressive Distributed Lag (ARDL) model proposed for time series, using daily data for the period from December 12, 2001 to December 8, 2017 . For comparative purposes, we also estimated the symmetric version. In the linear model, we found insignificant relationship between exchange rate and stock prices in most of the firms. Similarly, in the NARDL estimations, we observed that exchange rate movements do not have asymmetric impacts on stock prices in almost all the firms. In line with these findings, we recommend that financiers cannot make informed investment decisions using information obtained from the exchange rate market. In addition, the monetary authorities may need to reconsider the strict use of exchange rate as a policy tool to attract foreign portfolio investment.

KEYWORDS

NSE; ARDL; NARDL; asymmetry; exchange rate; stock prices

1. Introduction

Foreign exchange rate is an important macroeconomic variable that significantly affects the stock market in open economies. Movements in exchange rate affect stock prices because of their influences on the cash flow and international competitiveness of firms. Another channel of influence of the exchange rate on the stock market is through capital flows in and out of a country. Specifically, currency depreciation can affect share prices in either direction. Apparently, firms that are involved in international trade, which gain international competitiveness and thus export more, are expected to earn more profit and enjoy an increase in their share prices. In contrast, domestic firms that are not export oriented will face an increase in costs of imported inputs and perhaps experience a decline in their profit margins. Hence, these firms' share prices are expected to be negatively impacted. Therefore, the stock market or the index that summarizes the movement in the market can move in either a positive or a negative direction. The literature on the association between exchange rates and stock prices has evolved over time and includes a large number of studies that investigate this linkage for

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different countries. While some have investigated causality between stock prices and exchange rates, others have tried to distinguish between long-run and short-run effects by attempting to establish cointegration between the two variables. Recently, the review by Bahmani-Oskooee and Saha (2015) has revealed that most studies have found important short-run effects but no long-run relationship. Most of these studies share a common feature that when the exchange rate is included in a stock price determination model, it is assumed that it has symmetric effects on stock prices. In other words, if currency depreciation induces an increase in stock prices, appreciation conversely decreases stock prices.

This study is governed by the theoretical relationship between the foreign exchange market and stock market, developed by Dornbusch and Fischer (1980). This theory presents a flow-oriented model of exchange rates, which is linked to the current account balance or trade balance of a country. It is posited, however, that changes in the exchange rate affect the international competitiveness and profitability of firms, which in turn affects stock prices. For example, when a nation's currency depreciates, this will make locally produced goods cheaper in comparison to foreign goods, thereby enhancing exports. As a result of higher expected future cash flows, there would be increases in the stock prices of export-oriented firms and *vice versa* for import-oriented firms. In contrast, when the domestic currency appreciates, the resultant effect is that locally produced goods would be more expensive relative to foreign goods and therefore reduce foreign demand leading to a fall in stock prices. The outcome is, however, contrary for import-oriented firms. The flow-oriented model therefore proposed a positive relationship between exchange rates and stock prices.

Further, different companies in different sectors may react differently to exchange rate changes in setting their prices and adjusting their sales. Default risk, i.e. the inability or unwillingness of a foreign client to keep to their agreement, is also said to be another factor causing non-linearity or asymmetry if it is associated with foreign exchange rate risk. If a home currency depreciates, which results in an increase in costs of transactions in foreign currency, this may in turn cause a domestic client to default. This does not happen when domestic currency appreciates.

Therefore, the aim in this paper is to examine the extent to which listed Nigerian stock prices respond to exchange rate fluctuations. Unlike the works of Bahmani-Oskooee and Saha (2016b) among others, we examined the effect of the exchange rate fluctuations on the firms' stock prices at the individual firm level (disaggregate level). Beyond this, to the best of our knowledge, few studies have considered the symmetric and asymmetric effects of variations in exchange rates on stock prices at the firm level for Nigeria. As an important emerging market that is primarily dominated by unsophisticated retail investors, coupled with the recent semi-floating exchange rate regime, the Nigerian stock market provides an interesting setting to analyze whether there is symmetric or asymmetric exchange rate effects on individual firms' stock prices.

Following this section, we structure the rest of the paper as follows. Section 2 provides a review of the related literature while Section 3 outlines the methodology used in the analysis, which includes the baseline model, linear and non-linear ARDL specifications. In Section 4, we describe the data used for estimation and provide some preliminary analyses while the discussion of empirical results of both linear and non-linear estimations are offered in Section 5. Section 6 concludes the paper.

2. Literature review

This section provides a review of symmetric and asymmetric effects of exchange rate on stock returns in financial markets, supporting the hypothesis in this study that variations in exchange rates may affect the stock market in either direction. Numerous studies have explored the relationship between exchange rate and stock returns (see Hau & Rey, 2006; Chou & Tseng, 2015; Bahmani-Oskooee & Saha, 2015, 2016a, 2016b; Aggarwal, 1981; Ajayi & Mougoue, 1996; Alsalman, 2016; Amare & Mohsin, 2000 ; Tsen, 2017; Stavarek, 2004; Taufeeq et al., 2017; Sensoy and Tabak, 2016; Muhammad and Rasheed, 2002; Kutty, 2010; Lim and Sek, 2014; Kodongo and Ojah, 2012; Bahmani-Oskooee and Ilker, 1997; Bahmani-Oskooee and Tanku, 2008 among others).

There are different strands or directions of studies in the literature, while some examine causality between exchange rates and stock prices; others attempt to differentiate the long-run relationship from short-run impacts by establishing cointegration between the variables. A large number of the studies reviewed found short-run effects but no long-run relationships (see Bahmani-Oskooee & Saha, 2015; Grammig et al., 2001; Heimonen et al., 2017; Huang et al., 2016; Jain and Biswal, 2016;). They noted that a common conjecture guiding all of these studies is the linear (symmetry) effects of exchange rate movements on stock prices, i.e. currency depreciation (appreciation) raises (decreases) the demand for a nation's exports and improves (deteriorates) its trade balance and thereby enhances (depresses) stock prices (Pan et al., 2007; Lin, 2017; Mitra, 2017).

There are conflicting results among numerous studies in the literature, for example Boonyanam (2014), Caporale, Hunter, and Ali (2014), Moore and Wang (2014), Yang, Tu, and Zeng (2014), Balcilar et al. (2015), Demirhan (2009), and Du and Hu (2012) find no long-run cointegrating relationship between stock prices and the exchange rate. Groenewold and Paterson (2013), Unlu (2013), Tuncer and Turaboglu (2014), Mitra (2017) and Al-Shboul and Anwar (2014) however find a long-run relationship between the two variables. These mixed results could be ascribed to differences in sampling size and period, methodology employed by different authors, and the level of development of the country investigated. Al-Shboul and Anwar (2014) aimed to extend the existing literature on foreign exchange rate risk pricing. Unlike the existing studies on Canada, they use six alternative bilateral and one multilateral exchange rate proxies. Furthermore, using both a two-factor and a three-factor capital asset pricing model (CAPM), they test for the presence of a long-run relationship in exchange rate risk pricing, herding behavior, term structure and interest rate. The estimated results based on both the ordinary least squares (OLS) and generalized least squares (GLS) estimation techniques confirmed that exchange rate risk in the Canadian equity market is priced and that the pricing of this risk is time varying. This result holds for all seven exchange rate proxies. Their empirical analysis also suggested the presence of a long-run relationship among the key variables. This relationship is found to be insensitive to variations in the world market return.

In addition, there is a growing body of literature particularly in finance suggesting that there is an asymmetric relationship between exchange rate and stock prices (see for example, Bahmani-Oskooee & Fariditavana, 2014; Walid, Chaker, Masood, & Fry, 2011; Chkili Nguyen, 2014; Bahmani-Oskooee & Saha, 2016a, 2016b ; Azher & Iqbal, 2016

among others). Miller and Reuer (1998) argued in favor of asymmetric hedging. They postulated that if firms use real options to hedge against exchange rate changes, exposure coefficients are expected to be different for periods of exchange rate appreciation compared to periods of depreciation. The same, they claim, will be true if one follows research related to firms' pricing decisions in international markets. They generally find some support for asymmetric exposure using the Canadian dollar, Japanese yen and Mexican peso and stock returns in these three countries. Apergis and Rezitis (2001) used a measure of exchange rate volatility instead of exchange rate itself to extend the same analysis and show that volatility spillovers from foreign exchange markets to equity markets are asymmetric. Furthermore, given that asymmetry is typically linked with non-linearity, Bartram (2004) argues that non-linear foreign exchange rate exposures result if corporate cash flows are a non-linear function of exchange rates. This non-linearity could be due to uncertainty associated with future cash flows.

Koutmos and Martin (2003) further supported asymmetric exchange rate exposure empirically by decomposing exchange rate changes into their depreciations and appreciations using the partial sum concept and estimated exchange rate exposure models using standard methods. Considering a few sectors from Germany, Japan, UK, and the US, they find that in 40% of the country-sector models there is significant asymmetric exchange rate exposure. The asymmetric exposure is relatively more pronounced in the financial sector and consumer goods sectors. In their view, this could be attributed to asymmetric hedging in the former sector and pricing-to-market conditions in the latter sector. Also, Hsu, Yau, and Wu (2009) consider stock price indices of 33 industries in Japan to foreign exchange exposure; they do not find much support for asymmetric effects. Using correlation approach and correlation coefficient between positive movements and negative movements, they find that only pharmaceutical, real estate and air transportation industries exhibit asymmetric correlations, hence asymmetric exposure.

Nevertheless, current studies have tried to distinguish short-run exposure from long-run exposure by adopting the most recent method of Shin, Yu, and Greenwood-Nimmo (2014). Shin et al. (2014) introduced asymmetric cointegration and error-correction modeling which relies upon Pesaran, Shin, and Smith (2001) bounds testing approach under which variables in a given model could be a combination of stationary or I(0) and integrated of order one, I(1). Cuestas and Tang (2015) used monthly data from each of the 31 Chinese industries and with the Nonlinear Autoregressive Distributed Lag (NARDL) approach of Shin et al. (2014) found that some of the non-exporting industries are exposed to foreign exchange risk, which could be due to their dependence on imported inputs. Furthermore, industry returns are subject to lagged exposure effects but such effects quickly disappear and make swift adjustment to a new equilibrium around five months. This makes the long-run exposure to be symmetric or very small.

Bahmani-Oskooee and Saha (2016a) affirmed that exchange rate changes could affect different firms differently depending on whether they are export oriented or are heavily dependent on imported inputs. Therefore, the overall effects of exchange rate changes on an aggregate stock price index could be in either direction. After introducing non-linearity into the adjustment process and after using a non-linear ARDL approach to cointegration and error-correction modeling combined with monthly data from Brazil,

Canada, Chile, Indonesia, Japan, Korea, Malaysia, Mexico, and the UK, they show that exchange rate changes have asymmetric effects on stock prices, though the effects are mainly in the short run. In addition, Bahmani-Oskooee and Saha (2016b) investigated the asymmetric effects of exchange rate movements on stock price indices of 11 different sectors in the US. They employed an asymmetric cointegration and NARDL approach, and found that the changes in the nominal effective exchange rate of the dollar have significant asymmetric effects in the short run in ten sectors. Six of the 11 sectors have an asymmetric exchange rate long-run effect. Also, while depreciation in the dollar has a positive impact on the share prices in five of the six sectors, appreciation in dollar does not.

From the related literature reviewed, studies have considered the symmetric and asymmetric effects of variations in exchange rates on stock prices at the aggregate and sectoral levels but none has considered the effects at the firms' level using individual firm data particularly on Nigeria. As an important emerging economy, the Nigerian stock market provides an interesting setting to analyze whether there are symmetric or asymmetric exchange rate effects on individual firms' stock prices. Hence, the study employs the ARDL and NARDL frameworks to investigate short-run and long-run asymmetric effects of exchange rate on individual firms' stock prices. This is thought to be appropriate since aggregation at the economy-wide and sectoral levels may mask the impact of exchange rate movements on firms' stock prices.

3. Model and methodology[1]

Bahmani-Oskooee and Saha (2015) recently reviewed the entire literature on the relationship between exchange rate and stock prices and pointed out that these studies are commonly grouped into two categories on the basis of the methodological orientation. On the one hand is the group of studies that rely upon a bivariate model between exchange rate and stock prices. Such studies fail to incorporate other variables that might likely influence the linkage between the two variables. In the other group are studies that considered multivariate models that incorporate additional variables, which might influence the association. Based on the existing literature, the original model for this study is given below:

$$SP_t = \psi + \varphi EX_t + \mu_t \tag{1}$$

Where *SP* and *EX* denote the logarithm of stock price and exchange rate, respectively. $\psi$is the intercept term and φ is the parameter of the model to be estimated.

In order to estimate the asymmetric effects of exchange rate on stock prices, we partitioned the exchange rate variable into positive and negative using the partial sum process. The asymmetric version of equation 1 is specified as:

$$SP_t = \psi + \varphi EX_t^+ + \varphi EX_t^- + \mu_t \tag{2}$$

[1]We wish to express thanks to the anonymous reviewers for their suggestions which have helped to improve the methodology section.

Where the exchange rate variable EX is decomposed into EX_t^+ and EX_t^- signifying positive changes (depreciation) in exchange rate and negative changes (appreciation) in exchange rate, respectively.

Hence, the study employed the linear (symmetric) and non-linear (asymmetric) Autoregressive Distributed Lag Model developed by Pesaran et al. (2001) and Shin et al. (2014), respectively. The Autoregressive Distributed Lag (ARDL) model has several advantages among which are: its procedure is flexible and is applied to series that are integrated of different orders (i.e. I(0) or I(1) but not I(2) (Raza, Shahzad, Tiwari, & Shahbaz, 2016). In addition, its specification is proper in resolving the problems of endogeneity and residual serial correlation simultaneously (Pesaran et al., 1997).

3.1. *The symmetric ARDL (z, y)*

The analysis for this study begins with the assumption of a linear (symmetric) response of stock price to changes in exchange rate and subsequently we would allow for positive and negative changes in exchange rate by relaxing this assumption. Accordingly, the symmetric version of the ARDL is given as:

$$\Delta \ln SP_t = \psi_0 + \sum_{a=1}^{z} \varphi_a \Delta \ln SP_{t-a} + \sum_{b=0}^{y} \phi_b \Delta \ln EX_{t-b} + \psi_1 \ln SP_{t-1} + \psi_2 \ln EX_{t-1} + \varepsilon_t \quad (3)$$

Where Δ in Equation 1 is the difference operator, while ψ_i, φ, and ϕ are parameters and ε is the white noise disturbance. Also, $\ln SP$ is the log of stock price for each firm over a period of time t; $\ln EX$ denotes the log of exchange rate benchmark at period t. The long run slope (elasticity) coefficient is computed as $-\frac{\psi_2}{\psi_1}$ since in the long run, it is assumed that $\Delta \ln SP_{t-a} = 0$ and $\Delta \ln EX_{t-b} = 0$. Therefore, the short run estimate for exchange rate is obtained as ϕ_b. Eq. (1) can be re-specified to include an error correction term as follows:

$$\Delta \ln SP_t = \delta_t v_{t-1} + \sum_{a=1}^{z} \varphi_a \Delta \ln SP_{t-a} + \sum_{b=0}^{y} \phi_b \Delta \ln EX_{t-b} + \psi_1 \ln SP_{t-1} + \psi_2 \ln EX_{t-1} + \varepsilon_t \quad (4)$$

where $v_{t-1} = \ln SP_{t-1} - \gamma_0 - \gamma_1 \ln EX_{t-1}$ is the linear error correction term; the parameter δ_t is the error-correcting speed of adjustment for each unit which is also equivalent to ψ_1. The parameters γ_0 and γ_1 are computed as $-\frac{\psi_0}{\psi_1}$ and $-\frac{\psi_2}{\psi_1}$ respectively.

3.2. *The non-linear (asymmetric) ARDL (z, y)*

The NARDL bounds testing approach developed by Shin et al. (2014) is applied to estimate short- and long-run dynamics. The bound testing approach provides robust empirical results even for small sample sizes (Salisu and Isah, 2017; Salisu and Mobolaji,

2013; Ghatak and Siddiki, 2001; Narayan and Narayan, 2005; Pesaran et al., 2001) and can be applied regardless of the order of integration with the exception that the series is integrated with the maximum order of one. The order of integration can be verified using unit root tests. Further, when the time series are noted to have cointegration using their positive and negative components (Granger & Yoon, 2002), the case of non-linear cointegration is implied. Some possible reasons of non-linearity include, *inter alia*, noise traders, non-linear transaction cost, asymmetric adjustment process and/or extreme volatility. The latter becomes highly plausible when the sample includes major shocks such as the influence of the global financial crisis of 2007–08.

The NARDL framework allows modeling asymmetric cointegration using positive and negative partial sum decompositions and detecting the asymmetric effects both in the short run and long run. It also allows the joint analysis of the issues of non-stationarity and non-linearity in the context of an unrestricted error correction model. The non-linear cointegrating regression version of Equation 1 is specified as:

$$\begin{aligned}\Delta \ln SP_t = \psi_0 + \sum_{a=1}^{z} \varphi_a \Delta \ln SP_{t-a} + \sum_{b=0}^{y} \left(\phi_b^+ \Delta \ln EX_{t-b}^+ + \phi_b^- \Delta \ln EX_{t-b}^-\right) \\ + \psi_1 \ln SP_{t-1} + \psi_2^+ \ln EX_{t-1}^+ + \psi_2^- \ln EX_{t-1}^- + \varepsilon_t\end{aligned} \tag{5}$$

where $\ln EX_t^+$ and $\ln EX_t^-$ denote the positive and negative exchange rate series, respectively. The long run (elasticity) coefficients for $\ln EX_t^+$ and $\ln EX_t^-$ are calculated as $-\frac{\psi_2^+}{\psi_1}$ and $-\frac{\psi_2^-}{\psi_1}$.

These shocks are respectively constructed as positive and negative partial sum decompositions of exchange rate changes defined as:

$$\ln EX_t^+ = \sum_{k=1}^{t} \Delta \ln EX_k^+ = \sum_{k=1}^{t} \max(\Delta \ln EX_k, 0) \tag{6}$$

$$\ln EX_t^- = \sum_{k=1}^{t} \Delta \ln EX_k^- = \sum_{k=1}^{t} \min(\Delta \ln EX_k, 0) \tag{7}$$

The error correction version of Equation3 yields the following:

$$\begin{aligned}\Delta \ln SP_t = \tau_t \vartheta_{t-1} + \sum_{a=1}^{z} \varphi_a \Delta \ln SP_{t-a} + \sum_{b=0}^{y} \left(\phi_b^+ \Delta \ln EX_{t-b}^+ + \phi_b^- \Delta \ln EX_{t-b}^-\right) \\ + \psi_1 \ln SP_{t-1} + \psi_2^+ \ln EX_{t-1}^+ + \psi_2^- \ln EX_{t-1}^- + \varepsilon_t\end{aligned} \tag{8}$$

The error-correction term (ϑ_{t-1}) captures the long-run equilibrium in the asymmetric ARDL specified in Equation 6, while its associated parameter τ_t is the speed of adjustment term that measures how long it takes the system to converge to its long-run equilibrium following a shock.

In the non-linear framework, the first two steps to ascertain cointegration between the variables are the same as for the linear ARDL bounds testing procedure, i.e. estimating Equation 6 using OLS and conducting the joint null ($\psi_2^+ = \psi_2^- = 0$) hypothesis test.

However, in NARDL, the Wald-test is used to examine the longrun ($\psi_2^+ = \psi_2^-$) and short-run ($\phi_b^+ = \phi_b^-$) asymmetries in the relationship. Finally, the asymmetric cumulative dynamic multiplier effect of a unit change in $\ln EX_t^+$ and $\ln EX_t^-$ on $\ln SP_t$ is examined respectively as follows:

$$m_h^+ = \sum_{b=0}^{h} \frac{\partial \ln SP_{t+b}}{\partial \ln EX_t^+}, m_h^- = \sum_{b=0}^{h} \frac{\partial \ln SP_{t+b}}{\partial \ln EX_t^-}, \; h = 0, 1, 2, ...$$

where as $h \to \infty$, the $m_h^+ \to \psi^+$ *and* $m_h^- \to \psi^-$. Since ψ^+*and* $\psi^-$are the asymmetric long-run coefficients they can be calculated as ψ_2^+/ψ_1 *and* ψ_2^-/ψ_1, respectively.

4. Data and preliminary analysis

The dataset used comprised of daily exchange rate of Naira to US Dollar (NGN/USD) and stock prices of 54 firms[2] listed on the Nigerian Stock Exchange (NSE). The firms are grouped into six sectors for ease of analysis (see the Appendix for details). The data covers from December 12, 2001 to December 8, 2017. The official Exchange rate data was obtained from the Central Bank of Nigeria (CBN) website, while the stock prices are from NSE and Cash Craft Assets Management. In preparing the data for preliminary analysis and model estimations, we encountered the challenge of non-synchronous trading days. To deal with this problem, we painstakingly traced and removed the discrepancies in days using the exchange rate series as a yardstick. At the end of this exercise, we ended up with 3,856 daily observations.

The descriptive statistics are presented in Table 1. Starting with the mean statistic, for group 1 (industrial and construction), all the series are positive on average with WAPCO having the highest mean and FIRSTALUM having the lowest mean. The Table also indicated high standard deviations for the series with WAPCO and FIRSTALUM having highest and lowest levels of deviations, respectively. Considering group 2 (consumer goods) in the same Table 1, NESTLE has the highest value on average and highest standard deviation while PREMBREW has the lowest mean value and lowest standard deviation. Again, all the series in this group have positive average values.

Moreover, for group 3 (conglomerates and ICT), daily averages for AGLEVENT, JOHNHOLT, UACN, NCR and TRIPPLG are all positive, with the highest value being for UACN and the lowest for AGLEVENT. The standard deviation follows the same pattern with UACN and AGLEVENT having the highest and lowest deviations, respectively. Furthermore, group 4 (Financial services), showed the descriptive statistics for the firms in the banking, insurance and other financial institutions. The mean values for all the firms are positive where FBNH has the highest followed by GTB, while GUINEAINS and LASACO both have low average values. Standard deviations are also high for FBNH, GTB, and low for GUINEAINS and LASACO, respectively. For the Oil & Gas sector in group 5, the mean values are relatively high for all the firms except for BOCGAS with an average value of 6.78 while TOTAL has the highest mean of 173.47. In the Healthcare Pharmaceuticals and Agricultural Production sector in

[2]See Appendix for list of firms.

Table 1. Descriptive Statistics of Stock Prices and Exchange Rate.

Group One														
Industrial and Construction														
	Ashakacem	Berger	betaglas	ccnn	Cap	firstalum	wapco	cutix	jberger	uac-prop				
Mean	24.5729	6.8551	17.0656	9.7906	27.3979	1.1371	48.3054	3.4726	42.5466	12.4770				
Std Dev.	13.6994	3.2603	13.5056	5.3459	16.5343	1.2500	30.3770	3.6373	22.6457	7.0083				
Min	7.29	2.04	3.25	2.49	2.56	0.5	9.91	1.2	12.35	1.63				
Max	84.89	23.35	60.34	38.66	93	10.05	131	25.25	169.28	30				
No. of Obs.	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856				
Group Two														
Consumer Goods														
	Vitafoam	champion	nestle	cadbury	Flourmill	nascon	guinness	interbrew	dunlop	prembrew	pz	unilever	7up	nb
Mean	4.7506	3.9659	445.5317	35.7243	44.7215	6.2274	136.7288	9.5164	1.5870	1.3953	22.9710	27.9372	59.5161	84.9411
Std Dev.	1.9162	3.3990	345.3324	19.9244	26.8631	5.3763	62.4105	10.4622	1.4425	0.9174	9.2099	13.4158	48.2055	49.3151
Min	1.64	0.5	57	7.41	11	0.59	29	0.6	0.5	0.68	6.2	5.62	4.2	25.9
Max	15	19.48	1410.08	101	109.24	31.2	297.41	60	8.94	5.12	56	76	197	193
No. of Obs.	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856
Group Three														
Conglomerates and ICT IT Services														
	Aglevent	Johnholt	uacn	Ncr	Trippleg									
Mean	2.2526	3.8426	30.0134	7.3811	2.8254									
Std Dev.	2.5657	4.2921	17.1085	5.2128	2.9185									
Min	0.52	0.5	3.09	0.5	.5									
Max	18.9	23.95	71.2	18.7	20									
No. of Obs.	3856	3856	3856	3856	3856									
Group Four														
Financial Services: Banks, Insurances and other financial institutions														
	Aiico	Guineains	lasaco	lawunion	Nem	nigerins	Wapic	royalex	fbnh	wemabnk	ubn	access	gtb	uba
Mean	1.5956	0.7410	0.9854	1.2904	0.9980	2.1278	2.1647	1.9468	20.0678	3.5170	16.5360	7.2229	18.7432	12.4782
Std Dev.	1.1648	0.6983	0.8878	1.2763	0.9202	1.8857	2.5001	1.5940	12.2821	3.9850	11.9857	4.7993	8.6999	12.1946
Min	.5	.5	.5	.5	0.48	0.5	0.5	0.5	2.95	0.5	1.96	1.3	4.9	1.64
Max	7.5	5.25	5.99	7.5	6.32	9.45	13.7	6.52	72.76	15	50.33	25.5	43.1	63.94
No. of Obs.	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856	3856

(*Continued*)

Table 1. (Continued).

Group One										
Industrial and Construction										
	Ashakacem	Berger	betaglas	ccnn	Cap	firstalum	wapco	cutix	jberger	uac-prop
Group Five										
Oil & Gas: Services and petroleum products distribution										
	Oando	Conoil	fo	Mobil	total	*bocgas*				
Mean	57.3487	56.8018	87.7883	153.7158	173.4721	6.7825				
Std Dev.	46.3407	37.5686	91.4156	58.7889	52.5480	5.0723				
Min	2.97	13.71	7.73	57.25	53.2	2.16				
Max	282.77	195.51	342	402	345	31.16				
No. of Obs.	3856	3856	3856	3856	3856	3856				
Group Six										
Healthcare Pharmaceuticals and Agricultural Production										
	Glaxosmith	Morison	pharmdeko	okomuoil	livestock					
Mean	24.0796	4.7396	4.0908	27.2988	2.2527					
Std Dev.	17.7051	4.9817	2.8069	15.1776	1.5113					
Min	1.41	0.53	0.5	4.3	.5					
Max	70.7	25	19.15	107.81	9.98					
No. of Obs.	3856	3856	3856	3856	3856					
Nominal Effective Exchange rate of Naira to US Dollars										
	Exchange rate									
Mean	157.7852									
Std Dev.	49.7425									
Min	112.35									
Max	319.5									
No. of Obs.	3856									

Notes. This Table is made up of 54 firms listed on the Nigerian Stock Exchange. The firms are arranged into six groups for ease of analysis, thus: Group 1(Industrial & Construction) includes ASHAKCEM, BERGER, BETAGLAS, CCNN, CAP, FISRTALUM, WAPCO, CUTIX, JBERGER and UAC-PROP; Group 2 (Consumer Goods) includes VITAFOAM, CHAMPION, NESTLE, CADBURY, FLOURMILL, NASCON, GUINNESS, INTERBREW, DUNLOP, PREMBREW, PZ, UNILEVER, 7UP and NB; Group 3 (Conglomerate & ICT IT Services) is made up of AGLEVENT, JONHOLT, UACN, NCR and TRIPPLEG; Group 4 (Financial Services) include AIICO, GUINEAINS, LASOCO, LAWUNION, NEM, NIGERINS, WAPIC, ROYALEX, FBNH, WEMABANK, UBN, ACCESS, GTB and UBA. In Group 5 (Oil & Gas) we have OANDO, CONOIL, FO, MOBIL, TOTAL and BOCGAS; Group 6 (Healthcare Pharmaceuticals & Agricultural Production) includes GLAXOSMITH, MORISON, PHARMDEKO, OKOMUOIL and LIVESTOCK; and Nominal Effective Exchange rate of Naira to Dollars. All variables are at level.

group 6, the average values and deviations do not follow the same pattern as the other groups described earlier. While OKOMUOIL is with the highest mean value and LIVESTOCK with the lowest average value, GLAXOSMITH has the highest deviation from the mean, while LIVESTOCK has the lowest standard deviation. Finally, exchange rate has a positive average value of 157.79 and a standard deviation of 49.74.

As conventional for time-series analysis, we subjected the relevant variables to unit root tests. Pesaran et al. (2001) specified some requirements in order to estimate ARDL models, which includes that variables could be I(0) or I(1) or mixed but not I(2). As a preliminary exercise, we apply both the Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) tests to the level as well as the first differenced variables and report the results in Table 2. Evidently, Table 2 exhibits that there is no I(2) variable in the series employed in this study. Therefore, we can proceed to estimate all the models. Following the literature, we initially impose a maximum of four lags on each variable in both models 1 and 2. Eventually, we use Schwartz Information Criterion (SIC) to select an optimal lag for all our specifications.

5. Empirical results

5.1. *Symmetric stock-exchange rate relationship*

The linear estimations of our symmetry models are presented in Table 3. Again, as stated above, for ease of analysis the firms are arranged into six groups based on their sectoral classification. In each of the six groups, we report the short-run coefficients, long-run coefficients and the error correction terms.

Given the fact of the mixed order of integration shown by the series under investigation, we then proceed to determine the long-run and short-run responses of stock prices to changes in exchange rate. For group 1 (Industrial and Construction), the estimated coefficients in Table 3 show that the response of stock prices to exchange rate changes differs from one firm to the other. We find that in the short run, a change in exchange rate will result in a negative change in the stock prices of five of the firms[3] considered and a positive relationship in the other five firms. Considering the lagged values of exchange rate, the results exhibit that exchange rate has a positive impact on stock prices of five firms while the relationship is negative in the remaining firms. However, in the long run it appears that exchange rate positively influences the stock prices of four firms but the remaining six firms respond negatively to exchange rate fluctuations. Nevertheless, we must establish cointegration for the long-run estimates to be valid. The results of the F-test applied for significance of lagged level variables reveal that our calculated F-statistic of all the series except one firm are much less than the lower and upper bound critical values of (4.94 and 5.73), implying no cointegration. The F-statistic of 12.95 in JBERGER indicates cointegration between exchange rate and its stock prices. However, if we depend on a different test, we find evidence of cointegration. The alternative test is based upon the speed of adjustment or error correction concept. This is consistent with the findings of Bahmani-Oskooee and Saha (2016). The coefficient estimates from the EC are derived from Equation 4 to

[3]See Appendix for the complete listing of firms.

Table 2. Unit Root Test Results.

	Dickey-Fuller		Phillip-Perron	
	Level	First Difference	Level	First Difference
Variables	I(0)	I(1)	I(0)	I(1)
Exchange rate	−0.867	−45.680***	−0.869	−45.769***
ASHAKACEM	4.285***	-	−2.949	−86.246***
BERGER	−1.975	−39.669***	−2.205	−39.938***
BETAGLAS	−3.582**	-	−3.583**	-
CCNN	−2.347	−40.617***	−2.512	−40.667***
CAP	−1.040	−36.003***	−1.217	−36.208***
FIRSTALUM	−1.056	−53.468***	−1.150	−52.179***
WAPCO	−1.731	−43.738***	−1.843	−43.718***
CUTIX	−1.911	−35.804***	−2.049	−36.102***
JBERGER	−4.605***	-	−3.162*	-
UAC-PROP	−0.859	−45.048***	−0.925	−45.032***
7UP	−2.007	−43.132***	−2.007	−43.095***
CHAMPION	−1.129	−68.913***	−0.989	−64.768***
NESTLE	−2.580	−43.494***	−2.611	−43.474***
CADBURY	−1.018	−38.247***	−1.294	−38.280***
FLOURMILL	−1.005	−38.874***	−1.148	−38.793***
NASCON	−1.983	−43.790***	−2.079	−43.790***
DUNLOP	−1.238	−41.133***	−1.442	−41.311***
VITAFOAM	−3.291*	-	−3.263*	-
GUINNESS	−2.509	−30.775***	−2.611	−31.134***
INTERBREW	−1.691	−42.752***	−1.794	−42.847***
NB	−3.171*	-	−3.183*	-
PREMBREW	−1.999	−48.752***	−1.982	−48.710***
PZ	−1.483	−42.181***	−1.604	−42.125***
UNILEVER	−1.236	−39.011***	−1.573	−38.966***
AGLEVENT	−1.343	−57.716***	−1.165	−57.191***
JOHNHOLT	−0.417	−38.064***	−0.660	−38.307***
UACN	−0.576	−43.098***	−0.593	−43.070***
OKOMUOIL	−2.070	−52.561***	−2.126	−52.584***
LIVESTOCK	0.053	−35.320***	−0.461	−35.521***
AIICO	−2.327	−50.682***	−2.520	−49.791***
GUINEAINS	−3.632**	-	−3.140*	-
LASACO	−1.375	−32.823***	−1.764	−32.847***
LAWUNION	−0.687	−56.922***	−0.411	−56.490***
NEM	−1.439	−36.896***	−1.679	−36.819***
NIGERINS	−1.953	−36.027***	−2.197	−36.371***
WAPIC	−1.427	−38.041***	−1.654	−38.121***
ROYALEX	−1.646	−38.156***	−1.910	−38.005***
FBNH	−1.678	−33.818***	−1.790	−33.375***
WEMABANK	−1.768	−38.754***	−1.899	−38.837***
UBN	−1.985	−26.567***	−1.895	−27.370***
UBA	−0.761	−39.193***	−0.987	−39.147***
GUARANTY	−2.557	−40.194***	−2.580	−40.007***
ACCESS	−2.352	−44.350***	−2.438	−44.258***
OANDO	−2.072	−33.177***	−2.173	−33.022***
CONOIL	−1.896	−55.895***	−0.126	−55.524***
FO	−0.935	−39.373***	−1.154	−39.512***
MOBIL	−2.499	−54.561***	−2.158	−54.848***
TOTAL	−1.987	−43.984***	−1.973	−43.908***
BOCGAS	−2.548	−40.592***	−2.536	−40.675***
GLAXOSMITH	−1.840	−39.708***	−1.937	−39.632***
MORISON	0.357	−52.246***	0.343	−51.520***
PHARMDEKO	−2.247	−25.759***	−2.123	−23.377***
NCR	−0.661	−38.041***	−0.934	−38.627***
TRIPPLEG	−0.728	−36.523***	−0.937	−36.814***

Notes. All the variables stated here are in their natural logs, while ***, **, * indicate statistical significance at 1%, 5% and 10% respectively.

Table 3. ARDL Regression Results for Exchange Rate-Stock Price Nexus.

GROUP 1	ASHAKACEM	BERGER	BETAGLAS	CCNN	CAP	FIRSTALUM	WAPCO	CUTIX	JBERGER	UAC-PROP
EX	-0.9747*	0.9343	2.8015**	2.7293	-1.0711	-2.1598	3.4598*	-0.5598	-0.1988	-5.1717
	(0.5897)	(0.9521)	(1.2015)	(6.0468)	(3.9775)	(1.8040)	(1.9245)	(0.8888)	(0.4168)	(3.3559)
ΔEX	-0.2188	0.0079	-0.0222	0.0190	0.0537	-0.0414	0.2972***	0.0806	-0.2052	-0.0168
	(0.3173)	(0.1292)	(0.1136)	(0.1447)	(0.1407)	(0.1269)	(0.1138)	(0.1437)	(0.2544)	(0.1329)
ΔEX_{t-1}	0.4012	-0.0072	-0.0013	0.0730	0.0589	-0.0955	-0.0389	0.1620	0.0002	-0.1264
	(0.3232)	(0.1315)	(0.1157)	(0.1474)	(0.1433)	(0.1292)	(0.1160)	(0.1463)	(0.2590)	(0.1353)
Constant	0.0836**	-0.0070	-.0215	-0.0097	0.0074	0.0148	-0.0209*	0.0126	0.0557**	0.0413**
	(0.0390)	(0.0125)	(0.0138)	(0.0150)	(0.0139)	(0.0145)	(0.0111)	(0.0159)	(0.0253)	(0.0163)
u_{t-1}	-0.0104***	-0.0026**	-0.0019*	-0.0009	-0.0008	-0.0014	-0.0015*	-0.0032***	-0.0119***	-0.0015
	(0.0035)	(0.0013)	(0.0010)	(0.0014)	(0.0008)	(0.0011)	(0.0009)	(0.0012)	(0.0024)	(0.0011)
F-stat.	4.477	2.199	1.855	0.635	0.832	0.922	3.083	3.748	12.953	3.246
LL	2615.042	4514.3563	4786.2557	4273.5631	4333.2243	4553.1774	4781.7019	4289.4994	3082.351	4454.6233
$\overline{R}^2$	.16	.016	.003	.03	.005	.002	.024	.009	.244	.006
No. of Obs.	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113

GROUP 2	VITAFOAM	CHAMPION	NESTLE	CADBURY	FLOURMILL	NASCON	GUINNESS	INTERBREW	DUNLOP	PREMBREW	PZ	UNILEVER	7UP	NB
EX	-0.8960*	-1.4492	2.4803**	0.6244	-0.2222	-0.3280	0.5619	-0.0644	-5.2443	0.1544	-0.4332	1.1385	1.5887	1.5786* (0.8836)
	(0.4631)	(2.9295)	(1.0840)	(3.1265)	(1.1989)	(4.4157)	(1.0440)	(8.0590)	(15.9148)	(3.8978)	(1.6620)	(0.8486)	(3.8272)	
ΔEX	-0.0360	-0.0254	0.0801	-0.0390	0.1018	-0.0855	-0.1387	-0.0910	-0.0410	-0.2071***	-0.0806	0.0544	-0.01954	-0.0066 (0.1449
	(0.1385)	(0.1246)	(0.0946)	(0.1297)	(0.1189)	(0.2334)	(0.1184)	(0.1145)	(0.1174)	(0.0593)	(0.1277)	(0.1163)	(0.1124)	
ΔEX_{t-1}	0.0810	-0.2266	-0.0675	-0.3932***	0.1642	0.0016	-0.1183	0.0087	-0.1565	-0.0006	0.0362	-0.2511**	-0.1058	-0.1388 (0.1475)
	(0.1411)	(0.1268)	(0.0963)	(0.1320)	(0.1210)	(0.2376)	(0.1205)	(0.1165)	(0.1195)	(0.0605)	(0.1300)	(0.1183)	(0.1145)	
Constant	0.0357**	0.0089	-0.0096	0.0012	0.0096	0.0049	0.0047	0.0004	0.0059	-0.0001	0.0094	-0.0061	-0.00168	-0.0105 (0.0153)
	(0.0171)	(0.0122)	(0.0101)	(0.0174)	(0.0124)	(0.0243)	(0.0125)	(0.0143)	(0.0149)	(0.0081)	(0.0124)	(0.0115)	(0.0124)	
u_{t-1}	-0.0058***	-0.0010	-0.0017**	-0.0011	-0.0019**	-0.0012	-0.0022*	0.0004	-0.0002	-0.0004	-0.0016	-0.0026*	-0.0006	-0.0031*
	(0.0022)	(0.0008)	(0.0007)	(0.0012)	(0.0009)	(0.0010)	(0.0012)	(0.0005)	(0.0009)	(0.0008)	(0.0014)	(0.0014)	(0.0008)	(0.0016)
F-stat.	3.543	1.257	2.509	0.780	2.382	0.803	1.900	0.417	0.072	0.217	0.783	1.853	0.263	1.931
LL	4366.1475	4590.8678	5172.4179	4506.0761	4690.8938	3264.1043	4699.4024	4770.6993	4716.7489	6162.4842	4538.7764	4737.5673	4807.8553	4271.5558
$\overline{R}^2$	.005	.069	.002	.032	.031	.002	.038	.016	.015	.004	.011	.033	.005	.01
No. of Obs.	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113

GROUP 3	AGLEVENT	JOHNHOLT	UACN	NCR	TRIPPLEG
EX	-1.8518	-3.2528	-2.0915	-5.8392	-3.0242
	(1.3525)	(6.4483)	(2.6322)	(10.3145)	(5.9113)
ΔEX	-0.0670	0.0432	0.0729	0.0029	0.0073
	(0.2053)	(0.1187)	(0.1113)	(0.0713)	(0.0904)

(*Continued*)

Table 3. (Continued).

GROUP 1	ASHAKACEM	BERGER	BETAGLAS	CCNN	CAP	FIRSTALUM	WAPCO	CUTIX	JBERGER	UAC-PROP				
ΔEX_{t-1}	0.0254	-0.0506	0.0835	0.0010 (0.0727)	0.0209 (0.0921)									
	(0.2090)	(0.1209)	(0.1133)											
Constant	0.0301	0.0065	0.0146	0.0101	0.0058									
	(0.0214)	(0.0125)	(0.0108)	(0.0074)	(0.0087)									
u_{t-1}	-0.0030**	-0.0004	-0.0010	-0.0003	-0.0004									
	(0.0014)	(0.0006)	(0.0007)	(0.0004)	(0.0005)									
F-stat.	2.519	0.253	1.778	1.790	0.478									
LL	3535.4424	4693.0855	4829.4843	5768.8048	5267.8697									
$\overline{R}^2$	.08	.028	.007	.040	.052									
No. of Obs.	2113	2113	2113	2113	2113									
GROUP 4	AIICO	GUINEAINS	LASACO	LAWUNION	NEM	NIGERINS	WAPIC	ROYALEX	FBNH	WEMABNK	UBN	ACCESS	GTB	UBA
EX	-2.5980**	-2.4466	-1.0870	0.2943	0.6621	-4.8140	-3.1874	-1.1975	-1.5869	-3.0960***	-1.5469*	0.1913	2.1212**	2.4661
	(1.1312)	(5.8782)	(1.0976)	(58.6665)	(0.7665)	(8.3754)	(2.9842)	(2.5459)	(1.2226)	(1.1521)	(0.8418)	(1.0417)	(1.0019)	(4.4404)
ΔEX	-0.3530**	-0.0501	0.0066	-0.0393	0.0120	-0.0324	-0.2034	-0.0332	-0.0398	-0.0627	0.2049	-0.0853	0.1964	0.1056
	(0.1532)	(0.0526)	(0.0942)	(0.1486)	(0.1148)	(0.1150)	(0.1421)	(0.1232)	(0.1205)	(0.1343)	(0.2141)	(0.1225)	(0.1309)	(0.1346)
ΔEX_{t-1}	0.0213	-0.0647	-0.1412	-0.0125	-0.0118	0.0296	-0.0931	0.0378	0.1305	0.0631	-0.1150	0.1045	-0.0526	0.2555*
	(0.1561)	(0.0535)	(0.0959)	(0.1513)	(0.1169)	(0.1191)	(0.1447)	(0.1255)	(0.1227)	(0.1367)	(0.2181)	(0.1247)	(0.1332)	(0.1370)
Constant	0.0389*	.0030	0.0087	-0.0001	-0.0108	0.0081	0.0146	0.0061	0.0250	0.0363*	0.0528*	0.0021	-0.0232*	-0.0117
	(0.0210)	(0.0055)	(0.0111)	(0.0166)	(0.0111)	(0.0162)	(0.0191)	(0.0168)	(0.0284)	(0.0190)	(0.0297)	(0.0118)	(0.0128)	(0.0166)
u_{t-1}	-0.0029*	-0.0002	-0.0017*	0.0001	-0.0031***	-0.0003	-0.0009	-0.0010	-0.0023	-0.0022**	-.0050***	-0.0023**	-0.0030**	-0.0011
	(0.0016)	(0.0006)	(0.0010)	(0.0012)	(0.0010)	(0.0008)	(0.0010)	(0.0009)	(0.0017)	(0.0009)	(0.0016)	(0.0009)	(0.0014)	(0.0011)
F-stat.	1.842	0.162	1.527	0.002	5.760	0.132	0.443	0.878	1.255	3.052	4.985	3.055	3.452	2.032
LL	4153.5774	6414.4284	5181.4834	4218.391	4763.7127	4723.5249	4312.3666	4613.8821	4661.3419	4432.7478	3446.6831	4627.3512	4488.5721	4429.1239
$\overline{R}^2$	.008	.315	.106	.023	.057	.049	.033	.025	.04	.041	.015	.035	.009	.042
No. of Obs.	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113
GROUP 5	OANDO	CONOIL	FO	MOBIL	TOTAL	BOCGAS								
EX	-0.0816	12.5229	2.3496	0.6294	0.1315	-0.5065								
	(4.9834)													
		(63.0456)	(5.6543)	(0.9634)	(0.7099)	(1.4717)								
ΔEX	0.1178	0.0000	(0.0789	-0.0167	0.1057	-0.2266**								
	(0.1425)	(0.3673)	(0.1282)	(0.1457)	(0.1019)	(0.1150)								
ΔEX_{t-1}	-0.1541	-0.1224	-0.0327	-0.0021 (0.1484)	-0.0901	-0.0282								
	(0.1452)	(0.3740)	(0.1305)		(0.1038)	(0.1172)								
Constant	0.0038	-0.0422	-0.0029	0.0059	0.0129	0.0066								
	(0.0274)	(0.0450)	(0.0124)	(0.0151)	(0.0105)	(0.0115)								

(*Continued*)

Table 3. (Continued).

GROUP 1	ASHAKACEM	BERGER	BETAGLAS	CCNN	CAP	FIRSTALUM	WAPCO	CUTIX	JBERGER	UAC-PROP
υ_{t-1}	-0.0009	-0.0007	-0.0005	-0.0029	-0.0029*	-0.0015*				
	(0.0011)	(0.0031)	(0.0006)	(0.0020)	(0.0015)	(0.0009)				
F-stat.	1.004	0.885	0.336	1.115	1.996	1.379				
LL	4305.7374	2305.8262	4532.4489	4259.2643	5015.944	4759.4119				
$\overline{R}^2$	.071	.204	.072	.066	.0005	.014				
No. of Obs.	2113	2113	2113	2113	2113	2113				
GROUP 6	GLAXOSMITH	MORISON	PHARMDEKO	OKOMUOIL	LIVESTOCK					
EX	0.4224	-43.3575	-1.3011*	4.7513	38.7511					
	(1.4964)	(327.6924)	(0.7667)	(9.9146)	(413.706)					
ΔEX	-0.1744	-0.0160	-0.0370	0.3556***	-0.0129					
	(0.1229)	(0.0925)	(0.2067)	(0.1142)	(0.1297)					
ΔEX_{t-1}	0.0810	-0.0055	-0.0195	0.1018	0.0059					
	(0.1252)	(0.0941)	(0.2105)	(0.1164)	(0.1321)					
Constant	0.0022	0.0124	.0407*	-0.0004	-0.0001					
	(0.0120)	(0.0092)	(0.0242)	(0.0011)	(0.0010)					
υ_{t-1}	-0.0016 **	-0.0001	-0.0052**	-0.0076	-0.0179					
	(0.0007)	(0.0005)	(0.0020)	(0.0114)	(0.0143)					
F-stat.	2.642	1.073	3.260	0.353	1.162					
LL	4618.9654	5220.8392	3521.0121	4774.4195	4505.7182					
$\overline{R}^2$	.027	-.0013	.0007	.006	.073					
No. of Obs.	2113	2113	2113	2113	2113					

Notes. EX means log of exchange rate of Naira to US dollar (N/USD). LL stands for log-likelihood. ***, **, * represent 1%, 5% and 10% level of significance.

generate the error correction term (ECT) labeled. Asignificant negative coefficient obtained for ECT supports cointegration, which in this study is the case for all the firms in group 1.

Furthermore, considering the magnitudes of the elasticity coefficients, we find that the elasticity coefficients (both in the long run and short run) for all the firms are higher in the long run than in the short run. In the long run, the stock market is exchange rate elastic for six firms while it is inelastic for the other four firms. Although, in the short run all the firms are inelastic.

Considering Group 2 (Consumer Goods) on Table 3, among the 14 firms investigated, there is a negative relationship between nominal exchange rate and stock prices of 7 firms while the remaining 7 firms and exchange rate have positive relationship in the long run. However, these results are statistically significant only in three firms. Conversely, in the short run the coefficient of exchange rate is negatively related to 11 firms but has a positive relationship with the other 3 firms. Again, as seen in group 1 above, there seems to be no cointegration when considering the F test, but the alternative test results prove the existence of cointegration as indicated by the speed of adjustment term (υ_{t-1}). In addition, a significant negative coefficient obtained for υ_{t-1} indicates evidence of cointegration, where in the case of group 2, all the coefficients are negative, less than zero but significant only in 6 out of 14 firms. In terms of the magnitude of elasticity of coefficients, we also find that the elasticity coefficients are higher in the long run than in the short run for all the firms. In the short run, the stock market exhibits exchange rate inelasticity for all the series. On the other hand, in the long run, the stock prices are exchange rate elastic for six firms while being inelastic for eight firms. However, most of the coefficient estimates are statistically insignificant, except for three firms, which are significant at 1%, 1% and 5%, respectively, in the short run, and other three firms at 10%, 5% and 10%, respectively, in the long run.

Results for group 3 (Conglomerates and ICT IT Services) are also reported in Table 3. The coefficient estimates show that there is a positive response of an instant change in the nominal exchange rate on all the firms considered except for AGLEVENT, which has a negative association in the short run. However, a one period lagged dynamics of exchange rate has a negative effect on stock price of one firm and positive influence on the stock prices of the other four firms. In contrast, in the long run, it appears that the exchange rate-stock market relationship is negative for all the firms under consideration in group 3. When considering the magnitude of the coefficients, we find that all the firms are exchange rate elastic in the long run. In the short run, however, they are inelastic with very low magnitude. In addition to all these results, there appears to be no cointegration judging from the F-statistic test results. However, considering an alternative test of the error correction model, the results seem to have cointegration given the values for ECT.

Turning to the linear relationship between nominal exchange rate and stock prices in group 4 (Financial services), it can be clearly seen that changes in nominal exchange rate have effects only on stock prices of one firm at 5% in the short run. Nevertheless, in the long run it appears that nominal effective exchange rate has significant effects on four financial firms; since corresponding coefficients are significant at either 5%, 1%, 10% or 5%. In terms of the degrees of the elasticity coefficients, the results indicate that

they are also higher in the long run than the short run for all the firms. In the long run, of all the 14 firms investigated, the stock prices of 11 firms are exchange rate elastic, while the remaining 3 are exchange rate inelastic. In contrast, in the short run the stock market is exchange rate inelastic for all the firms under investigation. Observing the relationship between nominal effective exchange rate and the firms' stock prices, the results are mixed. Specifically, in the short run we find a negative relationship between nominal effective exchange rate and nine firms, which is significant only in one firm and insignificant positive for five firms. The link in the long run is also significantly negative for three firms, but negative and not significant for six financial firms. However, it is positive but insignificant for four financial firms, except one that is significant at 5%. Again, as emphasised above, our results in this group 4 of the F-test applied for joint significant level variables show that the F-statistic calculated as shown in Table 3 is less than the upper bound critical value of 5.73, which implies no cointegration. However, if we continue to rely upon the alternative test based on the error correction model, generated as v_{t-1} in Eqn. 4, a negative, less than zero and significant coefficient derived from v_{t-1} supports cointegration, which is the case in group 4 for Financial services.

Next, we examine the results for Group 5 (Oil & Gas). Taking into account the exchange rate-stock market nexus, we find that there is a positive relationship between nominal effective exchange rate and stock prices of five firms, but negative relationship with two firms in the short run. The effect of a change in nominal effective exchange rate is however significant at 5% in BOCGAS while it is almost zero in CONOIL. In the long run, on the other hand, a change in exchange rate has no statistical significance in any of the firms, but the relationship is negative for two firms. It is however positive for the other four firms. For the magnitude of the elasticity coefficients, the results show that the elasticity coefficients are again higher in the long run than the short run for all the firms, except for OANDO. In the long run, the stock prices of two firms are exchange rate elastic, while they are inelastic for four firms. In the short run, however, the stock prices of all the firms are exchange rate inelastic, with the effect almost zero for one firm.

Furthermore, we must ascertain cointegration for our long-run estimates to be validated. Going by the F-test applied for joint significance of lagged level variables, the results reveal that our calculated F-statistic series in Table 3 are far less than the upper bound critical value of 5.73, which means no cointegration. Here also we depend on an alternative test that shows evidence of cointegration. This alternative test is based upon error correction method. We generate the error term from Equation 4 labeled v_{t-1}. A negative significant coefficient obtained for v_{t-1} supports cointegration which is the case in the results for group 5 (Oil & Gas).

Finally, in the linear case, we present results for group 6 (healthcare, pharmaceuticals and agricultural production). We also proceed to determine the long-run and short-run dynamics of the influence of exchange rate changes on stock prices. Particularly in the short run, we find negative but insignificant relationships between nominal effective exchange rate and stock prices of four firms out of the firms investigated. The relationship is however positive and significant between nominal effective exchange rate and the other remaining one firm. The results in the long run exhibit positive and

insignificant relationship between nominal effective exchange rate and stock prices of three firms, while the link is negative for MORISON and PHARMDEKO, but at 10% significance level for PHARMDEKO. Referring to the magnitude of the coefficients of elasticity, we observe that the coefficients are higher in the long run than in the short run. Precisely in the short run, the stock prices of all the firms are exchange rate inelastic. Conversely, in the long run, all firms in group 6 are exchange rate elastic, except for one. Once again, we rely on our error correction concept to determine long-run cointegration since our F calculated for all the series is much less than the upper bound of critical value of 5.73. Since our error correction term obtained for v_{t-1} is negative and significant, it signifies there is long-run cointegration.

As the results in Table 3 show, we observed that the estimated standard errors are very small and almost all the coefficients are statistically insignificant, except for three firms in group one; four firms in group two. The results further established statistical significance in four firms in the financial sector; only one in the Oil & Gas sector; two in Pharmaceuticals and Agriculture sectors. These findings happen to be consistent with the studies by Phylaktis and Ravazzolo (2005); Rahman and Uddin (2009); Bahmani-Oskooee and Saha (2016); among others.

5.2. *Asymmetric stock-exchange rate relationship*

The results for group 1 (Industrial and Construction) in Table 4, show that in the long run, both positive and negative exchange rate changes tend to affect stock prices of the firms differently. A positive change of exchange rate, for instance, negatively affects the stock prices of six out of ten firms in group 1. The effect is statistically significant and negative for three firms. Still in the long run, a negative shock of nominal effective exchange rate has a positive influence on five firms, which is also significant only in one firm. A negative change in exchange rate is also negative and significant in three firms, although the magnitude is higher for negative than positive. The results also indicate that stock prices are exchange rate elastic in the long run in only three firms both for positive and negative changes, in WAPCO for negative changes only, while the price is exchange rate inelastic for the remaining firms.

In the short run, on the other hand, the stock prices reactions to both positive and negative shocks are somewhat similar. For the positive change, five firms respond negatively and the remaining five respond positively. For a negative change in exchange rate, six firms react positively while the remaining four have negative response. In addition, in the short run, all the firms are exchange rate inelastic for both positive and negative shocks. Once again, in order to validate our long-run assessment, we must establish cointegration through either the F-test or ECM (ϑ_{t-1}). Judging from the F-Statistic, there is non-existence of long-run relationship between nominal exchange rate and stock prices for all the firms in this group. However, if the alternative method of ECM is adopted, we establish long-run cointegration as all the error correction terms are negative and significant.

The results for group 2 (Consumer Goods), shows that while currency appreciation (Positive change in nominal exchange rate) has negative long-run effects in 11 out of 14 firms, depreciation has negative effects in 7 firms. The positive change in exchange rate

Table 4. NARDL Regressive Results for Exchange Rate-Stock Price Nexus.

GROUP 1	ASHAKACEM	BERGER	BETAGLAS	CCNN	CAP	FIRSTALUM	WAPCO	CUTIX	JBERGER	UAC-PROP
EX^{+}	-0.3739	-1.1615**	0.0279	0.3437	-0.1290	-0.4052	0.2053	0.0583	-1.6412*	-4.9593**
	(0.6936)	(0.6108)	(0.2483)	(0.3159)	(0.3070)	(0.2774)	(0.2489)	(0.3142)	(0.8632)	(2.2628)
EX^{-}	0.5027	-3.9528***	0.0278	0.3960	0.6794*	-0.4838	-4.2904**	0.0540	-3.9159**	-6.2910
	(0.9262)	(1.2436)	(0.3322)	(0.4223)	(0.4113)	(0.3699)	(2.0373)	(0.4194)	(1.7581)	(4.1210)
ΔEX^{+}	-0.4408	0.0283	0.0278	-0.0716	0.0643	-0.0607	0.2771**	0.0939	-0.2101	-0.0593
	(0.3485)	(0.1418)	(0.3323)	(0.1588)	(0.1542)	(0.1392)	(0.1250)	(0.1578)	(0.2792)	(0.1460)
ΔEX^{+}_{t-1}	0.8415***	0.2722	-0.0471	-0.3592	0.0442	0.3530	-0.1734	0.1139	-0.0019	0.3257
	(0.7829)	(0.3185)	(0.2803)	(0.3566)	(0.3466)	(0.3129)	(0.2810)	(0.3546)	(0.6272)	(0.3283)
ΔEX^{-}	0.9957**	0.0049	-0.1565	0.3367	-0.0300	0.1830	0.3929	-0.0134	-0.2106	0.2911
	(0.8118)	(0.3305)	(0.2907)	(0.3701)	(0.3599)	(0.3242)	(0.2919)	(0.3676)	(0.6505)	(0.3402)
ΔEX^{-}_{t-1}	-0.1936	0.1247	0.0221	0.2962*	0.1243**	0.1187	-0.1726	0.0341	-0.7234	0.1779
	(1.2068)	(0.4913)	(0.4325)	(0.5499)	(0.5346)	(0.4820)	(0.4336)	(0.5465)	(0.9672)	(0.5058)
ϑ_{t-1}	-0.0030**	-0.0066***	-0.0025**	-0.0016	-0.0016	-0.0014	-0.0038***	-0.0032***	-0.0065***	-0.0021
	(0.0014)	(0.0021)	(0.0012)	(0.0015)	(0.0013)	(0.0011)	(0.0013)	(0.0012)	(0.0022)	(0.0018)
Constant	0.0275***	0.0048**	0.0020*	0.0032	0.0039*	-0.0004	0.0029	0.0033***	0.0450***	0.0002*
	(0.0100)	(0.0023)	(0.0020)	(0.0032)	(0.0024)	(0.0006)	(0.0030)	(0.0013)	(0.0087)	(0.0023)
F-Stat.	1.453	3.522	1.509	0.802	0.814	0.618	3.666	2.510	3.073	2.332
LL	6265.7474	6276.4575	6548.0584	6035.056	6096.2077	6312.3372	6542.8286	6048.5218	5581.0448	6215.5649
$\overline{R}^2$	0.16	.018	.004	.033	.006	.0008	.024	.008	.002	.005
No. of Obs.	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113

GROUP 2	VITAFOAM	CHAMPION	NESTLE	CADBURY	FLOURMILL	NASCON	GUINNESS	INTERBREW	DUNLOP	PREMBREW	PZ	UNILEVER	7UP	NB
EX^{+}	-0.0343	-0.3052	-0.2322	-0.4390	-0.2929	0.0807	-1.9511***	-0.3262	-0.6158**	0.0389	-1.6839**	-0.1867	-0.1143	0.0047
	(0.3023)	(0.2720)	(0.2066)	(0.2831)	(0.2591)	(0.5097)	(0.2585)	(0.2498)	(0.2562)	(0.1293)	(0.7794)	(0.2545)	(0.2457)	(0.3168)
EX^{-}	-0.8019**	-0.1661	-3.4165**	0.1972	-0.6746*	-0.2971*	-4.8353***	0.0048	-0.4144	0.0100	-4.2859***	0.0280	-0.3105	-3.3687***
	(0.4039)	(0.3642)	(1.3396)	(0.3781))	(0.3463)	(0.6821)	(0.9842)	(0.3342)	(0.3421)	(0.1728)	(1.5862)	(0.3396)	(0.3290)	(0.9153)
ΔEX^{+}	-0.1637	0.0220	0.1715*	-0.4679***	0.0140	-0.1916	-0.1090	-0.0370	-0.0823	-0.2540***	-0.0464	0.0909	-0.0553	-0.0748
	(0.1519)	(0.1367)	(0.1038)	(0.1455)	(0.1304)	(0.2562)	(0.1296)	(0.1256)	(0.1286)	(0.0651)	(0.1402)	(0.1278)	(0.1234)	(0.1591)
ΔEX^{+}_{t-1}	0.2031	0.0404**	0.1986	-0.0302	0.4360	-0.1327	0.8227***	0.2977	0.4843*	-0.0338	-0.2467	-0.2743**	0.0158	-0.1219
	(0.3413)	(0.3071)	(0.2333)	(0.3196)	(0.2925)	(0.5755)	(0.2915)	(0.2820)	(0.2891)	(0.1461)	(0.3149)	(0.1305)	(0.2774)	(0.3575)
ΔEX^{-}	0.6462*	-0.1908	-0.2759	0.0002	0.6327**	0.4020	0.0286	-0.2744	0.3811	0.0187	-0.3586	-0.0569	0.2061	0.3711
	(0.3539)	(0.3188)	(0.2420)	(0.3318)	(0.3035)	(0.5950)	(0.3023)	(0.2925)	(0.3001)	(0.1513)	(0.3268)	(0.2977)	(0.2877)	(0.3709)
ΔEX^{-}_{t-1}	0.5516	0.0444	-0.4452	-0.2343	1.0150**	0.7056	-0.0478	0.1056	0.1235	0.0213	0.2062	-0.2255	0.1943	0.2094
	(0.5267)	(0.4737)	(0.3597)	(0.4928)	(0.4510)	(0.8876)	(0.4487)	(0.4351)	(0.4458)	(0.2252)	(0.4857)	(0.4421)	(0.4277)	(0.5514)
ϑ_{t-1}	-0.0052**	-0.0013	-0.0047***	-0.0010	-0.0013	-0.0029*	-0.0077***	-0.0006	-0.0012	0.0002	-0.0051*	-0.0034**	-0.0010	-0.0103***
	(0.0024)	(0.0009)	(0.0016)	(0.0012)	(0.0015)	(0.0016)	(0.0023)	(0.0010)	(0.0013)	(0.0009)	(0.0027)	(0.0017)	(0.0011)	(0.0024)
Constant	0.0067***	0.0018*	0.0059*	0.0057	0.0078**	0.0033**	0.0114***	0.0005	0.0003	0.0003	0.0059**	0.0064*	0.0022	0.0083***
	(0.0030)	(0.0010)	(0.0032)	(0.0035)	(0.0032)	(0.0017)	(0.0058)	(0.0008)	(0.0006)	(0.0003)	(0.0043)	(0.0038)	(0.0024)	(0.0050)
F-Stat.	2.521	0.880	2.948	1.036	1.893	1.227	3.884	0.856	0.441	2.430	1.286	1.451	0.280	6.515

(*Continued*)

Table 4. (Continued).

GROUP 1	ASHAKACEM	BERGER	BETAGLAS	CCNN	CAP	FIRSTALUM	WAPCO	CUTIX	JBERGER	UAC-PROP				
LL	6128.118	6736.0188	6936.8061	6266.9428	6452.0989	5025.2875	6462.5185	6530.8101	6478.4339	7925.4968	6299.5781	6496.8505	6567.0372	6038.9344
$\overline{R}^2$	.006	.004	.005	.032	.032	.002	.041	.016	.015	.008	.012	.032	.004	.016
No. of Obs	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113
GROUP 3	AGLEVENT	JOHNHOLT	UACN	NCR	TRIPPLEG									
EX^+	0.0774	0.0151	-3.0857**	-3.7822***	0.0664									
	(0.4492)	(0.2597)	(1.4180)	(0.7789)	(0.1977)									
EX^-	0.2936	-0.0681	-6.6991**	-10.8115***	0.0217									
	(0.5997)	(0.3465)	(2.9827)	(1.5401)	(0.2641)									
ΔEX^+	-0.0514	0.0342	0.0347	-0.0157	0.0057									
	(0.2255)	(0.1303)	(0.1221)	(0.0784)	(0.0993)									
ΔEX^+_{t-1}	-0.1009	-0.0340	0.0092	-0.0037	-0.0775									
	(0.5069)	(0.2931)	(0.2744)	(0.1760)	(0.2232)									
ΔEX^-	-0.2408	0.0896	0.2195	0.0912	-0.0288									
	(0.5252)	(0.3036)	(0.2850)	(0.1826)	(0.2313)									
ΔEX^-_{t-1}	-0.0594	-0.1432	0.6301*	0.0136	0.1664									
	(0.7813)	(0.4516)	(0.4231)	(0.2715)	(0.3439)									
ϑ_{t-1}	-0.0035**	-0.0006	-0.0024*	-0.0032***	-0.0007									
	(0.0016)	(0.0007)	(0.0014)	(0.0008)	(0.0006)									
Constant	0.0019	0.0002	0.0043*	.0014**	0.0002									
	(0.0012)	(0.0007)	(0.0023)	(0.0007)	(0.0005)									
F-Stat.	1.849	0.255	1.584	7.248	0.486									
LL	5295.6082	6452.1438	6590.6226	7538.7093	7026.9208									
$\overline{R}^2$	.08	.027	.007	.047	.051									
No. of Obs	2113	2113	2113	2113	2113									
GROUP 4	AIICO	GUINEAINS	LASACO	LAWUNION	NEM	NIGERINS	WAPIC	ROYALEX	FBNH	WEMABNK	UBN	ACCESS	GTB	UBA
EX^+	-0.4257	-0.2246*	-0.2975	-0.0434	-0.1078	-0.1696	0.3592	0.0555	0.3502	0.2047	0.3085	0.5088*	0.1136	0.4596
	(0.3348)	(0.1150)	(0.2061)	(0.3247)	(0.2511)	(0.2555)	(0.3102)	(0.2692)	(0.2629)	(0.2934)	(0.4673)	(0.2672)	(0.2847)	(0.2934)
EX^-	3.6406**(1.6705)	-0.0887	-0.1826	-0.0213	0.1306	-0.1537	0.9253**	-0.2126	-0.7786**	0.5958	-0.3138	0.1047	-0.5423	-0.0849
		(0.1532)	(0.2749)	(0.4336)	(0.3352)	(0.3417)	(0.4142)	(0.3598)	(0.3514)	(0.3922)	(0.6242)	(0.3576)	(0.3815)	(0.3920)
ΔEX^+	-0.4209***	-0.0818	-0.0025	-0.1026	-0.0458	-0.0560	-0.1599	-0.0220	-0.0566	-0.0796	-0.0381	-0.0999	-0.0408	-0.0537
	(0.1683)	(0.0577)	(0.1034)	(0.1631)	(0.1260)	(0.1284)	(0.1558)	(0.1353)	(0.1322)	(0.1474)	(0.2349)	(0.1344)	(0.1432)	(0.1475)
ΔEX^+_{t-1}	0.5080	0.1599	-0.1782*	0.0311	0.0893	0.1324	-0.4590	-0.0545	-0.1774	-0.2424	-0.2796	-0.4500	-0.0055	0.2548*
	(0.3779)	(0.1296)	(0.1057)	(0.3665)	(0.2833)	(0.2884)	(0.3501)	(0.3039)	(0.2968)	(0.3312)	(0.5275)	(0.3017)	(0.3213)	(0.1508)
ΔEX^-	0.1166	0.1774	0.1221	0.2953	0.3483	0.1061	-0.5646	-0.1284	-0.0399	-0.1466	1.3563***	-0.1958	1.4763***	0.7684**
	(0.3918)	(0.1342)	(0.2408)	(0.3799)	(0.2937)	(0.2991)	(0.3629)	(0.3152)	(0.3080)	(0.3434)	(0.5470)	(0.3133)	(0.3337)	(0.3438)
ΔEX^-_{t-1}	-0.5996	0.0404	0.2005	0.0846	-0.0284	0.5369	-0.9901	0.4192	0.7159	-0.0055	-0.2541	0.2941	-0.0208	0.5576
	(0.5828)	(0.1996)	(0.3581)	(0.5650)	(0.4365)	(0.4449)	(0.5398)	(0.4687)	(0.4580)	(0.5108)	(0.8154)	(0.4653)	(0.4970)	(0.5106)

(*Continued*)

Table 4. (Continued).

GROUP 1	ASHAKACEM	BERGER	BETAGLAS	CCNN	CAP	FIRSTALUM	WAPCO	CUTIX	JBERGER	UAC-PROP				
ϑ_{t-1}	-0.0064***	-0.0002	-0.0020*	0.0001	-0.0032***	-0.0011	-0.0012	-0.0013	-0.0028	-0.0026**	-0.0068***	-0.0026**	-0.0042**	-0.0014
	(0.0019)	(0.0006)	(0.0010)	(0.0013)	(0.0010)	(0.0013)	(0.0011)	(0.0015)	(0.0018)	(0.0011)	(0.0020)	(0.0012)	(0.0017)	(0.0011)
Constant	0.0013	0.0002	-0.0002	-0.0000	-0.0002	5.79e-06	-0.0007	-0.0003	0.0037*	0.0009*	0.0104***	0.0043**	0.0051*	0.0036*
	(0.0008)	(0.0004)	(0.0005)	(0.0007)	(0.0006)	(0.0006)	(0.0007)	(0.0006)	(0.0024)	(0.0008)	(0.0033)	(0.0017)	(0.0035)	(0.0021)
F-Stat.	4.971	0.202	1.247	0.002	3.981	0.278	0.400	0.593	1.253	2.102	4.218	2.139	2.940	1.994
LL	5919.4035	8173.8385	6940.887	5977.8689	6523.3282	6483.6423	6071.9166	6372.8927	6421.4393	6192.9135	5210.6104	6386.5021	6258.2548	6192.0769
$\overline{R}^2$	.013	.32	.11	.022	.057	.049	.032	.024	.04	.041	.018	.034	.018	.044
No. of Obs	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113	2113

GROUP 5	OANDO	CONOIL	FO	MOBIL	TOTAL	BOCGAS
EX^+	0.0468	0.3755	0.0634	-0.1216	0.0420	-0.5505**
	(0.3117)	(0.8029)	(0.2798)	(0.3187)	(0.2225)	(0.2511)
EX^-	0.1642	-0.1805	-0.0014	-0.1861	0.0280	-0.0643
	(0.4163)	(1.0725)	(0.3744)	(0.4261)	(0.2976)	(0.3350)
ΔEX^+	0.1041	0.0627	0.1574	-0.0177	0.1634	-0.3277***
	(0.1565)	(0.4035)	(0.1407)	(0.1600)	(0.1118)	(0.1260)
ΔEX^+_{t-1}	-0.1655	-0.4986	-0.1527	0.1045	-0.0958	0.5527*
	(0.3520)	(0.9065)	(0.3157)	(0.3597)	(0.2513)	(0.2834)
ΔEX^-	0.1862	-0.3907	-0.3592	0.0323	-0.1795	0.4694
	(0.3648)	(0.9398)	(0.3275)	(0.3728)	(0.2605)	(0.2935)
ΔEX^-_{t-1}	-0.4757	0.0331	0.1676	0.2532	-0.3710	-0.0381
	(0.5425)	(1.3976)	(0.4871)	(0.5544)	(0.3873)	(0.4365)
ϑ_{t-1}	-0.0017	-0.0015	-0.0005	-0.0029	-0.0031**	-0.0021*
	(0.0012)	(0.0011)	(0.0006)	(0.0020)	(0.0015)	(0.0011)
Constant	0.0034	0.0059	0.0024	0.0131	0.0137*	-0.0381
	(0.0025)	(0.0112)	(0.0025)	(0.0095)	(0.0071)	(0.4363)
F-Stat.	1.910	0.750	0.613	0.758	1.465	1.131
LL	6068.165	6283.7525	6293.0464	6018.2833	6776.4959	6522.5512
$\overline{R}^2$	.072	.004	.072	.065	.0007	.015
No. of Obs	2113	2113	2113	2113	2113	2113

GROUP 6	GLAXOSMITH	MORISON	PHARMDEKO	OKOMUOIL	LIVESTOCK
EX^+	-1.9619* (0.9557)	-0.0069	0.1688	-0.0289	-0.0580
		(0.2025)	(0.4521)	(0.2495)	(0.2834)
EX^-	-6.1277***	-0.0458	-0.9908	-0.0933	0.3977
	(2.0492)	(0.2700)	(0.6032)	(0.3343)	(0.3783)
ΔEX^+	-0.1775	-0.0135	-0.0379	0.3909***	-0.1178
	(0.1350)	(0.1016)	(0.2269)	(0.1254)	(0.1423)

(*Continued*)

Table 4. (Continued).

GROUP 1	ASHAKACEM	BERGER	BETAGLAS	CCNN	CAP	FIRSTALUM	WAPCO	CUTIX	JBERGER	UAC-PROP
ΔEX^{+}_{t-1}	0.3743	0.0183	-0.2047	0.1403	0.1191					
	(0.3031)	(0.2284)	(0.5103)	(0.2819)	(0.3198)					
ΔEX^{-}	-0.0508	-0.0381	-0.1307	0.2021	0.5891*					
	(0.3149)	(0.2367)	(0.5286)	(0.2924)	(0.3316)					
ΔEX^{-}_{t-1}	-0.1434	-0.0675	0.9980	0.0999	-0.5065					
	(0.4674)	(0.3518)	(0.7861)	(0.4346)	(0.4931)					
ϑ_{t-1}	-0.0042**	-0.0002	-0.0053**	-0.0007	-0.00005					
	(0.0017)	(0.0005)	(0.0020)	(0.0013)	(0.0010)					
Constant	0.0052**	-0.0010	0.0048**	0.0014	0.0011					
	(0.0021)	(0.0007)	(0.0024)	(0.0030)	(0.0008)					
F-Stat.	2.628	0.777	2.373	0.259	0.897					
LL	6379.7373	6979.5604	5280.6353	6533.4218	6266.6432					
$\overline{R}^2$	.027	-.002	-.0004	.005	.073					
No. of Obs	2113	2113	2113	2113	2113					

Notes. EX^{+} and EX^{-} mean log of positive and negative exchange rate of Naira to US dollar (N/USD).LL stands for log-likelihood. ***, **, * represent 1%, 5% and 10% level of significance.

has negative and significant effects for three firms, while a negative change in exchange rate is negative and statistically significant in seven firms. For the elasticity coefficients of exchange rate, two firms' stock prices are exchange rate elastic for currency depreciation while another two firms are exchange rate elastic for both currency appreciation and depreciation, but the impact is more from depreciation than appreciation; however, all other firms in this group 1 are exchange rate inelastic for both negative and positive shocks. Conversely, in the short run, positive and negative shocks appear to exert equal effect on all the firms' stock prices under consideration. A positive shock has significant negative short-run effect on two firms' stock prices, but positive and significant in only one; while a negative shock in the short run is positive and significant in another two firms. Again, to determine long-run cointegration, we rely on either the error correction model or the F-Statistic. Using the F-Statistic, we establish cointegration in one firm with a calculated F-statistic of 6.515, that is above the upper bound critical value of 4.85; the results are inconclusive in one other firm since its F-Statistic calculated (3.884) is between lower bound (3.79) and upper bound (4.85) critical values. Nevertheless, using the ECM, we can observe that there is long-run relationship between nominal exchange rate and the stock prices of all firms in the Consumer Goods sector.

Considering the results for group 3 (conglomerates and ICT), in the long run the results indicate that a positive change in nominal exchange rate leads to a positive response in three firms, while the effect is negative and significant in the remaining two firms. A negative change in exchange rate, however, has a positive impact in two firms, but it has a significant negative effect on three firms. In terms of the degree of elasticity coefficients, two firms are exchange rate elastic both for positive and for negative movements in exchange rate in the long run, while the other firms are exchange rate inelastic, regardless of whether the change is positive or negative. In the short run, on the other hand, the results are rather mixed. There is a negative response from one firm to both negative and positive exchange rate movements; two firms' stock prices respond positively to the negative and positive movements in exchange rate: a positive and negative change in exchange rate has a negative and positive effect on one. The results for one other show that stock price responds positively to positive change in exchange rate while a negative movement in exchange rate has a negative effect on stock prices. In terms of the scale of elasticity coefficients, all the stock prices are exchange rate inelastic in the short run. In order for our long-run assessment to be valid, cointegration must be established and either the F-statistic or ECM establishes it. Using the former, cointegration can be established in only one firm. Again relying on the ECM, we can see that there is cointegration in all the cases.

The results for group 4 (Financial Services), show that in the long run, an appreciation of the local currency has negative influence on stock prices of 6 out of 14 firms but positive influence on the remaining firms, although currency depreciation affects stock prices of 5 firms positively, while the effect is negative for the other 9 firms. For this group, in the short run, stock prices is exchange rate inelastic except for one firm. However, these effects are statistically significant only for five firms and insignificant for the others. In addition, in the short run a positive change in exchange rate is negative and significant for two firms, while a negative change is positive and significant for three firms. In terms of the magnitude of the elasticity coefficients, two firms are exchange rate elastic when there is currency depreciation in the short run, while all

the other stock prices are exchange rate inelastic whether there is an appreciation or depreciation. To ascertain cointegration, we again employed the F-statistics and the error correction terms. Given the results for F-statistics, we can clearly see that out of the 14 firms considered under the financial services sector, long run cointegration is established only in 1 firm. The results are inconclusive in two firms. However, we observed that long-run cointegration is established when the alternative method of ECM is employed for all the firms.

Furthermore, group 5 (Oil & Gas sector) results show that in the short run, four out of six firms respond positively to positive movement in nominal exchange rate while the remaining two firms react negatively when there is currency appreciation. When there is depreciation in currency, however, three firms respond positively while there is negative responce in the stock prices of the other three firms. Similarly, in the long run, currency appreciation continue to persist on the same path as in the short run as the stock prices of the same four firms continue to respond positively and the other two firms continue to respond negatively to positive exchange rate shocks. For a negative shock in nominal exchange rate in the long run, the response is positive and insignificant for two firms, and also not significant but negative for the remaining four firms. In terms of the degree of the elasticity coefficients, all stock prices in the Oil & Gas sector are exchange rate inelastic both in the long run and short run, and for both positive and negative shocks. Once again our F-statistics did not establish cointegration but the ECM did.

The last results are for group 6 (Pharmaceuticals and Agriculture). In the long run, both negative and positive nominal exchange rate changes have a propensity to exert negative impact on stock prices in three out of five firms, although the magnitude is higher for negative than positive in just one of the firms. Among the five firms, four are exchange rate inelastic except for one, which is exchange rate elastic in the long run regardless of whether the exchange rate shock is negative or positive. In the short run though, stock prices for all the firms responded more to positive exchange rate shocks than negative shocks and their response follows the same negative direction as in the long run. The magnitudes of the elasticity coefficients, however, are exchange rate inelastic for both positive and negative shock asymmetries in all cases, with long-run cointegration established given the error correction terms.

Similar to the symmetry case, the asymmetric dynamic model also shows that exchange rate does not have significant impact on the stock prices in most of the firms. The results in Table 4 indicate that the non-linear modeling did not improve the goodness of fit of the models. The adjusted-R^2 (R-squares) are still very small as demonstrated in the table, and negative for two firms. The majority of the parameters are statistically insignificant under the 1%, 5% and 10% conventional levels. As shown in Table 4, the ECM (ϑ_{t-1}) are statistically not significant in most cases. This signifies that there is no long-run relationship between exchange rate and stock prices of most firms. This further conclusion of no long-term equilibrium between stock prices and exchange rates is consistent with the findings of Nieh and Lee (2001), Bahmani-Oskooee and Sohrabian (1992).

6. Conclusion

In this study, we investigated the exchange rate-stock price relationship at firm level in Nigeria for the period from December 12, 2001 to December 8, 2017. More pointedly, we examined whether the stock prices of the individual firms responded asymmetrically to changes in exchange rate. Several studies have been carried out on the relationship between exchange rate and stock prices particularly at the country and industry levels; this study emerges to rigorously investigate non-linearities in exchange rate-stock price relationship using firm-level data. We follow Bahmani-Oskooee and Saha's (2016) recommendation and approach and determine whether exchange rate changes have symmetric or asymmetric effects on stock prices in 54 firms in Nigeria. We adopted Shin et al. (2014) asymmetric ARDL model. To perform reasonable comparative analyses, the symmetric version was also estimated.

Considering the linear model, we found the relationship between exchange rate and stock prices to be insignificant in most firms. A plausible reason could be the role played by the government and monetary authorities (CBN) in managing the exchange rate. These facts are observed in both the short run and long run for all the six groups. Similarly, for the NARDL approach, we found that exchange rate changes do not have asymmetric effects on stock prices for almost all the firms.

What this indicates is that the semi-floating exchange rate policy being managed by the authorities certainly facilitates the shielding of the Nigerian stock market from the effects of exchange rate fluctuations. In terms of investment tactics, financiers could make short-term investments in the Nigerian stock market without taking into consideration the exchange rate exposure. However, for long-term investments, the asymmetric exchange rate exposure should be cautiously monitored. Nevertheless, the recent semi-floating exchange rate policy regime might also accelerate the speed of the Nigerian currency becoming more flexible and tradable in the foreign exchange market. Moreover, the monetary authorities may need to reconsider the strict use of exchange rate as a policy tool to attract foreign portfolio investment. Instead, other tools such as interest rates may be complementarily deployed with a view to producing a favourable investment environment. Added to these is the fact that an increasing number of Nigerian enterprises are expanding their businesses overseas. Hence, the potential asymmetric exchange rate exposure could become very effective and, for this reason, Nigerian firms need to contemplate workable mechanisms for hedging against currency exposures.

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APPENDIX

Table A1. List of Firms Arranged in Groups.

Group One: Industrial and Construction	Group Two: Consumer Goods	Group Three: Conglomerates and ICT IT Services
ASHAKACEM	VITAFOAM	AGLEVENT
BERGER	CHAMPION	JOHNHOLT
BETAGLAS	NESTLE	UACN
CCNN	CADBURY	NCR
CAP	FLOURMILL	TRIPPLEG
FIRSTALUM	NASCON	
WAPCO	GUINNESS	
CUTIX	INTERBREW	
JBERGER	DUNLOP	
UAC-PROP	PREMBREW	
	PZ	
	UNILEVER	
	7UP	
	NB	
Group Four: Financial Services: Banks, Insurances and other financial institutions	**Group Five: Oil & Gas: Services and petroleum products distribution**	**Group Six: Healthcare Pharmaceuticals and Agricultural Production**
AIICO	OANDO	GLAXOSMITH
GUINEAINS	CONOIL	MORISON
LASACO	FO	PHARMDEKO
LAWUNION	MOBIL	OKOMUOIL
NEM	TOTAL	LIVESTOCK
NIGERINS	*BOCGAS*	
WAPIC		
ROYALEX		
FBNH		
WEMABNK		
UBN		
ACCESS		
GTB		
UBA		

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