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ABSTRACT

The study examined the impact of exchange rate and interest rate on stock prices in Nigeria using monthly data from January 1996 to December 2022. The key variables of interest were interest rate, exchange rate, and stock prices. The study also employed other variables like the oil price and inflation as control variables (given their important considerations to equity investors). The Autoregressive Distributed Lag (ARDL) estimation technique was adopted, and the result revealed that no long-run impact exists between the all-share index, exchange rate, and interest rate. However, in the short run, the oil price and exchange rate in the previous period and the all-share index in the previous period were significant in explaining the all-share index. In addition, the relationship between the exchange rate and the all-share index was negative, while the oil price has a positive relationship with the all-share index. Thus, it is important for the monetary authority to ensure the stability of the naira in order to encourage investors, thereby reducing the volatility of their investment and enabling investors to make informed investment decisions.

Keywords: All-share index, ARDL, Exchange rate, Interest rate, Stock prices.

JEL Classification: E42, E43, E44, E52, E53

INTRODUCTION

The stock market has been globally acclaimed for playing an important role in mobilizing domestic resources for investment, contributing to the growth and expansion of listed companies, resulting in increased productivity and employment in an economy. It plays a fundamental role in the creation and development of a robust and competitive economy (Babangida and Khan, 2021). In recent years, stock markets have become an integral part of many countries' economies. This increasing importance of stock markets has motivated economists to predict stock prices and financial returns. In addition, the estimation of stock market fluctuations is an important practice among investors and policymakers. It is especially important to obtain information on how various sectors are affected by changes in a country's macroeconomic variables (Türkyılmaz and Balıbey, 2013).

Macroeconomic performance is closely linked to the performance of the capital market. Thus, stock market performance and the central bank's monetary policy have become issues of policy discourse among economic researchers. In view of this development, monetary policy tools are being influenced by monetary policy authorities to achieve macroeconomic goals, as well as to control possible threats to financial system stability (Babangida and Khan, 2021). The stock market is part of the financial system, and a healthy financial system promotes economic growth by

allocating resources in an appropriate and effective manner. Its significance and contribution to achieving economic growth as a component of the financial system are essential. The functioning of the stock market depends on investors' buying and selling decisions, which are influenced by several economic factors. The stock market is a risky one when it experiences frequent changes in the prices of stocks, for which investors are always interested in being informed about the factors impacting stock prices and the extent of such impact (Fahlevi, 2019). Stock prices and stock returns have informative characteristics regarding the current conditions of a country's macroeconomic performance. While stock prices are affected by various internal factors such as monetary policy decisions, capital structure, changes within the firm or in the industry where the firm is operating, and external factors such as inflation, interest rates, and exchange rates.

When monetary authorities pursue a contractionary monetary policy for price stability, a rise in interest rates urges investors to sell stocks in order to benefit from higher interest rates, which will lead to a decline in stock prices, implying a negative correlation between interest rates and stock prices. Exchange rates also have an impact on stock prices through international competitiveness, which will, in turn, affect firms' cash flows and stock prices defined as the present value of future cash flows of companies (Frenkel 1976, 1983; Branson 1981). On the other hand, a rise in stock prices increases the demand for domestic assets and hence domestic currency, which will cause an upward shift in exchange rates. Along with the increase in demand for domestic assets and demand for money, interest rates will rise, inducing capital inflows to the home country. While these two rationales posit a positive relationship between exchange rates and stock prices, some results can be found pointing out that there is no relationship between these variables as they are affected by different factors (Gavin 1989).

The Nigerian Stock Exchange, now known as the Nigerian Exchange Group, was founded in 1961 to examine the viability of security exchanges in Nigeria. Operations started with just nineteen securities listed for trading. The market has grown with a total market capitalisation of 28.7 trillion Naira as at the 17th of January 2023, and over 250 listed securities comprising both equities and fixed-income securities. It services the second-largest financial centre in sub-Saharan Africa. The NSE has continued to evolve to meet the needs of numerous investors and achieve a high level of competitiveness globally. Along with securities listing and trading services, the Exchange offers other services such as market indices, provision of market data, and supplementary technology services, among others. Transactions on the stock exchange are electronically settled through the Central Securities Clearing Systems Plc (CSCS). The Automated Trading System (ATS), where dealers on the exchange are able to trade through a network of interconnected servers through a computer system, was launched by the Nigerian Stock Exchange on 27 April 1999. This provides a facility for remote trading and surveillance. In order to encourage foreign investment into Nigeria, the Federal Government of Nigeria abolished legislation preventing the flow of foreign capital into the country. This has made it possible for foreign market participants such as dealers and brokers to enlist on the Nigerian Stock Exchange and for individual investors to hold listed Nigerian securities. Companies incorporated in Nigeria and listed on the Nigerian Stock Exchange are also open and allowed multiple and cross-border listings on foreign stock exchange markets. This brings to the fore the implications accompanying the CBN's monetary policy implementations and decisions as it concerns the interest rate and exchange rate. Investors will thus take cognisance of the interest rate and exchange rate developments and policies as one of the factors underlying their investment decisions. The CBN will also be interested in the happenings

and developments affecting the financial markets and the stock exchanges and how they affect monetary policy decisions. Furthermore, given the country's dependence on crude oil as the main source of foreign exchange earnings and the volatility associated with oil prices, the exchange rate has been very unstable over the years. This has contributed to the continuous depletion of the external reserves and difficulty in repatriating the gains from the equity market by foreign investors. On the other hand, movements in currencies can have a substantial impact on the returns from foreign investments. When investments are made in securities denominated in an appreciating currency, total returns are improved. However, investing in securities denominated in a depreciating currency can reduce profits. Investors, therefore, seek correlations and observe the behaviour of exchange rates to enable them to predict future price movements in stocks and make informed financial decisions.

EMPIRICAL LITERATURE

Several studies have found a positive relationship between exchange rates and stock prices (Nwankwo, 2018), while others have found a negative relationship. The impact of interest rates on stock prices has been widely studied in the literature, with some researchers finding a positive relationship between interest rates and stock prices, while others have found a negative relationship (Bello, 2018). The direction and strength of the relationship between interest rates and stock prices depend on several factors, including the stage of the business cycle, the level of economic growth, and the level of risk tolerance of investors (Nwankwo, 2018). The literature is vast with studies examining the relationship among interest rates, exchange rates, and stock prices, especially in other climes. However, there is a dearth of studies of this relationship in Nigeria. This study, therefore, filled the gap by employing more robust econometric techniques, high frequency, and recent time series data on the variables of interest.

Mensah and Wereko (2020) examined the impact of exchange rate and interest rate volatility on stock returns, considering three major African countries: Ghana, Nigeria, and South Africa, using EGARCH and TGARCH models for estimation purposes and monthly data from January 2001 to December 2018. Evidence from the analysis suggests that asymmetry in the conditional volatility of the stock market is weak, while a positive shock to interest rates and exchange rates leads to a persistent increase in the stock price level over the period under investigation. The results under both methods were, however, mixed. In addition, the 2007 financial crisis influenced the conditional volatility of the markets within these periods of study, due to the interwovenness with the global stock markets. It also shows that positive news and good market conditions tend to influence volatility more than bad news. Adeniyi and Kumeka (2020) employed the ARDL technique on the daily data of 54 firms from December 1, 2001, to December 8, 2017. In the linear ARDL model, the exchange rate does not exert a significant impact on stock prices in most of the firms. While in the NARDL, exchange rate movements do not impact asymmetrically, the stock price in almost all firms. This means that financial investors would not benefit solely by using exchange rate movements to make decisions on the stock market. Also, monetary authorities might consider other means of policy controls in attracting foreign investment.

"In high and low-interest rate environments," by Salisu and Vo (2021), examined the behaviour of exchange rates and stock returns. The authors sought empirical evidence between nine industrialised economies whose interest rates are generally shown to fall significantly below the

threshold for a low-interest rate environment and nine selected emerging economies that sufficiently lie above the 1.25% threshold to qualify among the high-interest rate environment. The technique for analysis was the panel ARDL with weekly data. Findings from the analysis revealed differences in the relationship between the high and low-interest rate environment, both in the long run and short run. Also, there is a difference in the impact of exchange rates on stock returns, with a more prominent negative relationship in the short run and in a high-interest rate environment, and a prevalent positive relationship in the long run with stronger impacts in the low-interest rate environment compared with the high-interest rate environment. In addition, comparing exchange rate appreciation and depreciation, and negative and non-negative low-interest rates show that no further asymmetric effects may be expected other than the distinct findings found for the short run and long run, as well as the dissimilar findings found for the low and high-interest rate environments. These have the implication of shaping monetary policy decisions as well as providing guidance to international investors in targeting profitable investment decisions. In addition, it signals to emerging economies to learn from advanced economies that have steadily pursued a deliberate low-interest rate policy that appears to favour businesses (by removing uncertainties) and resulted in consistent investment yields. Similarly, a study by Adebayo (2021) used multiple regression analysis to investigate the impact of interest rates and exchange rates on the stock market in Nigeria. The results of this study showed that changes in interest rates had a positive impact on the stock market, while changes in exchange rates had a negative impact on the stock market. The study also found that the effect of interest rates on the stock market was more significant compared to the effect of exchange rates.

In another study, Badejo (2021) used time series analysis to examine the relationship between interest rates, exchange rates, and the stock market in Nigeria. The results of this study showed that changes in interest rates had a positive impact on the stock market, while changes in exchange rates had a negative impact on the stock market. The study also found that the effect of interest rates on the stock market was stronger compared to the effect of exchange rates. Gokmenoglu et al. (2021) examined the relationship between exchange rates and stock prices using the quartile-on-quartile approach. Findings revealed that unless specific market conditions are satisfied, exchange rate changes do not affect stock market performance. A study on the dynamics of oil price, exchange rate, and trade performance of quoted industrial sectors of the all securities market in Nigeria by Ajeigbe (2022) revealed a long-run relationship among oil price, exchange rate, and trade performance. The results from the PVECM showed that oil price and exchange rate are negatively related to the trade performance of the industrial sectors of the stock market. However, there was a positive relationship between oil price and exchange rate. This implies that a rise in oil price will lead to the appreciation of the dollar.

Biala and Oladejo (2022) investigated the nature of the relationship between exchange rates and stock prices in Nigeria. The study employed the ARDL bound test for estimation purposes. The results revealed a positive relationship in the first lag of the all-share index and a negative relationship in the second lag. The exchange rate, on the other hand, was found to have a negative and insignificant relationship with the stock prices. Money supply was insignificant and positive, while interest was negative in the short run. In the long run, the exchange rate was revealed to have a negative and significant impact on stock prices; money supply was positive and significant; and interest rate negative and insignificant. The result further revealed no causal relationship between

the exchange rate and stock price in Nigeria in the short run, while there exists a uni-directional causality from stock price to exchange rate in the long run.
Moussa and Delhoumi (2022) investigated the impact of interest rates and exchange rates on the stock market of MENA economies: Tunisia, Morocco, Egypt, Turkey, and Jordan. Non-linear ARDL with daily data from June 1998 to June 2018 was employed, and the results indicated a cointegrating relation between stock prices, interest rates, and exchange rates. In addition, stock returns were found to be sensitive to changes in interest rates and exchange rates in the short term. Thus, the impact of these macroeconomic variables in the MENA region cannot be emphasized.

METHODOLOGY

The study used secondary monthly time series data for the period 1996 to 2022, obtained from the Central Bank of Nigeria Statistical Bulletin. Monthly data from the period 1996 to 2022 for All Share Index (ASI), exchange rate (exchange rate used was the interbank exchange rate), interest rate, inflation, and oil price were obtained. The interbank exchange rate captures the rate that banks sell to themselves before adding a margin to sell to customers and clients. The central bank sells foreign currency directly to the banks, who then sell to individuals for investment and other purposes. Inflation and oil price were included as control variables given their influence on the decisions of investors in the equity market. Inflationary tendencies contribute to investment decisions of individuals; likewise, being an oil-dependent country, an increase in the prices of crude oil will improve liquidity in the economy and consequently improve stock investment. Also, given the influence and considerations of monetary policy decisions, this study considered the use of the maximum lending rate, as it is hinged on the monetary policy rate. This enables us to gauge how the Central Bank's monetary policy affects stock prices.

The time series properties of the data are tested using the Unit root test, Granger causality tests for the direction of causality of the variables, ARDL bound cointegration test to test the existence of a long-run and short-run relationship between the variables and also to estimate the coefficient of the long-run cointegrating relationship. We also adopt the ARDL error correction model to estimate the short-run relationship and the coefficient of the parameters. The study attempts to investigate the impact of exchange rate and interest rate on stock prices. In this case, stock prices are being proxied by the All-Share Index, and represent the dependent (exogenous) variable. Exchange rate refers to the value of the Nigerian currency relative to the US Dollar, and the interest rate employed for the study is being proxied by the maximum lending rate. The maximum lending rate is the rate that commercial banks charge when lending to customers with low credit ratings. The maximum lending rate is anchored on the Monetary Policy Rate (MPR). Exchange rate and interest rate are the independent variables of interest, while inflation and money supply are added for control purposes.

The functional form of the relationship between the variables of interest is expressed as follows:

$$\mathrm{ASI} = \mathrm{f}(\mathrm{EXC}, \mathrm{INT}, \mathrm{INF}, \mathrm{OILP}) \quad (1)$$

The empirical model to be estimated is given as:

$$\Delta ASI_t = \delta_{0i} + \sum_{i=1}^{k} \alpha_1 \Delta ASI_{t-1} + \sum_{i=1}^{k} \alpha_2 \Delta EXC_{t-1} + \sum_{i=1}^{k} \alpha_3 \Delta INT_{t-1} + \sum_{i=1}^{k} \alpha_4 \Delta INF_{t-1} + \sum_{i=1}^{k} \alpha_5 \Delta OILP_{t-1} + \delta_1 ASI_{t-1} + \delta_2 EXC_{t-1} + \delta_3 INT_{t-1} + \delta_4 INF_{t-1} + \delta_5 OILP_{t-1} + \varepsilon t \quad (2)$$

Where
ASI is the All-Share Index,
EXC is the Exchange rate,
INT is the Interest rate,
INF is the inflation rate,
and α0, α1, α2, α3, α4, α5 are parameters to be estimated.

t is expected that a significant relationship exists between the dependent variable (ASI) and the independent variables (EXC and INT). However, we expect a positive relationship between the exchange rate and stock prices. This means that an improvement in the value of the naira will deepen the financial market, leading to an increase in stock prices and encouraging investor participation in the stock market. For the interest rate, we expect a negative relationship with stock prices. This is because an increase in the MPR will lead to repricing in the equity market and bring about uncertainty in future earnings. This will discourage investors from investing in the stock market and instead invest in the fixed income market due to a much higher yield in the fixed income market. Improvement in the price of oil is expected to improve liquidity in the system and positively affect stock prices, while a high level of inflation in the system will discourage investment and lead to a negative effect on stock prices.

The study employs the ARDL approach developed by Pesaran et al. (2001) to examine the relationships among the variables in the model. The justifications for choosing the ARDL approach are: first, ARDL can be applied irrespective of whether the variables are stationary at the level value I (0) or after the first difference I (1) or a combination of both (i.e., I (0) or I (1)). Second, it can generate robust and reliable results whether the sample size is small or large. In addition, ARDL may yield non-biased long-run estimated coefficients with t-value (Narayan & Smyth, 2005). Lastly, it simultaneously generates long-term and short-term results (Pesaran et al., 2001). Where the variables are found to have a long-run cointegrating relationship, the ARDL can be used to estimate the long-run coefficient. This enables us to measure the extent of the long-run relationship existing between the variables. The general form of the ARDL given by Pesaran (1997) is specified as:

$$\Delta Y_t = \delta_{0i} + \sum_{i=1}^{k} \alpha_i \, \Delta Y_{t-1} + \sum_{i=1}^{k} \alpha_2 \, \Delta X_{t-1} + \delta_1 Y_{t-1} + \delta_2 X_{t-1} + \varepsilon t \quad (3)$$

$$\Delta X_t = \delta_{0i} + \sum_{i=1}^{k} \alpha_i \, \Delta X_{t-1} + \sum_{i=1}^{k} \alpha_2 \, \Delta Y_{t-1} + \delta_1 X_{t-1} + \delta_2 Y_{t-1} + \varepsilon t \quad (4)$$

Equations 3 and 4 have lags of both the dependent and independent variables. Where k is the ARDL model maximum lag order. The ARDL specification for our model is expressed as:

$$\Delta ASI_t = \delta_{0i} + \sum_{i=1}^{k} \alpha_i \, \Delta ASI_{t-1} + \sum_{i=1}^{k} \alpha_2 \, \Delta EXC_{t-1} + \sum_{i=1}^{k} \alpha_3 \, \Delta INT_{t-1} + \sum_{i=1}^{k} \alpha_4 \, \Delta INF_{t-1} + \sum_{i=1}^{k} \alpha_5 \, \Delta OILP_{t-1} + \delta_1 ASI_{t-1} + \delta_2 EXC_{t-1} + \delta_3 INT_{t-1} + \sum_{i=1}^{k} \delta_4 \, \Delta INF_{t-1} + \sum_{i=1}^{k} \delta_5 \, \Delta OILP_{t-1} + \varepsilon t \quad (5)$$

The hypothesis that the coefficients of the lag level variables are zero is to be tested. The null hypothesis of non-existence of the long-run relationship is defined as follows:
Ho: δ1 = δ2= 0 (null, i.e., the long-run relationship does not exist)
H_1: δ1 ≠ δ2 ≠ 0 (alternative, i.e., the long-run relationship exists)
The ARDL-ECM model established by Peseran and Peseran (1997) is expressed as:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta Y_{t-1} + \sum_{j=0}^{q1} \gamma_j \Delta X_{1t-j} + \sum_{k=0}^{q2} \delta_k \Delta X_{2t-k} + \varphi Z_{t-1} + e_t \quad (6)$$

Z is the error correction term that connects both the long run and the short run model, thus, representing the ECM. The test involves computing the F-statistic and comparing it against the lower bound and upper bound to determine if there is cointegration. The presence of cointegration will be indicated if the estimated F-statistic is higher than the upper bound value. However, evidence of no cointegration is reflected when the result of the F-statistic falls below the lower bound. Khan and Khan (2018) state that if the values fall between the two bounds, lower and upper, the result will be inconclusive.

RESULTS AND DISCUSSION

Table 1. Descriptive statistics of the variables

	ASI	EXC	INT	INF	OILP
Mean	25427.58	183.774	24.61676	12.8562	59.46133
Median	25296.42	148.94	24.575	12.16	57.23
Maximum	65652.38	460	32.27	47.56	138.74
Minimum	4890.8	75.3	17.17	-2.49	10.22
Std. Dev.	13869.57	100.2558	4.135633	6.21012	33.17313
Skewness	0.300579	1.172163	0.090767	1.421449	0.416644
Kurtosis	2.508632	3.106267	1.793946	8.723366	2.087706
Jarque-Bera	8.138244	74.3466	20.08155	551.3262	20.60978
Probability	0.017092	0.000	0.000044	0.000	0.000033
Sum	8238537	59542.79	7975.83	4165.41	19265.47
Sum Sq. Dev.	6.21	3246548	5524.417	12456.69	355447.5
Observations	324	324	324	324	324

Source: Author's compilation from EViews 12, 2023

The statistical properties of the variables under investigation are presented in Table 1. From Table 4.1, the data was collected for 324 months, i.e. 27 years. The mean of ASI between the periods 1996 to 2022 is 25427.58, the mean exchange rate is 183.77 naira per dollar, while interest rate, inflation, and oil price are 24.62, 12.85, and 59.46 respectively. In terms of variation, ASI has the highest standard deviation of 13869.57. Interest rate has the least deviation from its mean. The maximum value of ASI was 65652.38 while the minimum was 4890.8. The maximum value of exchange rate, interest rate, inflation, and oil price during these periods were 460, 32.27, 47.56, and 138.74 respectively. The minimum, on the other hand, were 75.3, 17.17, -2.49, and 10.22 respectively. The p-values of the Jarque-Bera statistics of the variables showed that the sample data do not follow a normal distribution, and that standard errors are not normally distributed.

Table 2. Correlation matrix

	ASI	EXC	INT	INF	OILP
ASI	1				
EXC	0.544938	1			
INT	0.039046	0.625541	1		
INF	-0.10738	0.178761	0.051272	1	
OILP	0.732001	0.302143	-0.06295	-0.15123	1

Source: Author's compilation from E-iewws 12, 2023

Table 2 summarizes the correlation matrix. It shows that ASI is positively correlated with the exchange rate, interest rate, and oil price. The correlation with oil price is strong while its correlation with interest rate is weak (approximately 4 percent). Whereas, ASI has a low and negative correlation with inflation (11 percent). This implies that when there is inflation, it is expected that share prices will fall, while an increase in interest rate and oil price will increase share price. The correlation between interest rate and exchange rate is also strong and positive, oil price and exchange rate are weak and positive; oil price with interest rate is weak and negative; while oil price with inflation is also weak and negative.

Table 3. Unit Root Tests

Null Hypothesis: the variable has a unit root						
At Level						
		LNASI	LNEXC	INT	INF	LNOILP
With Constant & Trend	t-Statistic	-2.207	-1.7075	-1.8472	-3.8614	-2.3024
	Prob.	0.4836	0.746	0.6793	0.0148	0.431
					**	
At First Difference						
		d(LNASI)	d(LNEXC)	d(INT)	d(INF)	d(LNOILP)
With Constant & Trend	t-Statistic	-6.6064	-16.4595	-11.6938	-8.0043	-13.1051
	Prob.	0	0	0	0	0
		***	***	***	***	***8
Order of integration		I(1)	I(1)	I(1)	I(0)	I(1)
Notes:						
(*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1%						
Lag Length based on AIC						

Source: Author's compilation from E-iewws 12, 2023

It is important to investigate the properties of the time series data. This was achieved by conducting the stationarity test using the Augmented Dickey Fuller (ADF) test. The constant and trend were found to be significant, and therefore, the result of the unit root is presented at both levels and first difference. The result of the unit root at levels and first difference is presented in Table 3. The ADF procedure was conducted by integrating the intercept and trend to ensure the robustness of the result. The intercept and trend were also found to be significant. Judging from the test statistics and the p-value, the test showed that the variables All-Share Index, exchange rate, interest rate,

and oil price are not stationary at levels but rather at first difference and thus integrated of order I(1), while inflation is stationary at levels, thus integrated of order I(0). None of the variables is found to be integrated of order 2 or beyond, which buttresses the choice of the ARDL estimation technique. It is therefore clear to adopt the ARDL method of co-integration since the result depicts I(0) and I(1).

Lag length selection and Model Selection Criteria

In establishing the lag length suitable for establishing cointegration in the model, the unrestricted Vector Auto Regression was used. A lag length of 2 based on Akaike Information Criterion (AIC) was found to be more appropriate. The top 20 models based on the AIC are presented in Table 4. The variables were found to be a mix of integrated of order 1 and order 0. To find a cointegrating relationship, the two steps were followed: Lag length selection and ARDL bound test.

Table 4. Lag selection based on AIC

VAR Lag Order Selection Criteria						
Endogenous variables: LNASI LNEXC INT INF LNOILP						
Exogenous variables: C						
Sample: 1996M01 2022M12						
Included observations: 320						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2287.26	NA	1.147089	14.32661	14.38549	14.35012
1	352.5524	5180.628	9.16E-08	-2.01595	-1.662672*	-1.874881*
2	384.9092	62.48906	8.75e-08*	-2.061933*	-1.41425	-1.8033
3	406.9971	41.96692*	8.92E-08	-2.04373	-1.10165	-1.66754
4	416.5438	17.84054	9.83E-08	-1.94715	-0.71067	-1.4534

Source: Author's Compilation from EViews 12, 2023
* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

ARDL Cointegration Test

The co-integrating relationship of the variables is estimated by the bound test. Table 5 summarily depicts the results from the bound test. I(0) is the lower critical bound value, and I(1) is the upper critical bound value. k is the number of independent variables in the ARDL model.

The result presented in Table 5 indicates that there is no co-integrating relationship between the dependent and independent variables. This is explained by the F-statistics, the upper bounds, and the lower bounds. According to the ARDL estimation technique, if the F-statistics are higher than the upper bounds, we conclude that there exists a co-integrating relationship, and if the F-statistics are lower than the lower bounds, it means that there is no co-integrating relationship among the variables. In the case of the model, at a 5 percent level of significance, the F-statistics are

approximately 1.94, and are lower than the lower bound; hence, we conclude that there is no long-run relationship among All-Share Index, exchange rate, interest rate, inflation, and oil price.

Table 5. Long run form and Bound Test

Dependent Variable: D(LNASI)				
Selected Model: ARDL(2, 2, 0, 1, 0)				
Sample: 1996M01 2022M12				
F-Bounds Test	Null Hypothesis: No levels relationship			
Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	1.936708	10%	1.9	3.01
K	4	5%	2.26	3.48
		2.50%	2.62	3.9
		1%	3.07	4.44
Actual Sample Size	322	Finite Sample: n=80		
		10%	-1	-1
		5%	-1	-1
		1%	-1	-1
t-Bounds Test	Null Hypothesis: No levels relationship			
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-1.24119	10%	-1.62	-3.26
		5%	-1.95	-3.6
		2.50%	-2.24	-3.89
		1%	-2.58	-4.23

Source: Author's compilation from EViews 12, 2023

Short Run Estimation

The estimation did not establish any cointegration (long-run relationship) among the macroeconomic variables employed in the model. The short-run result of the model is presented in the conditional error correction table, also known as the differenced ARDL. This is depicted in Table 6.

The short-run coefficients indicate that in the short run, a positive relationship exists between a lagged period of exchange rate, oil price, a lagged period of oil price, and the All-Share Index, and are both significant at a 10 percent level of significance. The short-run relationship with oil price is also significant at a 5 percent level of significance. This means that an appreciation in the value of the naira improves the exchange rate of the country and consequently leads to investment in the stock market by foreign investors as well as local investors. In addition, the coefficients explain that, for a one percent increase in a previous oil price, the All-Share Index increases by 7.33 percent. A percentage increase in the exchange rate in a previous period would decrease the All-Share Index by 20.44 percent. Also, an increase of 11.33 percent in the All-Share Index is caused by a lagged period of the All-Share Index. A percentage increase in the exchange rate would increase the All-Share Index by 17.18 percent. This result is consistent with Ayub and Masih

(2013), who found a positive and significant relationship with only the exchange rate in the short run. Musawa and Mwaangwa also found that the exchange rate impacts stock prices in the short run only. Also, for the oil price, an increase in the price of crude oil means more revenue and liquidity in the economy. This will increase investment and boost the performance of the stock market. In the short run, the lag of the All-Share Index influences the current stock index, while for interest rate and inflation, the short-run relationship with the All-Share Index is a function of its lag and differenced term. The interest rate has a negative relationship with the All-Share Index in the short run, while inflation has a positive relationship. This implies that an increase in interest rate will lead to a lower stock price and an increase in inflation will inflate stock prices. This resonates with the study of Okechukwu et. al (2019), who also found a positive relationship with the exchange rate and inflation and a negative relationship with interest rates. However, this conflicts with the study by Adebayo (2020), where a positive relationship was established between stock price and interest rates and a negative relationship between the exchange rate and stock price. The ECM, which represents the speed of adjustment of the All-Share Index after a change in the other independent variables, has a value that is negative, significant, and less than 1. This means that the model is stable, and it therefore takes approximately 0.9 percent for equilibrium to be restored.

Table 1. Short run Estimated Result

Dependent Variable: D(LNASI)				
Selected Model: ARDL(2, 2, 0, 0, 1)				
Included observations: 322				
Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNASI(-1)*	-0.00871	0.007018	-1.24119	0.2155
LNEXC(-1)	0.01771	0.016566	1.069086	0.2859
INT**	-0.00029	0.001349	-0.21274	0.8317
INF**	0.000978	0.000676	1.446367	0.1491
LNOILP(-1)	-0.0003	0.008934	-0.03308	0.9736
D(LNASI(-1))	0.117286	0.056185	2.087514	0.0377
D(LNEXC)	-0.17177	0.119121	-1.44196	0.1503
D(LNEXC(-1))	-0.20436	0.121098	-1.68756	0.0925
D(LNOILP)	0.073329	0.033227	2.206946	0.028
CointEq(-1)*	-0.00871	0.002781	-3.13166	0.0019

* p-value incompatible with t-Bounds distribution. ** Variable interpreted as Z = Z (-1) + D(Z).
Source: Author's compilation from EViews 12, 2023

Causality Test

The relationship between the All-Share Index and the exchange rate, interest rate, inflation, and oil price, based on the ARDL estimation techniques, showed no long-run relationship exists. In establishing the short-run causality of the model, the Wald test was employed. The Wald test is used to show the significance of the variables in the model. It means when a variable is restricted to zero and is significant, then such a variable improves the model. It tests the hypothesis that $\alpha 0$

(null hypothesis: α0 = 0). It suggests that the estimate of α significantly improves the model fit, and the variable is significant.

If the test rejects the null hypothesis, this suggests that the variables are significant for the model fit. However, if the null hypothesis is not rejected, it means that removing the variables from the model will not damage the fit of the model. Table 7 shows the result of the Wald test. The Wald test is used to show the significance of the variables in the model. From the result, the significance of the F-statistics and the Chi-square indicated that short-run causality exists between the dependent and independent variables. Consequently, the exchange rate, interest rate, inflation, and oil price are significant for the model fit and improve the model in the short run. Causality between the variables is determined by employing the Granger causality test and the Granger causality/Wald endogeneity test for robustness purposes.

Table 2. Wald Test. Short-run Causality (Restrictions are linear in coefficients)

Wald Test:			
Test Statistic	Value	df	Probability
F-statistic	852406.8	(9, 313)	0.0000
Chi-square	7671661.	9	0.0000
Null Hypothesis: C(1)=C(2)=C(3)=C(4)=C(5)=C(6)=C(7)= C(8)=C(9)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(1)		1.108576	0.056322
C(2)		-0.1173	0.056185
C(3)		-0.1718	0.119121
C(4)		-0.0149	0.173865
C(5)		0.204360	0.121098
C(6)		-0.0003	0.001349
C(7)		0.000978	0.000676
C(8)		0.073329	0.033227
C(9)		-0.0736	0.032953

Source: Author's compilation from EViews 12, 2023

Table 8. Granger/Wald Endogeneity

Wald Test/					
Dependent Variable	LNEXC	INT	INF	OILP	LNASI
LNASI	S	NS	NS	NS	
LNEXC		NS	NS	S	NS
INT	NS		NS	NS	S
INF	NS	NS		NS	N
OILP	S	NS	NS		S
** at 10 percent					
S= significant					
NS=not significant					

Source: Author's compilation from EViews 12, 2023

The Wald test results indicate that causality runs from the exchange rate to the all-share index, from the all-share index to oil price, from the all-share index to interest rate, and there is bi-

directional causality between oil price and exchange rate. This corresponds with the results of the pairwise causality tests.

Model Diagnostics

To demonstrate the robustness and reliability of the model, the residuals must be free from white noise. Several diagnostic tests were performed, including the stability test, CUSUM, CUSUM squares, serial correlation test, normality, and heteroscedasticity tests.

Model Stability Test

The stability of the model is diagnosed with the CUSUM and CUSUMSQ tests. The CUSUM test shows that the model is stable, as indicated by the critical line falling within the 5 percent critical level of significance. Figure 2 shows the CUSUM test. However, the CUSUMSQ test shows that the model is not fully stable, likely due to breaks in 2001m7 to 2008m12, corresponding to the period of the global economic recession. This period did not fall within the 5 percent level of significance. The CUSUMQ test is shown in Figure 3.

Normality Test

The normality test shows that the residuals or error term follow a normal distribution. The normality test's hypothesis is stated as follows:

H_0: Residuals are normally distributed.

H_1: Residuals are not normally distributed.

The graph of the normality test shown in Figure 1 indicates that the residuals are not normally distributed. This is further confirmed by the significantly high Jarque-Bera statistics and p-value, which is less than the 5% level of significance. The null hypothesis is, therefore, rejected. The non-normally distributed residuals may be explained by the upward movement of the exchange rate over the period considered. The normal distribution figure is depicted in Figure 1.

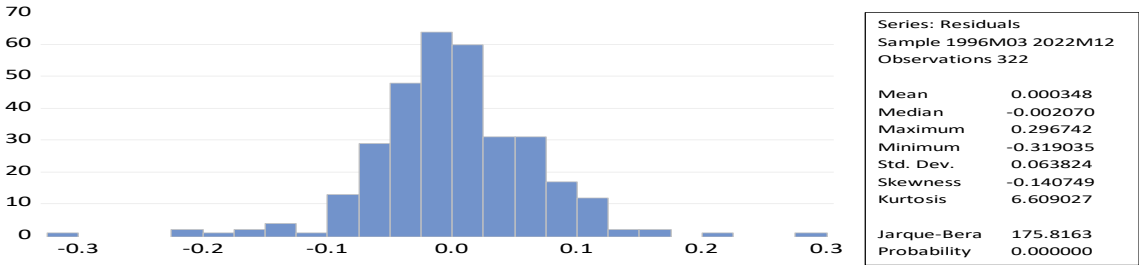

Figure 1. Normality Test, Source: Author's compilation from EViews 12, 2023

Figure 2. CUSUM Test, Source: Author's compilation from EViews 12, 2023

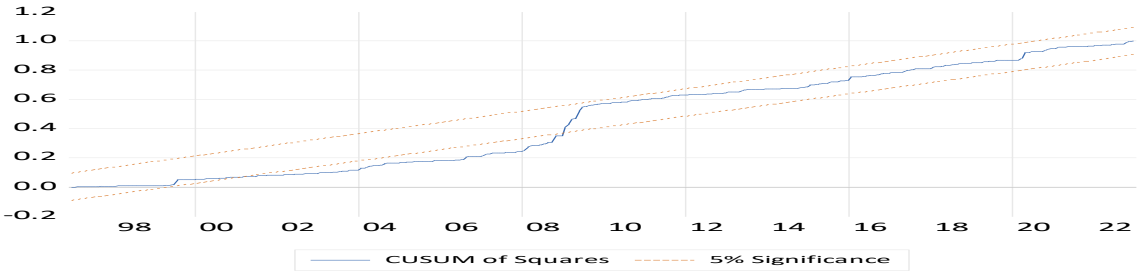

Figure 3. CUSUMSQ Test, Source: Author's compilation from EViews 12, 2020

Heteroskedasticity Test

The study employs the Harvey test for heteroscedasticity to affirm the robustness of the estimates. In the presence of heteroscedasticity, estimates would be unreliable among the residuals. The hypothesis for heteroskedasticity is stated as:

H_0: No presence of heteroskedasticity.

H_1: The is heteroskedasticity.

As evidenced by the p-value of 0.2429, which is higher than the 5% critical value, we cannot reject the null hypothesis. The result, therefore, concludes that the model is homoscedastic, and there is no problem of heteroscedasticity. This is depicted in Table 9.

Table 9. Heteroskedasticity Test

Heteroskedasticity Test: Harvey: Null hypothesis: Homoskedasticity			
F-statistic	1.287216	Prob. F (9,312)	0.2429
Obs*R-squared	11.52820	Prob. Chi-Square (9)	0.2412
Scaled explained SS	12.66440	Prob. Chi-Square (9)	0.1784

Source: Author's compilation from EViews 12, 2023

Serial Correlation Test

The Breusch-Godfrey Serial Correlation LM test tests the null hypothesis that no serial correlation exists among the residuals. The hypothesis to be tested is represented as:

H_0: No serial correlation.

H_1: there is serial correlation.

Table 10 shows that the probability value of the F-statistics (0.3697), which is higher than the critical value of 5%, indicates that the null hypothesis is not rejected. This means that the residuals are not serially correlated. This means that the observations are random and independent of one another. The residuals do not, therefore, depend on their lagged values. Therefore, the residuals are not serially correlated.

Table 10. Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.998176	Prob. F (2,311)	0.3697
Obs*R-squared	2.053779	Prob. Chi-Square (2)	0.3581

Source: Author's compilation from EViews 12, 2023

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the investigations and findings of this study, it suffices to conclude that there is no long-run relationship between the all-share index, exchange rate, interest rate, inflation, and oil price. In the short run, the impact of the oil price is positive and significant; the impact of the interest rate is negative and insignificant; and the impact of inflation is positive and insignificant. The exchange rate in a previous period impacts the all-share index negatively and significantly, likewise, the current period exchange rate impacts the all-share index negatively and insignificantly. It was also found that the share index in the previous period is capable of impacting the index in the current period.

Recommendations

Based on the findings, the monetary authorities should implement exchange rate policies that would lead to the appreciation of the domestic currency. This would encourage foreign participation in the equity market, as well as lead to the deepening of the capital market. The government and the central bank should adopt efficient and effective foreign exchange management that will consider the importance of the stock market as a catalyst for economic and financial development. It is also worth noting that the activities that influence share prices in a period affect other periods; this is reflected in the significant impact of a lag period all-share index on the current share index. Therefore, it is important that effective and continuous policies that encourage equity investments are implemented.

Further to the fact that the Nigerian stock exchange has over 250 listed securities, and as emphasized by Harding (2007), the more securities traded, the more the number of macroeconomic variables capable of influencing stock prices. Thus, there may be a need to assess the other variables under the purview of regulatory controls and regulations and realign them in manners capable of improving the stock prices.

In addition, there is a need for the fiscal and monetary authorities to assess the drivers of continuous inflation in the economy and curb it through monetary policy and fiscal expenditure decisions. A high level of inflation discourages foreign and local investors; this is because it erodes the time value of money. Finally, interest rates may, however, be moderated in such ways that they wouldn't affect the return from equity investment. A high-interest rate will discourage investment in equity and lead to poor stock market performance since investors would invest more in the bonds market and increase their savings for higher returns.

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