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Stock Prices and Exchange Rates Relations: Evidence from Nigerian Stock Exchange

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Abstract: *This study; stock prices and exchange rates relations made use of exchange rate proxied by exchange of Naira and United States of America Dollar and Stock price proxied by All Share Index collected from the Central Bank of Nigeria Statistical Bulletin and Nigerian Stock Exchange Fact Books respectively from January 02, 2014 to May 20, 2019. After estimations of the models, the following were revealing; stock price leads exchange rate in Nigeria Stock market. It was equally observed that negative correlation exists between stock prices and exchange rate and decrease in stock prices reduces wealth. It was also found that no long run relationship exists between stock prices and exchange rates .Therefore the researchers suggested among others that the regulatory and supervisory authorities should focus on domestic economic policies to stabilize the stock market.*

Keywords: All Share Index, Exchange rate, Stock market, Causality Test, Correlation Test.

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I. Introduction

The capital market of a nation depicts the extent of the economic growth, development and the vibrancy of both the monetary and fiscal policies in place. This is because capital is needed to propel the engine of the growth and as well enhance output, and real growth in the economy. This capital in focus is supplied to the economic environment through various channels: individuals; external sources (multi-lateral sources etc), banks and non financial institutions like insurance companies, mortgage banks, finance companies etc. Such capital funds provided could be in various forms or variants like equity, preferred stock, bonds or direct loans on short, medium or long term basis. However, in all these capital movements enumerated, there is a pre-determined or conscious attempt to create a financial intermediation process between the surplus units or lenders of funds and the users of funds (Nzotta, 2004).

In support, Ezirim (2005), the Nigerian capital market provides the needed mechanism to mobilize long run funds. The principal activities are in respect of providing an exchange mechanism to facilitate the purchase and sell of long term claims or securities. It also provides the network of facilities for transferring the long term claims and funds so transferred.

Meanwhile, a segment of the capital market, the stock exchange or the stock market is an economic institution which promotes efficiency in capital formation and allocation, coming down home, the Nigeria Stock Exchange (NSE) is the centre point of the Nigerian capital market, while the Securities and Exchange Commission (SEC) serves as the apex regulatory body. The NSE provides a mechanism for channeling public and private savings for productive purpose. The Exchange also provides means for trading in existing securities. The stock market also enables the authorities to mobilize long term capital for the economic development of the country. It provides the foreign businessmen with facilities to offer their shares and the Nigerian public an opportunity to invest and participate in the shares and ownership of foreign businesses. It also makes available facilities for the quotation and ready marketability of shares and stocks as well as the opportunities and facilities to raise fresh capital in the market. Nevertheless, if these mediums are not available and capital resources are not provided to those areas of need (productive sectors), the rate of expansion of the economy will be frustrated. These in turn will lead to external borrowing. However, the important benefit derivable from the stock market to all economic agents is the provision of long-term, non debt financial capital for development in all facets.

Ejem and Ogbonna (2019) argued that, exchange rate movement has different effects across the sectors of a country like Nigeria. The impact of a reasonable change or shift in the Exchange rate will usually worsen the financial condition of some investors and increase the loss or vice versa. Though, this impact on the economy may be compounded if regulation and management practices have limited sectors direct and indirect foreign exchange risk exposure. Notwithstanding, exchange rate instability and high levels of uncertainty negatively affect the business activities in a country. There is a general belief that exchange rate and its conditional variance (Volatility) are the determinant of economic activities especially in Nigeria and the rest of

the world. This goes a long way to elucidate why the fluctuations in exchange rates have attracted considerable attention in both field economic and finance.

On the relationship between stock prices and exchange rate movement in Nigeria, Ogbulu and Ndubuisi (2009) were of the opinion that the interaction between stock price and currency markets in a largely deregulated market economy has been the subject of intense academic debate in financial economies especially against the last recorded global stock market crash and its fallout in many markets of the world, Nigeria not exception. Ogbulu and Ndubuisi (2009) maintained that exchange rate movement in a free market setting can and in fact do affect stock prices. That a rise in exchange rate (depreciation) could lead to a general decline in the stock prices especially where the domestic economy is largely import dependent. Outside Nigeria, Aydemir and Demirhan (2009) added that the relationship between stock prices and exchange rates has preoccupied the minds of economists since both play important roles in influencing the development of country's economy. According to Aydemir and Demirhan (2009), over the years because of increasing international diversification, cross market return correlations, gradual abolishment of capital inflow barriers and foreign exchange restrictions or the adoption of more flexible exchange arrangements in emerging and transition countries, these two markets have become interdependent. Muhammed and Rasheed (2002) argued vehemently that, the issue of whether stock prices and exchange rates are related or not has received considerable attention after the East Asian crisis. During the crisis, the countries affected saw turmoil in both currency and stock market. If stock prices and exchange rates are related and the causation runs from exchange to stock prices, then the crisis in the stock markets can be prevented by controlling the exchange rates. Muhammed and Rasheed (2002) further argued that, developing countries can exploit such a link to attract/stimulate foreign portfolio investment in their own countries. Similarly, if the causation runs from stock prices to exchange rates then authorities can focus on domestic economic policies to stabilize the stock market. If the two market/prices are related then investors can use this information to predict the behavior of one market using the information on the other hand. Still on the relationship between stock prices and exchange rates, Rahman and Uddin (2009) revealed that the liberalization of foreign capital controls and adoption of floatation exchange rate regime in South Asian countries have widened the scope of studying the relationship between exchange rates and stock prices. Liberalization of foreign capital controls has opened the possibility of international investment and adoption of floating exchange rate regime has increased the volatility of foreign exchange market. Kutty (2010) also insisted that the understanding of the relationship between exchange rates and stock prices is important from the point of view of policy makers, and the investment community in this changing global environment. Kutty (2010) further stressed that, it's quite often included as an asset in the portfolio, and knowledge of the relationship between exchange rates and stock prices may enable the manager to manage risk efficiently. Kutty (2010) further suggested that in globally intertwined economy, in which there are little or few barriers to the of capital, has created investment opportunities for multinational corporations in developing and transition countries. This has in turn created a need to understand the link between exchange rates and stock prices to hedge the portfolio risk, Kutty (2010) added.

In validating the highly debated topic; stock prices and exchange rate interaction; the portfolio became approach postulated by Branson, Halttunsen and Mason (1977) suggested that exchange rate fluctuations and stock prices are correlated through account transactions. The theory is of the opinion that, as exchange rates fluctuates, investors engage in portfolio adjustment and balancing to take advantage of exchange rate changes as well as to achieve a diversified portfolio of assets. Implying that, a rise in exchange rate, makes investment in domestic stock market attractive to foreign investors and domestic investors with foreign currency. This leads to a rise in stock prices in the domestic stock market.

However, every economy is propelled by its Capital Market with the Stock Exchange Market playing a prominent role. It is pertinent to observe that prices of stock whether bullish or bearish is one of the performance indicators of that particular economy. On the other hand, the exchange rate of a country to other currencies, play vital role in determining the health of that country's economy. Consequently, stock prices and exchange rates are sine-qua-non of every economy. An overview of the performance of the Nigeria economy, seeing the downward trend in the performance of the stock market and the devaluation of the Naira one begins to wonder whether the exchange rate affects the stock market prices or not. A comparison of the All Share Index and the exchange rate shows that stock prices decreases as the exchange rates increases, this equally impacts on the economy. Putting into consideration the underdevelopment of the stock market and the devaluation of the Naira, amidst economic woes of the country, it becomes imperative to investigate the relationship between the stock market prices and exchange rates, to know how causation runs between stock prices and exchange rates with a view to making recommendations that will help both markets.

The subsequent parts of this study are organized as follows; section two will take care of review of related literature; section three addresses the materials and methods of analysis adopted; section four analyses the data, results and interpretation while section five handles conclusion and recommendations for policy making.

II. Review of Related Literature

2.1. Theoretical Review

This section will examine theories that supported the relationship between stock prices and exchange rates. First, **the traditional theory** advocates that exchange rates lead stock prices (Aydemir and Demirhan, 2009).

Second, **the portfolio balance approach** by Branson, Halttunsen and Mason (1977) states that exchange rates are determined by market mechanism, in other words changes in stock prices might have impact on exchange rate movements. This approach opined that stock prices is expected to lead exchange rate with a negative correlation since a decrease in stock prices reduces wealth this theory further expatiated that exchange rate fluctuations and stock prices are correlated through account transactions. The theory is of the opinion that, as exchange rates fluctuate, investors engage in portfolio adjustment and balancing to take advantage of exchange rate changes as well as to achieve a diversified portfolio of assets. Implying that, a rise in exchange rate, makes investment in domestic stock market attractive to foreign investors and domestic investors with foreign currency. This leads to a rise in stock prices in the domestic stock market (Aydemir and Demirhan, 2009).

Third, **the flow oriented model** by Dornbusch and Fisher (1980) argued that, rise in exchange rates (depreciation of the domestic currency) exerts upward pressure on the general cost of production in the economy leading to a downward revision of investors' expected rate of return, thereby affecting the prices of assets quoted on the stock market.

Fourth, **the real balance approach** according to Clark (2002) asserted that a rise in exchange rate which causes a rise in general level of prices in the domestic economy also leads to a decline in real balances and this in turn, induces investors in the aggregate to sell off their stock holdings in an effort to maintain their balances; an action that leads to a fall in stock prices as a result of the ensuring excess supply of assets in the stock market.

Fifth, **the balance of payment theory** as recorded by Jhingan (2006) opined that under free exchange rates, the exchange rate of the currency of a country depends upon its balance of payment. A favourable balance of payment raises the exchange rate, while an unfavourable balance of payment reduces the exchange rate. Jhingan (2006) insisted that the demand for foreign exchange arises from the debit side of the balance of payments. It is equal to the value of payments made to the foreign country for goods and services purchase from it plus loans and investments made abroad. The supply of foreign exchange arises from the credit side the balance of payments. It equals all payments made by the foreign country to our country for goods and services purchased from us plus loans disbursed and investment made in this country. The balance of payments balances if debits and credits are equal. If debits exceed credits, the balance of payments is unfavourable. On the contrary, if credits exceed debit, balance of payments is favourable. When balance of payments is unfavourable, it means that the demand for foreign currency is more than its supply. This causes the external value of the domestic currency to fall in relation to foreign currency. Consequently, the exchange rate falls. On the other hand, in case of balance of payments is favourable, the demand for foreign currency is less than its supply at a given exchange rate. This causes the external value of the domestic currency to rise in relation to the foreign currency. This causes the exchange rate to rise. This implies that the exchange rate is determined by the demand and supply of foreign exchange which in turn depends on the depth of the stock market in creating funds that can stimulate export.

2.2. Empirical Review

Heated arguments by scholars on whether exchange rates and stock prices are related or not, if causations run from stock prices to exchange rates or vice versa remains unresolved. Valid and contributing efforts are made and ongoing to add to already established positions on the relationship between exchange rates and stock prices.

Meanwhile, Ajayi and Mougouge (1996) applied recent advances in time-series analysis to examine the intertemporal relation between stock indices and exchange rates for a sample of eight advanced economies. An error correction model (ECM) of the two variables is employed to simultaneously estimate the short-run and long-run dynamics of the variables. The ECM results revealed significant short-run and long-run feedback relations between the two financial markets. Specifically, the results show that an increase in aggregate domestic stock price has a negative short-run effect on domestic currency value. In the long run, however, increases in stock prices have a positive effect on domestic currency value. On the other hand, currency depreciation has a negative short-run and long-run effect on the stock market.

Ajayi, Friedman and Mehdian (1998) made an empirical research on the relationship between stock prices and exchange rates with Granger Causality test. The result disclosed a significant unidirectional causality from stock returns to exchange rates in all the advanced economies.

Granger, Huangb and Yang (2000) applied recently developed unit root and cointegration models to determine the appropriate Granger relations between stock prices and exchange rates using recent Asian flu data. Via impulse response functions, it is found that data from South Korea are in agreement with the traditional approach. That is, exchange rates lead stock prices. On the other hand, data of the Philippines suggest the result expected under the portfolio approach: stock prices lead exchange rates with negative correlation. Data from Hong Kong, Malaysia, Singapore, Thailand, and Taiwan indicate strong feedback relations, whereas that of Indonesia and Japan fails to reveal any recognizable pattern.

Muhammad and Rasheed (2002) empirically and thoroughly investigated stock prices and exchange rates to know if they are related, with evidence from South Asian countries. Both the long run and short run associations between these variables are explored. The study employed cointegration, Vector Error Correction modeling technique. The result disclosed that no short run association between the said variables for all four countries. There is long run relationship between stock prices and exchange rates for Pakistan and India either. However, for Bangladesh and Sri Lanka, there appeared to be bidirectional causality between these two financial variables.

Stavarek (2005) investigated the nature of the causal relationship between stock prices and effective exchange rates in four old EU-member countries (Austria, France, Germany, and the UK), four new EU-member countries (Czech Republic, Hungary, Poland, and Slovakia) and in the USA. Both the long-run and short-run causalities between these variables are explored using Ganger causality with monthly data. The paper also tried to answer the question whether the linkages between analyzed economic variables are of the similar intensity and direction in the old and new part of the EU and how has been the relationship changing over the analyzed period. The results showed much stronger causality in countries with developed capital and foreign exchange markets (old EU-member countries and the USA) than in the new-comes. Evidence also suggests more powerful long-run as well as short-run causal relations in the period 1993-2003 than during 1970-1992. Causalities seem to be predominantly unidirectional with a direction running from stock prices to exchange rates. Finally, it was also detected much stronger relations applying real effective exchange rate than nominal effective exchange rate.

Tabak (2006) investigated the dynamic relationship between stock prices and exchange rates in the Brazilian economy. Recently developed unit root and cointegration tests which allow endogenous breaks, to test for a long run relationship between these variables were used. The study performed linear and nonlinear causality tests after considering both volatility and linear dependence. It was found that there is no long run relationship, but there is linear Granger causality from stock prices to exchange rates, in line with the portfolio approach: stock prices lead exchange rates with a negative correlation. Furthermore, it was found that evidence of nonlinear Granger causality from exchange rates to stock prices, in line with the traditional approach: exchange rates lead stock prices. These findings have practical applications for international investors and in the design of exchange rate policies.

Pin, Fok and Liu (2007) examined dynamic linkages between exchange rates and stock prices for seven East Asian countries, including Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan, and Thailand, for the period January 1988 to October 1998. Our empirical results show a significant causal relation from exchange rates to stock prices for Hong Kong, Japan, Malaysia, and Thailand before the 1997 Asian financial crisis. Causal relation was found from the equity market to the foreign exchange market for Hong Kong, Korea, and Singapore. Further, while no country showed a significant causality from stock prices to exchange rates during the Asian crisis, a causal relation from exchange rates to stock prices is found for all countries except Malaysia. The findings are robust with respect to various testing methods used, including Granger causality tests, a variance decomposition analysis, and an impulse response analysis. Findings also indicate that the linkages vary across economies with respect to exchange rate regimes, the trade size, the degree of capital control, and the size of equity market.

Aliyu (2009) examined the long and short-run interactions between stock prices and exchange rates in Nigeria, based on a sample, from February 1, 2001 to December 31, 2008. Three models were derived from the sample-the pre-crisis, crisis and basic models. The paper tested the time series properties of the series using the Augmented Dickey Fuller (ADF) and the Philips and Perron (PP) tests. In addition, the Engle and Granger two-step and the Johansen and Juselius cointegration procedures are also applied. The empirical results showed that all the series are I(1) and evidence of cointegration is established using the Johansen and Juselius methodology. Furthermore, causality tests revealed strong evidence of long-run bidirectional relationships between stock prices and exchange rates in the models. Policy-wise, the findings imply that the monetary authorities in Nigeria are not constrained to take stock market developments into account in achieving their exchange rate policy objectives, as established in the paper.

Aydemir and Demirhan (2009) examined the relationship between stock prices and exchange rates with emphasis on Turkish economy. The study employed date from February 23, 2001 to January 11, 2008 subjected

to causality test. The results of the analysis revealed that there is bidirectional relationship between exchange rate and all stock market indices.

Rahman and Uddin (2009) examined the dynamic relationship between stock prices and exchange rates using Johansen and Granger Causality. The results revealed that there is no cointegrating relationship between stock prices and exchange rates. While granger causality result showed no causal relationship between stock prices and exchange rates in the countries.

Zhao (2010) empirically analyzed the dynamic relationship between Renminbi (RMB) real effective exchange rate and stock price with VAR and multivariate generalized autoregressive conditional heteroskedasticity (GARCH) models using monthly data from January 1991 to June 2009. The results showed that there is not a stable long-term equilibrium relationship between RMB real effective exchange rate and stock price. There are also not mean spillovers between the foreign exchange and stock markets. Furthermore, the paper examines the cross-volatility effects between foreign exchange and stock markets using likelihood ratio statistic. There exist the bidirection volatility spillovers effects between the two markets, indicating the past innovations in stock market have the great effect on future volatility in foreign exchange market, and vice versa.

Kutty (2010) looked at the relationship between stock prices and exchange rates in Mexico. The study made use of Granger Causality and found that stock prices lead exchange rates in the short run and there is no long run relationship between stock prices and exchange rates.

Alagidele, Panagiotidis and Zhang (2011) investigated the nature of the causal linkage between stock markets and foreign exchange markets in Australia, Canada, Japan, Switzerland, and UK from January 1992 to December 2005. Recently developed cointegration tests were employed and no evidence of a long-run relationship between the variables is found. Three variations of the Granger causality test are carried out and causality from exchange rates to stock prices is found for Canada, Switzerland, and UK; weak causality in the other direction is found only for Switzerland. The Hiemstra–Jones test is used to examine possible non-linear causality and the results indicate causality from stock prices to exchange rates in Japan and weak causality of the reverse direction in Switzerland.

Lee, Doong and Chou (2011) examined the interaction between stock price and exchange rate and explored their dynamic correlation influenced by the stock market volatility. The study used newly developed Smooth Transition Conditional Correlation–Generalized Autoregressive Conditional Heteroscedasticity (STCC–GARCH) model and applied weekly data from Indonesia, Korea, Malaysia, the Philippines, Taiwan and Thailand for the period 2000 to 2008 to test the dynamic correlation hypothesis. The empirical results indicated that there are significant price spillovers from stock market to foreign exchange market for Indonesia, Korea, Malaysia, Thailand and Taiwan. Furthermore, the correlation between stock and foreign exchange markets becomes higher when stock market volatility increases in Asian emerging markets except in the Philippines. These results are important for international investors and managers to devise hedging and diversification strategies for their portfolios. The evidence suggested that investors can hedge risk between stock and foreign exchange in domestic markets when the stock market is stable. Otherwise, when the stock market becomes volatile, investors diversify their portfolio internationally for hedging risk since the correlation between stock and foreign exchange markets becomes higher.

Tsai (2012) used the data of six Asian countries to estimate the relationship between stock price index and exchange rate. According to the portfolio balance effect, these two variables should be negatively related. However, since the evidence from traditional ordinary least squares estimation is not favorable, the quantile regression model was adopted to observe the various relationships between stock and foreign exchange markets. The results showed an interesting pattern in the relation of these two markets in Asia, which indicates that the negative relation between stock and foreign exchange markets is more obvious when exchange rates are extremely high or low.

Kisaka and Mwasaru (2012) examined the causal relationship between stock prices and exchange rates in Kenya. The study employed Granger Causality to show that exchange rates granger causes stock prices in Kenya.

Zubair (2013) made use of Johansen's cointegration to test for the possibility of co-integration and Granger-causality to estimate the causal relationship between stock market index and monetary indicators (exchange rate and M2) before and during the global financial crisis for Nigeria, using monthly data for the period 2001-2011. Results suggested absence of long-run relationship before and during the crisis. The Granger-causality tests showed a uni-directional causality running from M2 to ASI before the crisis while during the period of the crisis there is absence of causality between the variables. This suggested that ASI show responsiveness to M2. Thus, absence of the direct linkage between ASI and Exchange rate showed that the market is inefficient and perhaps not derived or guided by the fundamentals.

Fowowe (2013) conducted an empirical investigation into the relationship between stock prices and exchange rates for the two largest economies in Sub-Saharan Africa – South Africa and Nigeria. The methodology used accounts for structural breaks in the data and the long-run relationship between stock and

foreign exchange markets. The results of multivariate causality tests with structural breaks showed that causality runs from exchange rates to domestic stock prices in Nigeria (flow channel) while in South Africa, no causality exists between domestic stock prices and exchange rates. The results also revealed that there is causality from the London stock market to both countries' stock markets, thus showing that international stock markets are driving both the Nigerian and South African stock markets.

Bahamani-Oskooee and Saha(2015) conduted this paper in threefold. First, the authors reviewed all empirical literature by dividing them into two groups of univariate and multivariate studies. Second, a table which summarizes the main features of each study is provided to help future researchers to have easy access to summary of each study. Finally, a new direction for future research is proposed. This new direction relies upon non-linear ARDL approach and shows how to investigate symmetric versus asymmetric effects of exchange rate changes on stock prices

III. Methodology

3.1. Sources of data and Tools for analysis

The variables of this study exchange rate proxied by exchange of Naira and United States of America (USA) Dollar (Naira/USD) and Stock price proxied by All Share Index (ASI) are collected from the Central Bank of Nigeria (CBN) Statistical Bulletin and Nigerian Stock Exchange (NSE) Fact Books respectively from January 02, 2014 to May 20, 2019. In this study, Econometric tools are employed in the analysis and estimation. In testing for correlation among the variables, the correlation matrix is used. In checking where causation runs between stock prices and exchange rates, Pairwise Granger Causality is engaged. Ordinary Least Square (OLS) is employed to examine the global utility of the model. Augumented Dickey Fuller (ADF) unit root test is used to check the stationarity of the variables. Johanen Cointegration to check if long run relationship exists within the variables. Error Correction Model was used to estimate the model. Vector Autoregresive (VAR) Model, Impulse Responses and Variance Decomposition were also employed.

3.2. Description of tools

3.2.1. Unit Root Test

To stem the problem of spurious regression, it is important that the time series properties of the data set employed in the estimation is ascertained. It might be reasonable to test for the presence of unit root in the series using the Augmented Dickey Fuller (ADF) unit root test to test for the stationarity of the variables (Brooks, 2008).

3.2.2. Co-integration Test

It is often said that co-integration is a means for correctly testing the relationship between two variables having unit roots (integrated order 1). The Johansen's co-integration test was applied to check the co-integration between and among the variables. There are different methods of testing for co-integration but Jung and Seldon (1995) stated that Johansen co-integration test is more valid as there is no need of prior knowledge of the co-integration vectors in cases when they are unknown. According to Koirala (2009), the Johansen (1998) method of testing for the existence of co-integration relationships has become standard in the econometrics literature because of its superiority over other alternatives. According to Engle and Granger (1987), as a set of variables Yt is said to be co-integrated of order (d,b) denoted Yt = CI(d,b) if all components of Yt are integrated of order d or b (band d > 0) and there exists a vector $\beta = (\beta_1, \beta_2 \ldots \beta_n)$ such that a linear combination $\beta Y_t = \beta_1 Y_{1t} + \beta_2 Y_{2t} + \ldots\ldots \beta_n Y_{nt}$ is not integrated of order (d,b).

3.2.3. Error Correction Mechanism (ECM)

The next step is to estimate the equation using ordinary least square (OLS) technique. Having ascertained whether or not co-integration exist, then the next step requires the construction of error correction mechanism to model dynamics relationship. The purpose of the error correction model is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. If co-integration is accepted, it suggests that the model is best specified in the first difference of its variables with one period lag of the residual {ECM (-1)} as an additional regressor.The advantage of using error correction models (ECM) is that it incorporates the variables at both side levels and first differences and thus ECM captures the short run disequilibrium situations as well as the long-run equilibrium adjustments between variables (Mukhtar and Ahmed, 2007). Co-integration is a test for equilibrium between non-stationary variables integrated of the same order.

3.2.4. Vector autoregressive models

Vector autoregressive models (VARs) were popularized in econometrics by Sims in 1980 as a natural generalization of univariate autoregressive model. A VAR is a system regression model (i.e. there is more than

one dependant variable) that can be considered a kind of hybrid between the univariate time series models and the simultaneous equations models. VARs have often been advocated as an alternative to large-scale simultaneous equations structured medels (Brooks, 2008).

3.2.5. Granger Causality Test

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another while ordinary regression reflects mere correlations. Granger causality in economics could be tested for by measuring the ability to predict the future values of a time series using prior values of another time series. To determine the direction of causality between the variables, we employ the standard Granger causality test (Granger, 1969). The test is based on error correction (ECM), which suggests that while the past can cause or predict the future, the future cannot predict or cause the past. Thus, according to Granger (1969), X Granger causes Y if past values of X can be used to predict Y more accurately than simply using the past values of Y. If a time series is a stationary process, the test is performed using the level values of two (or more) variables. In practice it may be found that neither variable Granger-causes the other, or that each of the two variables Granger-causes the other. For instance, if a signal X_1 "Granger-causes" (or "G-causes") a signal X_2, then past values of X_1 should contain information that helps predict X_2 above and beyond the information contained in past values of X_2 alone. The test is based on the following regressions:

$Y_t = \alpha_0 + \sum\_(i = 1)\text{^}n\ \alpha_i{}^y\ Y_{t-1} \sum_{i=1}^{n} Xt - 1\ \alpha_i x + U_t$ …… (1)

and

$X_t = \beta_0 + \sum\_(i = 1)\text{^}n\ \beta_i{}^y\ Y_{t-1} \sum_{i=1}^{n} Xt - k\ \beta_i x + Y_t$…….. (2)

Where X_t and Y_t are the variables to be tested while U_t and V_t are white noise disturbance terms. The null hypothesis $\alpha_i{}^x = \beta_i{}^y = 0$ for all i's is tested against the alternative hypothesis $\alpha_i{}^x \neq 0$ and $\beta_i{}^y = 0$. If the co-efficient of $\alpha_i{}^x$ are statistically significant but that of $\beta_i{}^y$ are not, then X causes Y. If the reverse is true, then Y causes X. However, where both co-efficient of $\alpha_i{}^x$ and $\beta_i{}^y$ are significant then causality is bi-directional.

3.2.6. Impulse responses and variance decomposition

Block F-tests and examination causality in a VAR will suggest which of the variables in the model has statically significant impacted on the future values of each of the variables in the system. But F-test results will not, by construction is able to explain the sign of the relationship or how long these effects require to take place. That is, F-test results will not reveal whether changes in the value of a given variable have a positive or negative effect on other variables in the system, or how long it would take for the effect of that variable to work through the system. Such information will, however, be given by an examination of the VAR's impulse responses and variance decompositions (Brooks, 2008).

Impulse responses trace out the responsiveness of the dependent variables in the VAR to shocks to each of the variables. So, for each variable from each equation separately, a unit shock is applied to the error, and the effects upon the VAR system over time are noted. Thus, if there are g variables in a system, a total of g^2 impulse responses could be generated. The way that this is achieved in practice is by expressing the VAR model as a NMA- that is, the vector autoregressive model written as a vector moving average (in the same way as was done for univariate autoregressive models in previous case). Provided that the system is stable, the shock should gradually die away (Brooks, 2008).

Variance decompositions offer a slightly different method for examining VAR system dynamics. They give the proportion of the movements in the dependent variables that are due to their 'own' shocks, versus shocks to the other variables. A shock to the i^{th} variable will directly affect that variable of course, but it will also be transmitted to all of the other variables in the system through the dynamic structure of the VAR. Variance decomposition determine how much the *s*-step-ahead forecast error variance of a given variable is explained by innovations to each explanatory variable for s = 1, 2, ... In practice, it is usually observed that own series shocks explain most of the (forecast) error variance of the series in a VAR. To some extent, impulse responses and variance decompositions offer very similar information (Brooks, 2008).

For calculating impulse responses and variance decompositions, the ordering of the variables is important. To see why this is the case, recall that the impulse responses refer to a unit shock to the errors of one VAR equation alone. This implies that the error terms of all other equations in the VAR system are held constant. However, this is not realistic since the error terms are likely to be correlated across equations to some extent. Thus, assuming that they are completely independent would lead to a misrepresentation of the system dynamics. In practice, the errors will have a common component that cannot be associated with a single variable alone (Brooks, 2008).

3.3. Definition of Variables

3.3.1. All Share Index (ASI)

All Share Index (ASI) is capital weighted average of all shares listed in a particular stock exchange and is computed daily (Ibenta, 2005).

3.3.1. Exchange rate

Exchange rate is the price of one currency in terms of another. This price can be viewed as the result of the interaction of the forces of supply and demand for foreign currency in a particular period of time (Nzotta, 2004; Appleyard, Field and Cobb, 2008).

3.4. Model Specification

The functional model is as follows;

Stock Prices = f (Exchange Rates) (1)

ASI = f (Naira/USD) (2)

While the explicit form is;

For OLS Specification;

$ASI = b_0 + b_1 Naira/USD + e_{t-1}$ (3)

For VAR Specification;

$ASI_t = \alpha_{01} + \alpha_{11} ASI_{t-1} + \alpha_{21} Naira/USD_{t-1} + U_1$ (4)

$Naira/USD_t = \beta_{02} + \beta_{12} ASI_{t-1} + \beta_{22} Naira/USD_{t-1} + U_2$ (5)

Where,

ASI = All Share Index

Naira/USD = Exchange Rate of Naira and US Dollar

IV. Analysis, Results and Interpretation

The researchers started by examining the correlation among the variables using correlation matrix as shown in Table 1

Table 1: Correlation Matrix

VARIABLES	NAIRA_USD	ASI
NAIRA_USD	1.000000	-0.159559
ASI	-0.159559	1.000000

Table 4.3 above provides correlation matrix of the variables. The correlation matrix between Naira/USD and ASI is -0.159559, which is a negative correlation. That shows variables are not linearly perfectly correlated. There is no presence of multicolinearity.

The researcher proceeded to know how causation runs between exchange rates (Naira/USD) and stock prices (ASI) as shown on table 2 below;

Table 2: Pairwise Granger Causality Tests

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
NAIRA_USD does not Granger Cause ASI	1331	1.55358	0.2119
ASI does not Granger Cause NAIRA_USD		2.87294	0.0569

Table 2 above reveals that exchange rates (Naira/USD) does not granger cause stock prices (ASI). On the other hand, stock prices (ASI) granger causes exchange rates (Naira/USD) Therefore, exchange rates (Naira/USD) and stock prices (ASI) have unidirectional effect. That shows that stock prices (ASI) leads exchange rates (Naira/USD).

Having established the relationship and causal effects among the variables, the researchers move to analyzing the global usefulness of the model.

Table 3: Ordinary Least Square (OLS)

Dependent Variable: ASI
Method: Least Squares
Date: 12/23/19 Time: 07:03
Sample: 1/02/2014 5/20/2019
Included observations: 1333

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NAIRA_USD	-13.98391	2.371470	-5.896727	0.0000
C	36446.93	606.9997	60.04439	0.0000

R-squared	0.025459	Mean dependent var	32982.60
Adjusted R-squared	0.024727	S.D. dependent var	5642.280
S.E. of regression	5572.085	Akaike info criterion	20.09043
Sum squared resid	4.13E+10	Schwarz criterion	20.09822
Log likelihood	-13388.27	Hannan-Quinn criter.	20.09335
F-statistic	34.77139	Durbin-Watson stat	0.004824
Prob(F-statistic)	0.000000		

Table 3 reveals the estimated model for the relationship between exchange rates (Naira/USD) and stock prices (ASI). From the table, the adjusted R-squared (R^2) is 2.54% and Durbin Watson (Dw) statistics is 0.004824, which shows the presence of positive autocorrelation. This is unreliable and cannot be used for further analysis and policy formulation.
Then the researchers proceeded to testing the stationarity of the variables using Augmented Dickey-Fuller (ADF) Unit Root Test

Table 4: Augmented Dickey-Fuller Unit Root Test

	Lag	ADF Test Statistic	ADF Test Statistic	Critical Values		
Variables	SCI	Level	1st difference	5%	10%	Remarks
ASI	1	-1.81770(0.3721)	-30.12417(0.0000)	-2.863504	-2.567865	Stationary
NAIRA/USD	0	-1.142212(0.7009)	-36.26206(0.0000)	-2.863504	-2.567865	Stationary

Table 4 presents the ADF unit root test. The result shows that the variables are differenced once to be stationary, hence said to be integrated at order one (1(1)) at 5% and 10% significance level.
Therefore, the researchers proceed to testing if long run relationship exists among the variables using Johansen cointegration as depicted below;

Table 5: Johansen Cointegration test

Date: 12/23/19 Time: 07:01
Sample (adjusted): 1/09/2014 5/20/2019
Included observations: 1328 after adjustments
Trend assumption: Linear deterministic trend
Series: NAIRA_USD ASI
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**

None	0.003456	7.084938	15.49471	0.5678
At most 1	0.001871	2.487354	3.841466	0.1148

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.003456	4.597584	14.26460	0.7915
At most 1	0.001871	2.487354	3.841466	0.1148

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 5 above indicates that unrestricted rank test (Trace and Maximum Eigenvalue) has no cointegration equation at 5% level of significance among the variables. This shows that no long run relationship exists between stock prices (ASI) and exchange rates (Naira/USD).
The cointegration test result provides for short run fluctuations. Therefore, the researchers apply error correction model to examine the interplay of the long run and short term fluctuations in the model using the general specific approach as depicted below on table 6.

Table 6: Error Correction Model (ECM)

Dependent Variable: D(ASI)
Method: Least Squares
Date: 12/23/19 Time: 07:06
Sample (adjusted): 1/07/2014 5/20/2019
Included observations: 1330 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ASI(-1))	0.193867	0.026969	7.188640	0.0000
D(NAIRA_USD(-1))	-6.565039	3.982437	-1.648498	0.0995
D(NAIRA_USD(-2))	7.290920	3.977973	1.832823	0.0671
ECM(-1)	-0.003111	0.001853	-1.678704	0.0934

R-squared	0.041310	Mean dependent var	-9.123233
Adjusted R-squared	0.039141	S.D. dependent var	383.4010
S.E. of regression	375.8227	Akaike info criterion	14.69912
Sum squared resid	1.87E+08	Schwarz criterion	14.71473
Log likelihood	-9770.912	Hannan-Quinn criter.	14.70497
Durbin-Watson stat	2.010908		

Table 6 shows the parsimonious ECM estimates with maximum lag of two. The Durbin-Watson (Dw) statistic is 2.010908 and Adjusted R-square is 3.91%. That shows absence of autocorrelation. The result also indicates that ASI reinforces itself. That exchange rate (Naira/USD) exerts both positive and negative significant impact on ASI at 10% significant level. ECM is correctly signed and significant at 10% significant level.
Since this topic is dynamic in nature and the variables are stationary at same level, the researchers decided to make slight entrance into vector autoregressive (VAR) estimation. Let's start with determining the lag length with VAR Lag Order Selection Criteria as seen on table 7 below.

Table 7:VAR Lag Order Selection Criteria

Endogenous variables: ASI NAIRA_USD
Exogenous variables: C
Date: 12/23/19 Time: 07:18
Sample: 1/02/2014 5/20/2019
Included observations: 1331

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-20797.96	NA	1.28e+11	31.25464	31.26244	31.25756
1	-12955.32	15649.94	984907.7	19.47606	19.49947	19.48483
2	-12928.61	53.20626*	951874.5*	19.44194*	19.48096*	19.45657*

* 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

The VAR lag order selection criteria on table 7 above shows that lag length of 2 is selected at 5% level based on sequential modified LR test statistic, Final prediction error (FPE), Akaike information criterion (AIC), and Hannan-Quinn information criterion (HQ).
Then the researchers move to know if short term errors can be corrected in the long run using Vector Error Correction Model (VECM) as shown below;

Table 8: Vector Error Correction Model (VECM)

Error Correction:	D(ASI)	D(NAIRA_USD)
CointEq1	-1.000000	-0.000345
	(4.0E-10)	(0.00019)
	[-2.5e+09]	[-1.82587]

The analysis in table 8 above shows that error correction equation (CointEq1) satisfied the condition, hence, significant. The speed of adjustment is 100%. That means short term errors can be corrected in the long run with annual speed of adjustment of 100%. Also long run causality flows from independent to dependent
The researchers proceed to checking the responses of stock price to the exchange rate stimuli using impulse responses as presented on Figure 1 below.

Figure 1: Impulse Response

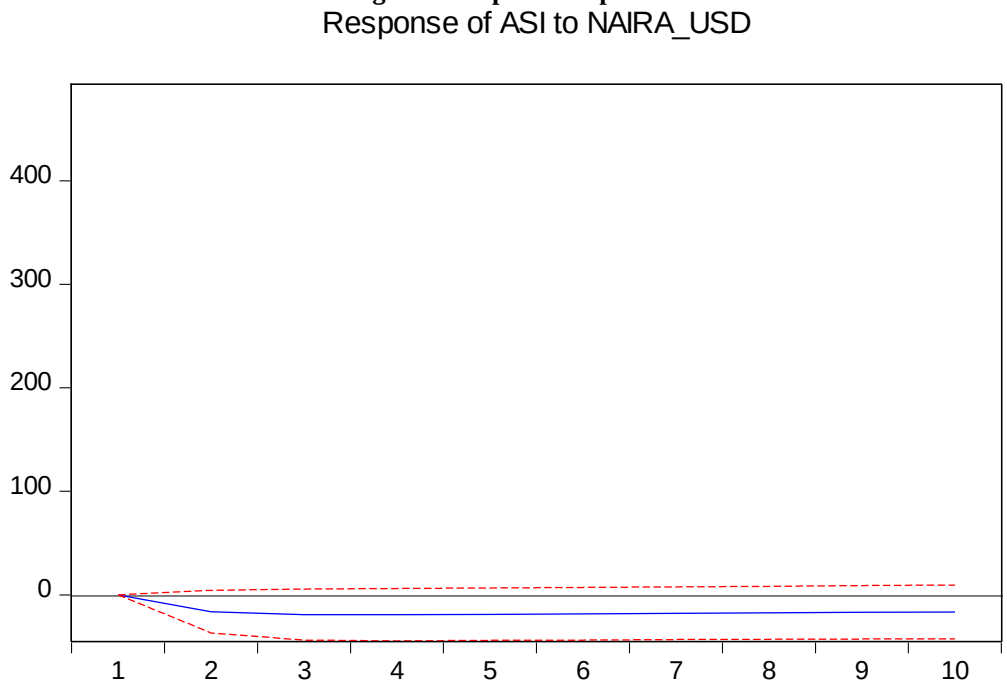

Fig 1 shows that a shock in exchange rate (Naira/USD) deviates the ASI trend line from zero percent thresholds to a negative trend till tenth year.
Now proceed to variance decomposition.

Table 4.10 Variance Decomposition

Period	S.E.	ASI	NAIRA_USD
1	376.0969	100.0000	0.000000
2	583.5824	99.92217	0.077834
3	741.4829	99.88590	0.114097
4	871.5243	99.86923	0.130771
5	983.9291	99.86107	0.138932
6	1084.059	99.85706	0.142940
7	1175.038	99.85532	0.144679
8	1258.852	99.85494	0.145063
9	1336.853	99.85541	0.144585
10	1410.008	99.85647	0.143533

From the above, ASI explains 100 percent of its variations in the first period and diminishes slightly to 99.85 percent in the tenth period. In other words, "the own shock" started from 100 percent and decreased to 99.85 percent. Naira/USD fluctuated from zero percent of the variation in ASI in the first period and increased to 0.143 in the tenth year.

V. Conclusion and Recommendation

In conclusion, this study stock prices and exchange rates relation in Nigeria rightly observed that stock prices (ASI) granger causes exchange rates (Naira/USD) implying stock price leads exchange rate. That negative correlation exists between stock prices and exchange rate. These findings clearly corroborate **the portfolio balance approach** by Branson, Halttunsen and Mason (1977) that stock prices is expected to lead exchange rate with a negative correlation since a decrease in stock prices reduces wealth. That exchange rates are determined by market mechanism, in other words changes in stock prices might have impact on exchange rate movements. This result agrees with the findings of Ajayi and Mougoue (1996); Kutty (2010). It was also found that no long run relationship exists between stock prices (ASI) and exchange rates (Naira/USD) corroborating the findings of Rahman and Uddin; Kutty (2010). Therefore the researchers suggested as follows,

since the causation runs from stock prices to exchange rates the regulatory and supervisory authorities should focus on domestic economic policies to stabilize the stock market. As found also, exchange rate (Naira/USD) exerts both positive and negative significant impact on ASI, hence related. Since the market/prices duo is related then investors should use available information to predict the behavior of one market using the information on the other hand.

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