

Dynamics of Oil Price, Exchange Rate and the Trade Performance of Quoted Industrial Sectors at the All Securities Market (Asem) in Nigeria

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ABSTRACT

The study examined the dynamic interaction among oil price, exchange rate and the trading performance of quoted industrial sectors at the Nigerian stock exchange market from 1980 to 2020 used in a Panel Vector Error Correction Mechanism (PVECM) framework. Data were sourced from BP Energy Review, Central Bank of Nigeria Statistical Bulletin and Annual report of the Nigerian Stock Exchange Market. Findings showed that long run relationships were established for oil price, exchange rate and the stock market performance of the industrial sectors. The result revealed a long run negative relationship among oil price, exchange rate and the stock market performance of the industrial sector. In the absence of possibility of complete shift of the burden of oil price rise on to the consumers, the profits and dividends of companies are reduced which may result into decline in stock prices on the long run. The study suggested that variations in oil price and exchange rate are two strong macroeconomic factors which also stand as a risk factor to the performance of the Stock Exchange Market both at the aggregate market level and the disaggregated industrial sector level, therefore, government policies need to be redirected towards controlling for both the negative and positive effect of the risk factors as their impact on the Stock Exchange Market is revealing from this study.

Keywords: Oil price, Exchange rate, Quoted industrial sectors, Panel Vector Error Correction Mechanism, Nigerian stock exchange market.

INTRODUCTION

The impact of crude oil price on the stock market has been of keen interest to many people in recent time as it has appealed the attention of investors as well as researchers basically from different approaches such as through empirical and theoretical angle, sectoral, country explicit, regional and global analysis approach. (Kelikume and Muritala, 2019, Hamdi et al, 2019, Wong and El. Massah, 2018; Xiao et al., 2018, Hu et al., 2018, Ji et al, 2018 Dutta, Nikkinen and Rothovious, 2017; Huang et al, 2017; Kang, de Gracia and Ratti, 2017). The impact on quoted industrial sectors can be traced to corporate liquidity and earning which has triggered both the theoretical and empirical investigation into the interaction between crude oil prices and the sectoral stock market value (Badeeb and Lean, 2018). The interaction between oil price and sectoral stock value can be traced to Asset Pricing Theory, which revealed that the price of oil posed a risk factor for equity markets (Mokni, 2020; Ferson and Harvey, 1995). It is also confirmed that oil price can affect the stock market through various channels which include the disaggregated industrial sectors (Salisu and Isah, 2017; Arouri et al, 2011; Huang et al, 1996).

In another scenario, given the growing trend towards globalization in the stock markets, the vulnerability of stock returns to changes in the exchange rates is on the increase, because investors may try to reduce their risk through global deviation (Fasanya & Akinwale, 2022; Bala & Hassan, 2018; Akdogu & Birkan, 2016). This implies that; adequate knowledge about the interaction between exchange rate and the sectoral stock value is sine qua non to boosting both the foreign direct investment and the foreign portfolio investment which are major drivers of aggregate investment and growth. Besides, the path of exchange rate can be predicted via the linkage between stock markets in two countries, which determines the capability of the multinational companies to accomplish their foreign transactions (Hammood, 2022; Gokmenoglu, Eren & Hesami, 2021; Afshan et al, 2018; Zivkov et al, 2018).

It is rational to say that oil price and exchange rate are the two major macroeconomic variables controlling the economy and its economic activities, but the direction of their impact on the trade performance of quoted industrial sector in Nigeria is what is yet to be ascertained given the dynamics of the world economic system. This study determined the dynamic interaction among oil price, exchange rate and the trade performance of quoted industrial sector at the Nigerian Stock exchange market. The study extends the understanding of the relationship among oil prices, exchange rate and the stock markets in Nigeria by testing for linear short run and long run linkages at disaggregated industrial sector levels. More so, most of the studies linking oil price, exchange rate and stock market in Nigeria such as Adebisi, et al, (2010), Akinlo (2014), all focus on empirical evidence at the aggregate market level. This study takes a different perspective and explores the dynamics with emphasis on the interaction among oil price, exchange rate and the trade performance of quoted industrial sector at the All Securities Market (ASEM) in Nigeria. The remainder of the paper is organised as follow. In section 2, a review of literature is provided on the interaction among oil price, exchange rate and sectoral stock returns. In section 3, the theoretical framework underpinning the study and methodology was described. Section 4 presents the result and discussion and section 5 concludes the study with recommendations.

RELATIONSHIP AMONG OIL PRICE, EXCHANGE RATE AND SECTORAL STOCK VALUE

Several authors have attempted to examine the interaction among oil price, exchange rate and stock value of the industrial sectors at various stock exchange markets.

A study by Fasanya and Akinwale (2022) examined the effect of exchange rate shocks on ten (10) sectoral stock returns in Nigeria from January 2007 to December 2018. The autoregressive distributed lag and nonlinear autoregressive distributed lag were employed to examine symmetric and asymmetric relationship between exchange rate and sectoral stock returns. The result from the study shows that only financial service sector moves in an asymmetric fashion in the short and long period without taking account of structural breaks and with structural breaks, none of the sectoral stock returns were asymmetric. The result showed that exchange rate movement affects the sectors differently. Therefore, this study concludes that a single model cannot fit all the sectoral stock returns because all sectors react otherwise to exchange rate movements and the information about a particular sector cannot be used to forecast other sectors. These results offer important insights for investors, regulators and policymakers.

A similar study by Ahmed & Mohammad (2022) investigated the effect of oil prices on firm's returns using a panel Vector Autoregressive (PVAR) model. Granger causality tests are used to

see if oil prices are effective in predicting returns. The dynamic impact of supply shocks is studied using Impulse Response Functions (IRFs). From January 2011 to May 2021, the study made use of daily data from all listed power sector enterprises on the Pakistan stock exchange. To investigate the differences in reactions between the Pre-COVID and COVID eras, the sample was separated into two groups. Oil shocks are inversely associated with daily firm stock returns. The study concluded that lack of impact of stock prices on oil prices deteriorates during the COVID pandemic. The study could not uncover any evidence of a significant relationship. In developing countries that rely on oil imports, the study sheds light on the utility of oil price shocks in daily stock return predictions.

From another perspective, Guglielmo (2021) analysed the effects of oil prices and exchange rates on sectoral stock returns in the BRICS-T countries over the period from 2 January 2001 to 22 March 2021. After estimating a benchmark linear model, the possible presence of structural breaks is investigated using the Bai and Perron (2003) tests, and a state-space model with time-varying parameters is then estimated. The main findings can be summarised as follows. Both the sub-samples and the time-varying estimates indicate a greater role for exchange rate returns. Oil prices have a positive and significant impact on the energy sector in all countries except India; a negative and significant one on the financial sector of Brazil, Russia, India, and South Africa; no effect on the transportation sector of Brazil, China, and South Africa, a negative one on those of India and Turkey, and a positive one in the case of Russia. The vulnerability of energy-dependent sectors to global fluctuations implies that appropriate energy policies should be adopted to reduce risk.

Another study by Abeng (2016) focused on the impact of oil price fluctuation on the sector level activities of the stock market in Nigeria. Five industry sectors were examined based on availability of data while included macroeconomic factors were selected guided by economic theory and existing literature. The results from the study suggested that changes in oil prices significantly affect stock returns of all the sectors, except food beverages and tobacco. This is similar to the findings from McSweeney and Worthington (2007) and Agusman and Deriantino (2008) for the Australian and Indonesian stock markets, respectively, the parameter estimates of market returns for the banking, insurance, food beverages and tobacco, oil and gas and industrial sectors significantly exceeded unity, suggesting a high risk exposure of these sectors vis-à-vis market returns. The food beverages and tobacco and oil and gas sectors exhibit significantly negative sensitivity to exchange rate risk, indicating the devastating effect of the depreciation of the domestic currency on the returns of these sectors. The consequences are huge. First, the negative response of all sectors to exchange rate movement calls for prudent management of reserves plus informed and timely intervention in the market by the monetary authority to keep the rate stable. Secondly, the insensitivity of the food beverages and tobacco to oil price movement is an indication of the inefficiency instituted by the subsidy on petroleum products that insulate domestic consumption from market fundamentals. Subsidies distort the efficient allocation of resources by the market and in the case of Nigeria abet and aid corruption. Another study from Nigeria by Akomolafe and Danladi (2014) analysed the association between the industrial stock returns and changes in oil price. Cointegration and Vector Error Correction Mechanism was employed and the variables measured comprised stock market returns for the selected industries which are banking, oil and gas and construction industries. Findings point toward industries belonging to sectors seemingly are not directly affected by oil prices and are also sensitive to oil price changes.

A study from Europe by Degiannakis, Filis & Kizys (2014) investigated the effect of oil and stock price returns grounded on evidence from European industrial sector indices in a time-varying Multivariate Heteroscedasticity framework with the use of data from 10 European sectors. Findings revealed that the networks between sector indices and oil price changes over time are industry specific. In addition, the supply side shocks of oil price resulted in low to moderate positive correlation levels. The precautionary demand led the price of oil to almost zero correlation levels and oil price shocks based on aggregate demand created significant changes in the correlation levels. (Either positive or negative). Result further revealed that both the source of the oil price shock and the type of industry are major factor of the correlation level between industrial sector returns and the price of oil.

From United States of America, Gormus (2013) determined industry sub sectors of the Istanbul Stock Exchange in Turkey in light of performance of the US Stock market as a link to oil price shock. He made use of a multifactor market model and the regression result showed that oil price shocks suggestively impact some sectors while others are more initiatives by fluctuations of US stock market. The findings further revealed that oil has the highest effects on Leasing and factoring, Wood & Paper Industries. A comparative study by Reboredo and Rivera-Castro (2013) in which they made use of daily data based on the aggregate S&P 500 and Dow Jones Stoxx, Europe 600 indexes and US and European industrial sectors (automobile and parts, banks, chemical, oil and gas, industrial goods, utilities, telecommunications, and technologies) over the period from 01 June 2000 to 29 July 2011 to investigate oil prices and stock market returns showed that oil price changes effect on stock market returns is minimal in the pre-crisis period both on the aggregate as well as the sectorial level. The results supported the positive interdependence between oil price shocks and the stock returns at both the aggregate and the sectorial level from the onset of the financial crisis.

In a similar study from Turkey by Eksi, et al. (2012) which examined the connection between crude oil prices and the indices of seven Turkish manufacturing sub-sectors over the period 1997: 01-2009:12. The study made use of the Error Correction Mechanism which revealed the long term causality running from crude oil price to chemical petroleum plastics and basic metal sub-sectors showing that these sub-sector are highly sensitive to crude oil price changes. Another study from Turkey by Berk and Aydogan (2012) explored the impacts of crude oil price variations on the Turkish stock market returns. The study employed Vector Auto regression (VAR) model using daily observations of Brent Crude oil prices and Istanbul Stock Exchange National Index (ISE-100). Variance decomposition test results revealed little evidence on the evaluation of crude oil price variation and the Turkish stock market. Similar findings are reported for the European Markets.

THEORETICAL FRAMEWORK AND METHODOLOGY

This study adopted the Arbitrage Pricing Theory. This theory was circulated by economist Stephen Ross in 1976 as an alternate to the Capital Asset Pricing Model (CAPM). The theory contests that a connection between the returns of a portfolio and the returns of a single asset may be charted through a linear combination of many independent macro-economic variables. Alternatively, the likely returns of a financial asset can be shown as a linear function of various macroeconomic variables or theoretical market indices, where the sensitivity to change in each factor is represented by a factor-specific beta coefficient. These macro-economic variables are called risk factors. The APT is based on three basic elements; first is the assumption that a

statistical model, the factorial model describes the returns of financial assets, the second assumption is the motion of arbitrage portfolio and finally the derivation of the relationship evaluation.

The theoretical framework of the Arbitrage Pricing Theory provided theoretical underpinning for the relationship between stock market, exchange rate and the oil price. However, stock market return of the industries is proxy in this study by trade performance (stock value) indicator of the industries. Therefore, there is need for us to justify the interconnection of relationship that exists between trade performance of the industrial sector and the macroeconomic variables that are included in the study. In this regard, the popular Arbitrage Pricing Theory (APT) was found to be accessible because the theory is built around stock market returns and its elements are prominent in the theory. According to Arbitrage Pricing Theory (APT), stock market returns are a function of the expected return and the unexpected returns of the market. In other words, this study utilized the Arbitrage Pricing Theory as a basis to establish a linear relationship between the industrial sector stock value and the macroeconomic variables in this study. The APT model of risk and return is a concept developed more recently relative to its alternative approach known as the Capital Asset Pricing Model (CAPM) by Jack Treynor and William Sharpe. Both the APT and the CAPM view the relationship between expected returns and risks as positive. However, APT is distinct from CAPM in the sense that it separates market risk factors and assigns a beta for each component. In comparison, the CAPM valuation model utilizes one market risk factor and thus a single beta. The concept of the APT valuation model can be explained by describing the components on stock value:

$$S = \bar{S} + X \quad (3.1)$$

Where S represents the actual stock value, $\bar{S}$ is the expected component of the value, and X serves as the unexpected factor. Equation (3.1) states that the actual stock market return is dependent on the expected (forecasted) component and on the unexpected (shock) factor. The unpredicted factor of the actual return is deliberated as the exact degree of risk since the anticipated factor has already been discounted by the market. The predictable factor will have no influence if such is mollified by the actual value. Under the APT model, the unexpected component X can be further broken down into two kinds of risks: systematic risks (market risks) and unsystematic or idiosyncratic risks (industry-specific risks). As the name infers, market risks have a broad impact on stock value, whereas industry risks may only affect a specific industry's stock value. Macroeconomic factors such as, exchange rate, industrial production, money supply, interest rates, oil price or inflation normally have an effect on nearly all industries. On the other hand, industry-specific announcements such as the launching of a particular product may have an impact on its manufacturers, distributors, and competitors.

With the incorporation of the systematic and unsystematic risks $X = m + \epsilon$ in equation (3.1), the new equation will be

$$\bar{S} + m + \epsilon \quad (3.2)$$

Where m stands for the systematic risks, and ϵ represents the unsystematic risks. Note that the ϵ of a specific industry, say industry A, is not related to the ϵ of another industry, say industry

B. In other words, the uncertainty factors affecting the stocks of industry are not correlated to the uncertainties that may influence the stocks of industry B.

$$\text{Corr}(\epsilon_A, \epsilon_B) = 0 \quad (3.3)$$

While the unsystematic risk ϵ components of the returns of industry A and B are not related, the same systematic risk may exert an influence on both industries indicating a link between their returns. For instance, inflation announcements will most likely have an effect on all the industries, thus their returns share the common factor of being affected by inflation news. The impact of a systematic risk is represented by the beta coefficient β , specifically; it indicates the responsiveness of a stock's value on a given systematic risk. The β can be positive, negative, or zero, depending on the response of the stock value on the systematic risk. When a stock increases (decreases) in response to a positive (negative) movement in the systematic risk, then the β is regarded as positive. Meanwhile, when a stock value had an inverse response relative to the movement of the systematic risk, then the β is considered negative. In some cases, the β can be zero when the stock is uncorrelated with the systematic risk. By returning to equation (3.3) and incorporating the variables included in this study, the return of a stock can be expressed in this form:

$$= \bar{S} + \beta_1 F_1 + \beta_{OIL\ PRICE} F_{OIL\ PRICE} + \beta_{EXCR} F_{EXCHR} \quad (3.4)$$

Where $\beta_{OIL\ PRICE}$, β_{EXCR} denote the stock's oil price beta, exchange rate beta respectively. The extent of the impact of a systematic risk on a stock can be measured by the magnitude of the beta. Thus, assuming that $\beta_{OIL\ PRICE}$ is 1, then stock value would increase (decrease) by 1.0 percent for every 1.0 percent increase (decrease) in the price of oil. On the other hand, when $\beta_{OIL\ PRICE}$ is -1, then stock return would increase (decrease) by 1.0 percent for every 1.0 percent decrease (increase) in the price of oil. Equation (3.4) is known as the factor model, with factors (denoted by F) representing systematic risk sources. For a factor model with n factors, a more formal and general equation would be:

$$S = \bar{S} + \beta_1 F_1 + \beta_2 F_2 + \dots + \beta_n F_n + \epsilon \quad (3.5)$$

Where ϵ is industry specific and does not have a relationship with the ϵ of other industry. However, equation (3.5) implies that stock value is determined by macroeconomic variables which include the oil price, exchange rates, and others by being sources of systematic risk to the market. Although, based on existing literature, there are no rules that can be used to identify the appropriate number of systematic risk factors to be included in a model. Thus, this study utilized systematic risk as a conduit between the stock value and the macroeconomic variables. In other words, equation (3.5) implies that stock value is a function of macroeconomic variables like the oil price, exchange rates, interest rate, inflation rate, industrial production, external reserve and rate of money supply.

Model Specification

Modelling the dynamic interaction among oil price, exchange rate and the trade performance of the industrial sectors at the Nigerian Stock Exchange Market calls for the use of panel vector autoregressive (PVAR) model since the research involve 11 industrial sectors. In this case, each of the major variables that made up the system model is taken as endogenous within the context of the empirical analysis. In examining the nature of the interaction of the variables, the study constructed a PVAR model using oil price, exchange rate and trade performance (stock value)

of the industrial sectors at the All Securities Market (ASEM) at the Nigerian Stock Exchange Market which are the three main variables of interest following Christian and Deodat (2009) Panel Vector Autoregressive (PVAR) model with slight modification. This was used to examine the dynamic interaction among the three variables for the Nigerian Stock Exchange Market. This method combined the traditional Panel Data Analysis with the Vector Autoregressive model to capture the dynamic interaction of the variables that make up the system equations. Each variable in the equation is explained by its own lag and lags of the other variables such that the variables are treated as jointly determined. This technique captures both short-run and long-run dynamic interaction of the variables as it test for the existence of co-integration once the lag order of the model is identified. It also allows the estimation of long-run relationships when variables are I (1).

The formulation of tri-variate PVAR model allows examination of dynamic interaction of these three variables for the Nigeria Stock Exchange Market. Its specification acknowledges the endogeneity, unobserved individual heterogeneity and cross-sectional heterogeneity of the variables. It also makes provision for dealing with the simultaneity problem amongst oil price, exchange rate and trade performance of the industrial sectors helping us to avoid the difficult task of determining the variables that are truly exogenous. This panel combination with VAR model as used in the study is expressed as follows:

$$lindustrials_{c,t} = \theta_{1,0} + \sum_{i=0}^p \alpha_{1,i} lindustrials_{c,t-i} + \sum_{i=0}^p \beta_{1,i} loilp_{c,t-1} + \sum_{i=0}^p \delta_{1,i} lexchr_{c,t-i} + \mu_{c,t} \quad (3.6)$$

$$loilp_{c,t} = \theta_{2,0} + \sum_{i=0}^p \alpha_{2,i} lindustrials_{c,t-i} + \sum_{i=0}^p \beta_{2,i} loilp_{c,t-1} + \sum_{i=0}^p \delta_{2,i} lexchr_{c,t-i} + \mu_{c,t} \quad (3.7)$$

$$lexchr_{c,t} = \theta_{3,0} + \sum_{i=0}^p \alpha_{3,i} lindustrials_{c,t-i} + \sum_{i=0}^p \beta_{3,i} loilp_{c,t-1} + \sum_{i=0}^p \delta_{3,i} lexchr_{c,t-i} + \mu_{c,t} \quad (3.8)$$

Where

lindustrials = the log of trade performance of industrial sectors

loilp = log of oil price

lexchr = log of exchange rate

c= the panel identity or cross sector identifier

p= the optimal lag length of each variable selected in accordance with the lag length selection criteria. This captures the stochastic patterns and co-movements of the variables and allows for the study of their dynamics in terms of deviations from the equilibrium across the industrial sectors. (Su-Fang li et al, 2013)

$\mu_{c,t}$ = the error correction term.

This estimation was carried out after testing for the unit root of the variables in order to confirm if they are stationary. The co-integration of the variables allowed the transformation of PVAR

equation (3.6-3.8) into Panel Vector Error Correction Model (PVECM) as given in the equations below:

$$\Delta \text{industrials}_{c,t}$$

$$= \theta_{1,0} + \rho_{1,ti} ECT_{c,t-1} + \sum_{i=0}^p \alpha_{1,i} \text{industrials}_{c,t-i} + \sum_{i=0}^p \beta_{1,i} \text{loilp}_{c,t-1} + \sum_{i=0}^p \delta_{1,i} \text{lexchr}_{c,t-i} + \mu_{c,t} \quad (3.9)$$

$$\Delta \text{loilp}_{c,t} = \theta_{2,0} + \rho_{2,ti} ECT_{c,t-1} + \sum_{i=0}^p \alpha_{2,i} \text{industrials}_{c,t-i} + \sum_{i=0}^p \beta_{2,i} \text{loilp}_{c,t-1} + \sum_{i=0}^p \delta_{2,i} \text{lexchr}_{c,t-i} + \mu_{c,t} \quad (3.10)$$

$$\Delta \text{lexchr}_{c,t} = \theta_{3,0} + \rho_{3,ti} ECT_{c,t-1} + \sum_{i=0}^p \alpha_{3,i} \text{industrials}_{c,t-i} + \sum_{i=0}^p \beta_{3,i} \text{loilp}_{c,t-1} + \sum_{i=0}^p \delta_{3,i} \text{lexchr}_{c,t-i} + \mu_{c,t} \quad (3.11)$$

Data Description

The data for this study for the period of 1980-2020 were sourced from Central Bank of Nigeria Statistical Bulletin 2020, published by Central Bank of Nigeria, BP Statistical Review of World Energy 2020, Nigerian Stock Exchange Annual Report published by the Nigerian Stock Exchange. In this study, the major variables of interest were Oil price (OP), Exchange rate (ER), stock value of the quoted industrial sectors which was proxy by the value of trading activities of the each sector in stock at the All Securities Market (ASEM) within the period under study and the control variables which has been identified in the literature are Interest rate, Inflation rate, Industrial production/output as proxy for economic activity, external reserve and industrial, rate of money supply.

ESTIMATION AND ANALYSIS OF RESULTS

This section presents the empirical analysis that ascertained the dynamic interaction among oil price, exchange rate and trade performance of the industrial sectors at the Nigerian Stock Exchange Market based on the period 1980-2020. This section is divided into various sub-sections. Sub-section one presents the panel unit root result of the three main variables in which is the baseline of the study. Sub section two reports the Lag Length Selection Criteria. Sub-section three revealed the result from the panel Cointegration test of the three variables. Sub-section four presents the Panel Vector Error Correction Model for Oil price, Exchange rate

and Stock market performance of the industrial sector. Sub section five shows the Impulse Response Functions. Sub-section six presents the Forecast Error Variance Decomposition Results.

a. Panel Unit Root Test

The Im, Pesaran and Shin (2003) (IPS) unit root test as well as the Levin, Lin and Chu (2002) (LLS) specification are used to test for the presence of unit root in the panel data. Since the characteristics of the 11 industrial sectors involve in the study are likely to be heterogeneous in nature, IPS test was preferred to LLC unit root test. However, LLC unit root test results were used to confirm IPS test results. Individual Intercept was included in the test equation in all the mentioned unit root tests. The lag length for each variable was automatically selected by Schwartz Information Criterion (SIC) and Individual Intercept was included in test equation for all variables. Newey-West method was equally applied to choose the optimal lag length or bandwidth. The results are presented in table 1 below.

The Im-Pesaran Shin (IPS) (2003) W-statistic results showed that the logs of Industrials, Oil price and Exchange rate contain unit roots at their levels. While their first differences probabilities are less than 1%. This means that the variables are stationary in their first differences. This way, when a regression is run on these variables in their first differences, there will be an absence of spurious outcomes. Meaning that the variables are integrated of order one, they are I (1) processes. Based on the above findings the precondition for the Cointegration test by Pedroni (1999, 2004) was satisfied for the first difference of the logs of all the three variables.

Table 1: Panel Unit Root Tests with Individual Intercept

Variables	Stock Value	Oil Price	Exchange Rate
	Im, Pesaran Shin W- statistic		
Levels	-1.3503	-1.81586	-1.3835
(P-values)	(0.0885)	(0.0347)	(0.0833)
1 st Difference	-14.2039	-7.91801	-7.29574
(P-values)	(0.0000)**	(0.0000)**	(0.0000)**
	Levin, Lin & Chu t*- statistic		
Levels	-5.3350	-1.55245	-5.4821
(P-value)	(0.0001)	(0.0603)	(0.0000)
1 st Difference	-11.8335	-7.4348	-6.15884
(P-values)	(0.0000)**	(0.0000)**	(0.0000)**

**** denotes significance at 1% in first difference. (P-values) are in brackets. All the variables are expressed in logarithmic form**

Source: Author's (2022)

b. Lag Length Selection Criteria

In evaluating the specified PVAR model, the possible existence of long run relationship among the variables was tested with application of Pedroni co-integration method. However, before the test was applied, it was necessary to determine appropriate lag length as Pedroni co-integration test is sensitive to the number of lags included in its estimation. According to Eiders (1995), the selection of an appropriate lag length is as significant as determining the variables to be included in system equations as models with fairly large number of lags have the tendency

of generating residuals that tend towards the white noise process, which might not be parsimonious. On the other hand when lag length is not enough, the models can be parsimonious, but fails to generate appropriate required residuals that are random enough to approach a white noise process. That is, the more lags included in a model, the more loss of initial values. The inclusion of too few lags can make the size of the test to be incorrect (Wooldridge, 2007).

This necessitates the need for determining the appropriate optimal lag length prior to the test of co-integration in order to avoid these problems of misspecification and loss of the degrees of freedom. This optimal lag order was determined with the sequential modified Likelihood Ratio test statistics (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQIC) as shown in Table 2

Table 2: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	43.05862	NA	0.000153	-0.269755	-0.232445	-0.254818
1	709.4373	1314.808	1.83e-06	-4.696547	-4.547305	-4.636800
2	825.0902	225.8543	8.93e-07	-5.414749	-5.153576	-5.310192
3	937.7076	217.6511	4.45e-07	-6.112509	-5.739405	-5.963142
4	1106.940	323.6502	1.51e-07	-7.191517	-6.706481	-6.997340
5	1471.245	689.3575	1.38e-08	-9.584140	-8.987173	-9.345153
6	1712.777	452.1615	2.89e-09	-11.15001	-10.44112	-10.86622
7	1822.114	202.4749	1.47e-09	-11.82568	-11.00485	-11.49707
8	1977.210	284.0830*	5.50e-10*	-12.80950*	-11.87674*	-12.43608*

***indicates lag order selected by the criterion**

Source: Author's (2022)

The entire criterion: LR, FPE, AIC, SC and HQIC suggested an optimal lag of eight at 5% level of significance. This suggestion was taken since none of the criterion opposes this position. Therefore, the study applied the optimal lag length of eight for the estimation in order to minimize the statistics.

c. Panel Cointegration Test

As the study have been able to establish that the log of the trade performance of the industrial sector (stock value), oil price (oil) and exchange rate (each) are all integrated of order one I(1) in the panel unit root test as shown by IPS panel unit root test in table 3. The next stage was to test for co-integrating interrelationship of the variables to determine the possible existence of a long-run relationship of the variables. Pedroni Panel Cointegration test were employed for this purpose. Pedroni examines properties of residual- based tests for the null of no co-integration for dynamic panels in which both the short run dynamics and the long-run slope coefficients are permitted to be heterogeneous across individual members of the panel. Pedroni considers both pooled within dimension tests and group mean between dimension tests and to avoid autocorrelation in the model, the industrial sector trade performance and other variables were estimated in different models. Individual intercept, intercept and trend and no intercept

and trend (None) test were carried out on the variables as shown in table 3. The test result shows that in all the eleven of Pedroni's statistics eight significantly reject the null hypothesis of no co-integration in favour of the presence of co-integration among the variables. This implies that there exist long-run relationship among the trade performance of the industrial sector, oil price and exchange rate in Nigeria.

Table 3: Pedroni Cointegration Test Results with Individual Intercept

Variables	Statistic	Probability	Weighted Statistic	Probability
Panel v-Statistics	8.713022	0.0000	5.653380	0.0000
Panel rho-Statistics	-3.213310	0.0007	-0.967638	0.1666
Panel PP-Statistics	-9.057215	0.0000	-14.14701	0.0000
Panel ADF-Statistics	-8.746291	0.0000	-9.855202	0.0000
Group rho-Statistics	-1.674504	0.0470		
Group PP-Statistics	-12.13962	0.0000		
Group ADF-Statistics	-9.373545	0.0000		

Source: Author's (2022)

d. Panel Vector Error Correction Co integrating Results

The presence of Co integration between variables suggests a long run relationship amongst the variables under consideration. This implies that the study can estimate Panel Vector Error Correction Model (PVECM) which requires the variables to be linked in the short run and the long run. The results of the long-run relationship among trade performance of the industrial sector, oil price and exchange rate in the period 1980-2020 are presented in the table below:

Table 4: Cointegrating Results of the PVECM Equation

Variable	Coefficient	Std Error	t-Statistic
STOCK VALUE as Dependent Variable			
OILP(-1)	-1.126598	0.01844	-61.0887
EXCHR(-1)	-1.462830	0.00544	-268.681
LOILP as Dependent Variable			
STOCK VALUE (-1)	-0.887628	0.01014	-87.5347
EXCHR(-1)	1.298449	0.01517	85.6141
LEXCHR as Dependent Variable			
STOCK(-1)	-0.683606	0.00255	267.572
LOILP(-1)	0.770149	0.01294	59.5018

Source: Author's (2022)

Table 4 above reports the summary of the long- run interaction of the three variables within the context of the PVECM estimation. In the first equation, the trade performance of the industrial sectors is shown to be negatively related to oil price and statistical significant. The equation also revealed a significant negative relationship between the trade performance of the industrial sectors and exchange rate. The equation shows that exchange rate had long-run negative effect on the trade performance of the industrial sectors at the Nigeria Stock Exchange Market. This is consistent with the findings most previous empirical studies as regard the stock market in Nigeria. Fasanya & Akinwale (2022), Hammood, 2022, Akinlo (2014), Asaolu (2011) Adebisi et al (2010), Adaramola (2012), Ogundipe et al (2012); Akinlo (2014) among others concluded that exchange rate depreciation produces adverse consequences on the performance

of the stock exchange market which can be transmitted into the disaggregated Industrial sectors. Exchange rate is sensitive to the trade performance of the industrial sectors at the stock exchange market as it determines the profitability of almost all the firms in each sector. In the period when exchange rate depreciates, industry sectors whose activities has a linkage with international transactions benefits during this period and industry whose activities are into consumer goods agonised during this period and vice versa. Exchange rate is as crucial to the trade market performance of the industrial sector as it determine the value and volume of stock traded at the Market.

In the oil price equation, oil price relationship with the trade performance of the industrial sector is equally shown to be negative in the long run and statistically significant, while oil price has a positive and statistically significant relationship with exchange rate. The equation shows a long-run relationship between oil price and exchange rate as exchange rate positively impact oil price in Nigeria. This result is consistent with the result of studies by Mokni, (2020), Oyinlola et al (2013), Ashaolu and Ilo, (2012) Jebbin and Osu (2012), Riman et al (2013) Oriavwote and Eriemo (2012), Adeniyi et al (2012). Sulaiman and Muhammad (2011) studied this issue in depth using VECM and their result suggests that oil price exercise a significant positive effect on exchange rate in the long run.

As for exchange rate equation, exchange rate relates negatively with the trade performance of the industrial sectors and not statistically significant while exchange rate has a positive and statistical significant relationship with oil price in the long run. On the overall, the interaction of the three variables based on the evidence from the study indicates that the trade performance of the industrial sectors and oil price are similar in their pattern of responses as they share negative relationship in the long run. Oil price and exchange rate also share similarities in their pattern of responses as the share a positive relationship in the long run. Exchange rate and the trade performance of the industrial sector can be seen to share a similar pattern in their responses as they revealed a negative relationship on the long run.

In conclusion, it can be deduced that the trade performance of the industrial sector has a statistical significant relationship with oil price and exchange rate in the long run. The result also shows that oil price and exchange rate has a statistical significant relationship with each other in the long run.

e. Impulse Response Functions

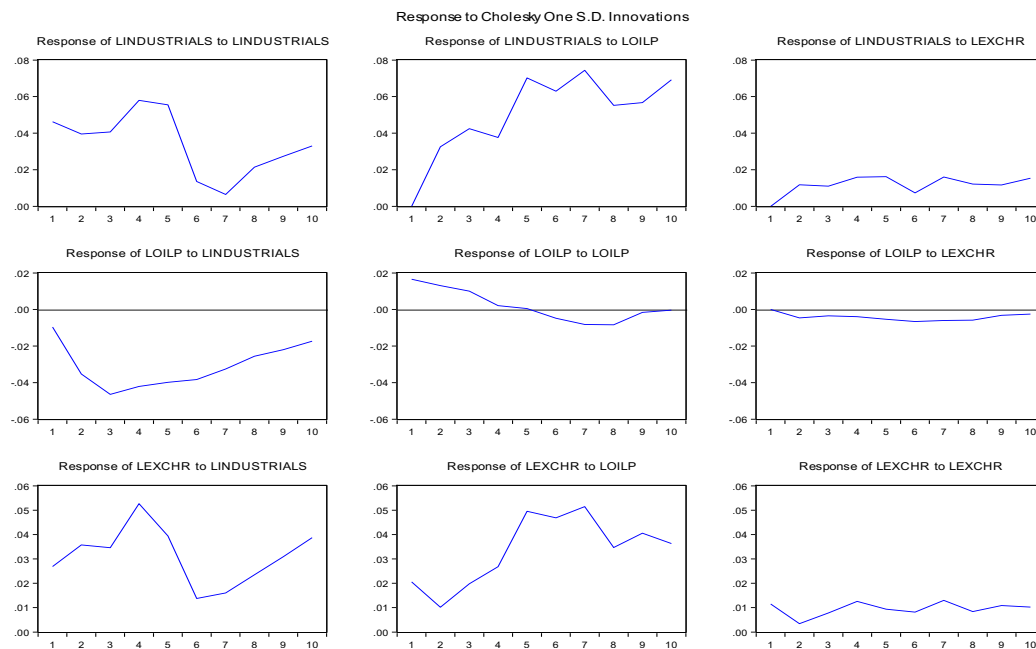
Impulse response functions provide information and analyse the behaviour of a variable due to random shock or innovation in other variables. The impulse response traces the cross effect on current and future values of the endogenous variables of one standard deviation shock to the variables. This function supplement the short run analysis as it tells us how one variable responds at a given time to a one standard deviation innovation (impulse) generated from any other variables in earlier times and how that effect can be multiplied. This implies that for each variable from each equation, a unit shock to the error is analysed in order to determine its effects upon the PVECM system over time.

The impulse response function in Figure 1 shows that the trade performance of the industrial sectors responds in a fluctuating way to a shock to itself in such a way that it rises in a particular period and fall in another period. The trade performance of the industrial sector also responds

to oil price shock by improving in its performance marginally from the first period to the third period before it started fluctuating till the eight period and started improvement in performance again. The response of the stock market performance of the industrial sector to shocks in exchange rate revealed a slight improvement in the first and second period and started fluctuating until the sixth period when the response dropped drastically and improved slightly again in other period.

The response of oil price to shocks from the trade performance of the industrial sector revealed a negative response as shocks from the stock exchange market can have effect on oil price especially if the shock is coming from the oil and gas industrial sector and other industrial sector which has oil as their input in production process. The response of oil price to a shock in itself showed a positive and negative reaction as it was positive in the first three periods and diminish for the rest of the period to negative. The response of oil price to shocks in exchange rate during the whole period was negative.

The response of exchange rate to shock form the trade performance of the industrial sector revealed a slight increase in the first and second period and dropped at the third period, then rises again at the fourth and fifth period but dropped drastically at the sixth period, then improved tremendously from the seventh period to the end of the period. The response of exchange rate to shocks in oil price decrease in the first and second period and respond increasingly in the third to the sixth period when it started fluctuating throughout the whole period. The response of exchange rate to its own shock shows a slight response throughout the whole period.



Source: Author's (2022)

Figure 1: The Impulse Response Function

f. Forecast Error Variance Decomposition Results

Forecast Error Variance Decompositions are equally employed to further explore the nature and dynamics of interaction amongst oil price, exchange rate and trade performance of the

industrial sector in the Nigerian Stock Exchange Market. The forecast error variance decomposition measures the proportion of the forecast error variance for each variable which resulted from its own innovation and innovation in the other endogenous variables. The forecast error variance decomposition gives information on the strength of random shock amongst variables and shows the contribution of all other variables to the variance of each variable. It helps to identify the main channels of influence amongst the variables in the VECM. This study determined how much of the future variations in the trade performance of the industrial sectors (STOCK VALUE); Oil price (OILP); and Exchange rate (EXCHR) are explained by one standard deviation shocks to each of the variable at ten periods time horizon. The numbers underneath each variable represent the percentage of variance for the variables in the error decompositions. The results of the generalized forecast error decompositions which showed the forecast error variance of each variable that is attributable to its own shock and shocks in the other variables in the model in addition to the results of impulse response analysis in the preceding section are presented in tables 5 to 7

g. Variance of Trade Performance of the Industrial Sector

The examination of forecast error variance decomposition of trade performance in table 5 indicated that STOCK VALUE explained about 31 percent forecast error variation in its own shocks for all the periods, starting from 100 percent in the first period to 31.33 percent in the 10th period. In the first period, no innovations from oil price and exchange rate could account for the forecast error variance in the trade performance of the industrial sectors. The situation is different from period two to period ten as innovation in oil price contributed as a source of forecast error variance of the trade performance of the industrial sectors from 21.6% to 65.15%. While innovation in exchange rate for forecast error variance of the trade performance of the industrial sector is between 2.84% and 3.48%. The innovation for shock to oil price made much contribution to the variance in the trade performance of the industrial sectors compared to innovation in exchange rate. It means, in the short run, the impulse in oil price to the fluctuation in the trade performance of the industrial sectors is much more compared to the innovation in the trade performance of the industrial sectors which contribute 65.15% variation in the trade performance of the industrial sector in the long run.

Table 5: Variance Decomposition of STOCK VALUE

Period	S.E.	STOCK VALUE	OILP	EXCHR
1	0.046277	100.0000	0.000000	0.000000
2	0.070017	75.53019	21.62708	2.842730
3	0.092079	63.17262	33.74830	3.079088
4	0.116221	64.49769	31.69838	3.803924
5	0.147588	54.11881	42.32216	3.559030
6	0.161194	46.07711	50.73319	3.189697
7	0.178358	37.76854	58.81784	3.413615
8	0.188305	35.17456	61.34866	3.476781
9	0.198896	33.41521	63.12554	3.459250
10	0.213699	31.33282	65.15378	3.513402

Cholesky Ordering: STOCK VALUE OILP EXCHR

Source: Author's (2022)

h. Variance Decomposition of Oil price (OILP)

From table 6, the forecast variance error decomposition of oil price (OILP) revealed that variance error decomposition of oil price explained 74.7 percent to 6.08% percent variations of its own shocks in the first and last period respectively. The table also shows that in the short-run, the shock to the trade performance of the industrial sector contributes 74.41 percent variance fluctuation in oil price. In the long- run, the contribution of innovation in the trade performance of the industrial sector increases to 92.14 percent as variance fluctuation in oil price. The innovation in exchange rate explained less than 1 percent forecast error variance of oil price with 1.19 percent, 0.82 percent and 1.77 percent in the second third and last periods respectively.

The innovation in the trade performance of the industrial sector explain more variance of oil price than exchange rate in the given system equation. Furthermore, the position of shock to exchange rate in error variance decomposition of oil price is similar to its role in the forecast error variance decomposition of the trade performance of the industrial sector. In particular, innovation in exchange rate tends to explain less variance of oil price in the long term than in the short term. The similar patterns of exchange rate effects on oil price and trade performance of the industrial sector provide evidence to negate the role of exchange rate in both oil price and the trade performance of the industrial sector in the Nigeria Stock Exchange Market. Innovation in exchange rate explains 1.19 percent of the variance in the trade performance of the industrial sectors, while exchange rate explains 1.77 percent of variance of oil price in the long-run.

On the overall, the analysis of the variance decomposition confirms previous findings that exchange rate effect might not make a great impact on the trade performance of the industrial sectors and oil price as exchange rate affects only the industrial sector than are into foreign contract and foreign goods and services.

Table 6: Variance Decomposition of OILP

Period	S.E.	STOCK VALUE	OILP	EXCHR
1	0.019133	25.28739	74.71261	0.000000
2	0.042471	74.14712	24.66411	1.188776
3	0.063801	85.77951	13.40450	0.815988
4	0.076555	89.77822	9.385794	0.835984
5	0.086462	91.60052	7.361797	1.037682
6	0.094938	92.28969	6.364009	1.346297
7	0.100889	92.15057	6.297843	1.551590
8	0.104573	91.73273	6.511670	1.755599
9	0.106924	91.98189	6.251168	1.766941
10	0.108350	92.13660	6.088589	1.774810

Cholesky Ordering: STOCK VALUE OILP EXCHR

Source: Author's (2022)

i. Variance Decomposition of Exchange Rate (EXCHR)

Table 7 shows that the forecast error variance of exchange rate is largely independent of the innovations in all the other two variables in the system. Though the innovations in the trade performance of the industrial sector as a source of forecast error variance of exchange rate contributed 74.84 percent from the second period and declined to 43.80 percent in the last period. It explained the forecast error variation in exchange rate less than oil price whose innovation is found to be stronger only in the long run of the system. On the overall, the contribution of innovation in the trade performance of the industrial sectors and oil price to variance decomposition of exchange rate was higher in both short and long run horizon as they play important role in explaining the variance of exchange rate. In particular, exchange rate explains about 5.43 percent of the variance of itself in the second period and this reduces to about 3.9 percent in the last period.

Table 7: Variance Decomposition of Exchange Rate

Period	S.E.	STOCK VALUE	OILP	EXCHR
1	0.035745	56.44139	33.13841	10.42020
2	0.051672	74.83546	19.73133	5.433207
3	0.065742	73.98014	21.24029	4.779572
4	0.089287	74.86113	20.55360	4.585272
5	0.109856	62.34200	33.89595	3.762058
6	0.120519	53.11115	43.30206	3.586790
7	0.132656	45.29770	50.77857	3.923737
8	0.139365	43.87776	52.20230	3.919940
9	0.148805	42.81155	53.21713	3.971321
10	0.158313	43.79776	52.27422	3.928022

Cholesky Ordering: STOCK VALUE OILP EXCHR

Source: Author's (2022)

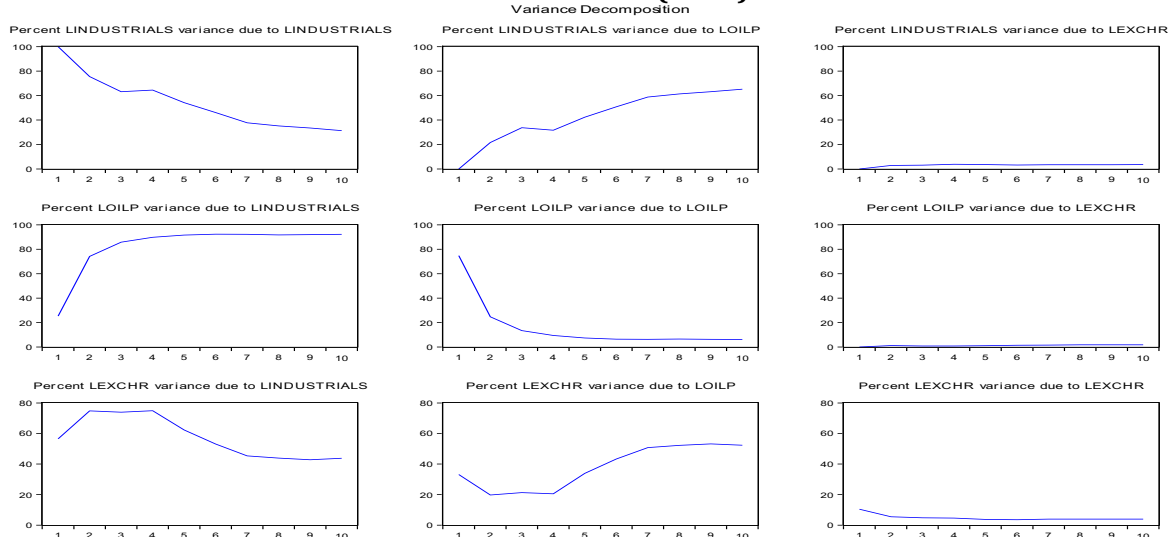


Figure 2: Variance Decomposition of Oil Price, Exchange Rate and Stock Market Performance of the Industrial Sector (1980-2020).

Cholesky Ordering: STOCK VALUE, OILP, EXCHR

Source: Author's (2022)

CONCLUSION

From the result of the study, long run relationships were established for oil price, exchange rate and the trade performance of the industrial sectors. The result revealed a long run negative relationship among oil price, exchange rate and the trade performance of the industrial sector. Oil is an important component of production cost. In the absence of possibility of complete shift of the burden of oil price rise on to the consumers, the profits and dividends of companies are reduced which may result into decline in stock prices on the long run. In the literature, the link between exchange rate and oil prices has been examined at theoretical levels by, among others, Krugman (1980) and Rogoff (1991), and at empirical levels by, among others, Zhou (1995), and Dibooglu (1995). The findings of these studies suggest the existence of a positive relationship between the two variables, i.e., a rise in oil prices is linked to a dollar appreciation and vice versa. This study supports the empirical findings which revealed a long run positive relationship between the two variables.

The various impulse responses showed that oil price variations has a decreasing effect on the trade performance of the industrial sector. More so the trade performance of the industrial sector increases steadily over the long run in response to a positive shock from oil price. However, oil price has a temporary positive impact on trade performance of the industrial sector. Oil price has immediate contractionary effect on sector stock return up to certain quarter, and then becomes expansionary. This means that oil price determines the level of profitability of firms in the various industries as movement in sectoral stock returns in Nigeria is highly sensitive to crude oil prices. (Akomolafe and Danladi, 2014; Akinlo, 2014). On the other hand, exchange rate shock effect on the trade performance of the industrial sector was negative and its effect is low such that its effect almost disappears during the 10 periods. By implication, the weak and negative relationship between exchange rate and trade performance of the industrial sector can be expressed in terms of commodity markets theory. In companies that are more export-oriented, the increase in exchange rate would have a negative impact on the company's shares and the stock exchange market as a whole (Samane and Amir, 2014).

The variance decomposition revealed that short-run changes in the trade performance of the industrial sector, oil price and exchange rate are explained by innovations in their own very shocks to themselves. This means that larger percentages of stock variances are caused by oil price and exchange rate. This implies that oil price and exchange rate has little or no predictive power on the stock market performance of the industrial sector in Nigeria in the earlier periods. This is contrary to the findings of studies on oil price and stock market; exchange rate and stock market. (See Adebisi et al, 2010, Basher and Sardosky, 2010, Adaramola, 2012, Akomolafe and Danladi, 2014). On the other hand from the variance decomposition result, oil prices and exchange rates respond positively to a positive shock from the trade performance of the industrial sector. Rapidly rising stock prices in a country like Nigeria or an increased demand for global credit are two factors which can also put pressure on oil prices to rise. Oil prices respond not only to economic fundamentals like real economic activity but also to movements in emerging stock prices. Stock market are often seen as leading economic indicators and rapidly rising stock prices in Nigeria signals the expectation of higher economic growth ahead. Exchange rate on the other hand has a strong predictive power on the trade performance of the industrial sector as a change in exchange rate would affect a firm's foreign operation and overall profit according to theory. This would in turn affect its stock prices and the nature of the change in the sector stock prices would depend on the multinational characteristics of the firms.

This study recommended the following:

- The negative effect of oil price both on the short run and long- run on the stock market performance of the industrial sector is an indication of the harmful effect oil price changes can have on the Nigeria stock exchange market, therefore every effort must be geared towards stability in the price of oil as it remains the main product in which the Nigerian economy depend on as her major revenue.
- The positive effect of exchange rate on the short run on the stock market performance of the industrial sector is an indication that almost all the sectors benefit from both the depreciation and appreciation of Naira against Dollars. Studies have shown that Industries that engage foreign production and activities tend to benefit when exchange rate depreciate while industries that engaged in local production and services tend to benefit when exchange rate appreciates. It is therefore recommended that industries in Nigeria should be mandated to involve more in local production and services and exportation as exchange rate appreciation improves the economy.
- The negative long run relationship in oil price is a sign for oil importing country in which Nigeria cannot be excluded; therefore, Government has to revamp the various refineries in the country so that import bills on petroleum products will be kept at minimum so as to reap the full benefits of oil production in Nigeria.
- From the results obtained, exchange rate management policies should focus on foreign exchange demand strategies and in addition, incorporating the movement of international oil prices into exchange rate management, as Nigeria remains an oil dependent economy. The consequences of oil price shocks on the economy are real since oil remains the major foreign exchange earner for the country.

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