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NEXUS AMONG ECONOMIC GROWTH, STOCK MARKET ACTIVITY AND EXCHANGE RATE MOVEMENT IN THE ORGANIZATION OF PETROLEUM EXPORTING COUNTRIES (OPEC)

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ABSTRACT

Since the work of Dornbusch and Fisher (1980) on assets pricing and exchange rate, the nexus between stock market and exchange rate has continued to receive considerable attention in the literature. Owing to this inevitable side effect of the stock market, if an economy depends heavily on the activity of the stock market, then the economic performance may likely be greatly affected. In this study, we investigated the interconnectedness among economic growth, exchange rate and stock market activity in selected OPEC countries. Monthly data from February 2010 to March, 2018 were utilized while the method of analysis employed is the Toda-Yamamoto (TY) for Iran, Nigeria and Venezuela and vector autoregressive (VAR) technique was employed in case of Kuwait, Qatar and Saudi Arabia due to the stationarity results. Findings showed that there is no causal relationship among economic growth, exchange rate and stock market activity in Iran, Kuwait and Saudi-Arabia. In Nigeria, no bi-causal relationship exists between stock market activity and exchange rate, but a unidirectional relationship running from stock market activity to economic growth was observed. In Venezuela, there is a bi-causal relationship between exchange rate and stock market while in *Qatar, a unilateral causation running from exchange rate to economic growth was observed. Causal relationships differ across Petroleum Economic Countries' exchange rate, stock market activity and growth. The implication of this result is that to the extent that oil quantity and price are major driving force of their economic activity, countries whose growth is caused by stock market activity need to be wary of this action. Based on the results, a couple of recommendations are proffered on country-specific level. Generally, it is imperative for countries to come up with a favourable macroeconomic coordination that will dampen the negative causal effect. Such macroeconomic coordination could be centered on stock market activity.*

Keywords: Stock Price, Exchange rate, Economic growth, OPEC, Vector Autoregressive

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INTRODUCTION

Since the work of Dornbusch and Fisher (1980) on assets pricing and exchange rate, the nexus between stock market and exchange rate has continued to receive considerable attention in the literature. Stock market serves as a valuable market for the mobilisation and allocation of funds among competing uses that are critical to growth and development of the economy (Unkoro

and Uko, 2013). In addition, it serves as a channel through which surplus funds are moved from lenders-savers to borrower-spenders who have shortages of funds. Consequently, the behavior of the market tends to influence the performance of the economy. However, the stock market is characterised with bubble and burst owing to the behavior of the participants, that is, speculative bubbles and the fads and also to the business environment (Abimbola and Olusegun, 2017; Ifarajimi and Onyejiuwa,2015, and Kurronen, 2015). Owing to this inevitable side effect of the stock market, if an economy depends heavily on the activity of the stock market, the economic performance may likely be greatly affected.

As the stock market influences economic growth, so also economic growth influences the stock market. Economic growth implies continuous increase in output and, increase in spending. Consequently, most firms experience increased profitability leading to expansion of businesses. The high profit makes the company shares more attractive while the expansion of business could motivate firm owners to desire to sell shares, thereby raising the activity in the market. Therefore, there will be stock markets bubble during the period of economic boom but during downturn, the stock market may likely be negatively affected, depending on the forecast of the players about the future (Blanchard, 2017; Folawewo, Olubiyi *et al*, 2012). If the players are convinced that the downturn will be temporary, they may not sell their shares and even buy highly risky shares. In this case, the stock price may change slightly or remain the same. On the other hand, if players sense that the slowdown will be prolonged, they may seek to reallocate their portfolio. Depending on what people expect to happen in the future, the activity in the stock market may be affected slightly, crash or enter crisis.

There is also a strong connection between the stock market and exchange rate as well as between exchange rate and economic growth.. Stock market bubbles can attract foreign investors which will demand for domestic currency in order to purchase the stock. The process leads to exchange rate appreciation, which discourages exports and hence reduction in the value of economic activity, thus implying that stock market activity, economic growth and exchange rate are interconnected. It is therefore imperative to investigate this link, particularly in countries where oil production and exportation have the tendency to influence and be influenced by stock market and exchange rate. This study therefore assesses this link in the case of Organization of Petroleum Exporting Countries (OPEC). OPEC has attracted interest is that the revenues generated from oil have proved to be of great importance to these member countries However, the selling price or quantity to produce is determined by the Cartel and or the world market, indicating that no single OPEC member has control over the price or the output to sell (OPEC, 2016). By implication, changes in the oil price will impact oil revenue, which will in turn influence economic activity (Lin, 2012). Once the economic activity is affected, stock market is expected to respond to these changes and might also affect exchange rate. Further, some OPEC members are now considered as emerging markets in their respective regions owing to their relatively developed stock markets and the stock market capitalization of oil companies in each of these countries that account for not less than 44 percent of GDP (OPEC, 2016). It is therefore important to understand the interaction of the three variables in the emerg-

ing/oil producing nations.

Several papers focused essentially on either stock market and exchange rate, or stock market and economic growth while others focus on exchange rate and economic growth (Alajekwu and Achugbu, 2012; Bayar, Kaya *et al*, 2014; Effiong, 2016; Zubair, 2013; Heimonen et al, 2017). Very few studies were found to focus on Nigeria (Adeoti and Adebisi, 2018; Abimbola and Olusegun, 2017; Ahmad et al, 2015). Our study extends the frontier of knowledge in this respect by considering other OPEC member countries across region. It is our hoped that the result will be of help to the government of each of these countries in decision making. The study also considers the analysis of a three-variable VAR model using a relatively high frequency data in contrast to low frequency data commonly found in the literature. It must be recalled that VAR requires large sample size so as to make up for large degree of freedom and hence, the result is superior to the low frequency data.

LITERATURE REVIEW

There are few empirical studies on the causal relationship among exchange rate, stock market and economic growth. Studies such as Adeoti *et al* (2018, Ifarakimi and Onyejinwa (2015), Aggarwal and Sadiq (2017) are some examples. Much of the empirical works are on the causal relationship between each pair. (Korkmaz, 2013; Lawal et al, 2016). Consequently, this section reviews papers on exchange rate and economic growth, stock market and exchange rate, stock market and economic growth and stock market, exchange rate and economic growth.

Korkmaz (2013) investigated the effect of exchange rate on economic growth from 2002 to 2011 in nine randomly selected European countries using Granger causality test. The result showed a long term rand bi-causal relationship between the foreign exchange rate and economic activity. Kazi, *et al* (2014) studied the causality between exchange rate and economic growth in Bangladesh from the period of 1973 to 2013 using Granger's Causality test. It was discovered that a bi-directional causality exists between exchange rate and economic growth. Lawal et al (2016) employed autoregressive distributed lag (ARDL to examine the exchange rate fluctuation and the Nigerian economic growth from 2003 to 2013. The empirical results show that exchange rate fluctuation has no effect on economic growth in the long run though a short run relationship exists.

Mamun , et al (2018) examined the causality between stock market development and economic growth in Bangladesh from 1993 to 2016 employing ARDL Bounds testing approach. The result indicated that stock market development has direct impact on economic growth both in the short run as well as in the long run. Also, Granger Causality tests confirm a bidirectional causal relationship between stock market development and economic growth.

Pan and Mishra (2017) investigated the stock market development and economic growth from January 1999 to November 2015 in China using the ARDL model. The findings did not show any evidence of a relationship between the stock market and the real economy in the short run. Pasrun (2015) investigated the dynamic relationship between stock prices and economic growth in Indonesia using a quarterly data from 2004 to 2013 and employed VAR and Two Steps Engle-Granger for estimation. The

result shows that there is a significantly dynamic relationship between stock price and economic growth and occurred at the start of the second quarter and a positive relationship which means that when stock prices went up (went down), then the economic growth of Indonesia went up (went down) as well. Each 1% increase (decrease) in the stock prices was always followed by 0.09% increase (decrease) in Indonesian economic growth. Bala and Hassan (2018) studied the exchange rate and stock market interactions in Nigeria from 1985 to 2015 using the ARDL model and Granger Causality tests. The results showed that exchange rate and economic growth have positive and statistically significant impact on stock market in Nigeria, while money supply has negative and statistically significant influence on stock market over the study period.

Mwaang and Njebele (2017) in the case of Zimbabwe studied the long-run and short-run relationship between the exchange rates and stock market prices using a monthly from January, 2004 to December, 2016, using the VAR and ARDL model. It result indicated that there is no short-run relationship between the exchange rate and stock market prices. Dahir et'al (2017) examined the dynamic relationship between exchange rates and stock prices in BRICS countries using daily data from January 1, 2006 to December 31, 2016 using a wavelet analysis. The results indicate that exchange rates lead stock returns in Brazil and Russia. However, the India stock price index pair has a negative relation while South Africa seems to have a bidirectional causality; the Chinese index pair did not show any correlation.

With papers that examine the connections among the three variables, Ifarajimi and Onyejiuwa (2015) investigated the exchange rate fluctuation, stock market performance and economic growth in Nigeria under democratic dispensation from 1999 to 2016 using VAR Granger Causality/Block Exogeneity Wald Tests. The study revealed that exchange rate shocks are crucial factors in explaining economic growth and growth in stock market in the long run.

Abimbola and Olusegun (2017) appraised the exchange rate volatility, stock market performance and aggregate output nexus in Nigeria using a quarterly data from 1985 to 2015 by employing ARCH, GARCH and the Bayesian VAR model. The result showed that exchange rate volatility Granger Caused stock price movement and aggregate output and vice versa. Saidi et al (2017) studied the effect of stock prices and exchange rates on economic growth in Indonesia from the first quarter of 2004 to third quarter of 2015 using ARDL model. The result showed that stock prices and exchange rates affect Indonesia's economic growth. The study also discovered that the amount of influence of stock prices on economic growth is greater than the effect of exchange rates on economic growth. Adeoti and Adebisi (2018) studied the case of Nigeria from 1986 to 2014. The study employed ARDL bounds test Cointegration and Vector Error Correction Model (VECM). The results showed a uni-directional causality running from aggregate output to stock prices in the short run, while in the long run, a bi-directional causal relationship was established.

There is scanty empirical works on the causal relationship among exchange rate, stock market and economic growth despite the theoretical connections among the three. There are however paucity of studies of the causal relationship among exchange rate, stock market and economic growth among

the OPEC despite their fast growing stock market and being the countries that their growth and stock market are driven by the oil proceeds. Hence, this study seeks to fill this gap.

METHODOLOGY

Theoretical Framework

This study utilized the stock- and flow-oriented models. The models are considered relevant because they are capable of showing the interconnectedness among economic activity, exchange rate and stock market activity. The stock oriented model, pioneered by Frankel (1983) and Brason (1983) holds that advances in the stock market affects exchange rate through the liquidity and wealth effects. A decrease in stock prices reduces the wealth of local investors which lowers their demand for money. Consequently, banks react by lowering interest rates which dampens capital flows, reducing the demand for local currency with the resultant effect of exchange rate depreciation. Conversely, an increase in the stock prices is expected to attract capital inflows, thus leading to exchange rate appreciation. As investors adjust their portfolio ratio of domestic to foreign assets in response to changes in economic conditions, the exchange rate responds accordingly. Hence, this theory postulates that stock prices cause exchange rate (Caporale et al., 2004; Chkili & Nguyen, 2014; Tsai, 2012; Wong, 2017).

The flow oriented model proposed by Dornbusch and Fisher (1980) postulates that real exchange rate induces real stock price returns. The model assumes that exchange rate is largely determined by the current account and trade balance. Also, exchange rate fluctuations affect both multinational and domestic firm's operations. In this regard, a change in exchange rate influences the value of firms' foreign operations via balance sheet as either profits or losses. Once firms declare profits or losses, the firm's stock prices will change. Also, exchange rate affects the stock prices of domestic firms, through their input -output prices and demand for their products. In this case, the causality is expected to run from exchange rate to stock prices. Thus, a depreciation/appreciation of the exchange rate enhances/reduces the competitiveness of firms and affects positively/ negatively their earnings and stock prices. This is because depreciation of local currency makes exportation more attractive thus, increases foreign demand which helps the competitiveness of firms in such country although stock prices might either increase or decrease depending on the orientation of country or firm either for export or import (Dornbusch and Fischer, 1980; Pan et al., 2007; Ülkü and Demirci, 2012).

Model Specification

The theoretical framework discussed proposes that there is a causal relationship among exchange rate, economic activity and stock market performance. Consequently, the functional relationship among the three variables is specified in equations 1-3

$$GDP = f(STO, EXR) \quad \ldots\ldots (1)$$

$$STO = f(GDP, EXR) \quad \ldots\ldots (2)$$

$$EXR = f(GDP, STO) \quad \ldots\ldots (3)$$

where GDP, STO and EXR is economic activity, stock market activity and exchange rate respectively. Equations 1 to 3 imply that the three variables cause one another. The estimable equations of the above is provided in equations 4-6

$$GDP_t = \alpha_1 + \alpha_2 STO_t + \alpha_3 EXR_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

$$STO_t = \beta_1 + \beta_2 GDP_t + \beta_3 EXR_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 5$$

$$EXR_t = \phi_1 + \phi_2 STO_t + \phi GDP_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 6$$

The choice of estimation techniques for the models proceeded from the outcome of the formal tests. Since this study assessed inter-relationship among the variables, either the original Vector Autoregression (VAR) or any of its modified versions was employed, depending on the co-integration result. If all the series are I(0), the appropriate VAR model would be estimated. The basic VAR is presented in equations 7 to 9.

$$GDP_{1t} = \pi_1 + \sum_{k=1}^{q} \pi_{2k}\, GDP_{t-k} + \sum_{k=1}^{q} \pi_{3k} STO_{t-k} + \sum_{k=1}^{q} \pi_{4k} EXR_{t-k} + \varepsilon_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 7$$

$$STO_{1t} = \delta_1 + \sum_{k=1}^{q} \delta_{2k}\, GDP_{t-k} + \sum_{k=1}^{q} \delta_{3k} STO_{t-k} + \sum_{k=1}^{q} \delta_{4k} EXR_{t-k} + \varepsilon_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .8$$

$$EXR_{1t} = \psi_1 + \sum_{k=1}^{q} \psi_{2k}\, GDP_{t-k} + \sum_{k=1}^{q} \psi_{3k} STO_{t-k} + \sum_{k=1}^{q} \psi_{4k} EXR_{t-k} + \varepsilon_{3t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots 9$$

Where q= the optimal number of lags, π_i, δ_i and ψ_i are long run coefficients

If all the series are I(1), further test of Fisher-Johansen co-integration is required so as to establish the absence or existence of long run relationship. If there is no long run relationship (no co-integration), the VAR-in-First-Differences version of equations 7-9 (Ying, 2001) .

However, if all the variables are co-integrated at I(1), the Vector Error Correction Model (VECM) is most appropriate. The dynamism of VECM makes it enjoy superiority over the previously considered models as it captures both short run and long run relationships among variables. It

also indicates the direction of causality which is a major weakness of the co-integration tests, such as Granger-causality test (Granger, 1988). If the series are of the combination of I(0) and I(1) and are co-integrated, the Toda-Yamamoto model is considered. If they are not, the short run models in equations 7-9 are to be estimated. Given the difficulty in interpreting the coefficients of multivariate models the Granger-causality test (Granger, 1969) and the Impulse Response Function (IRF) are further carried out. The last stage involved checking the validity of the models considered for estimation, and to ascertain that the relevant underlying assumptions are not violated.

Measurement of variables and Sources of data

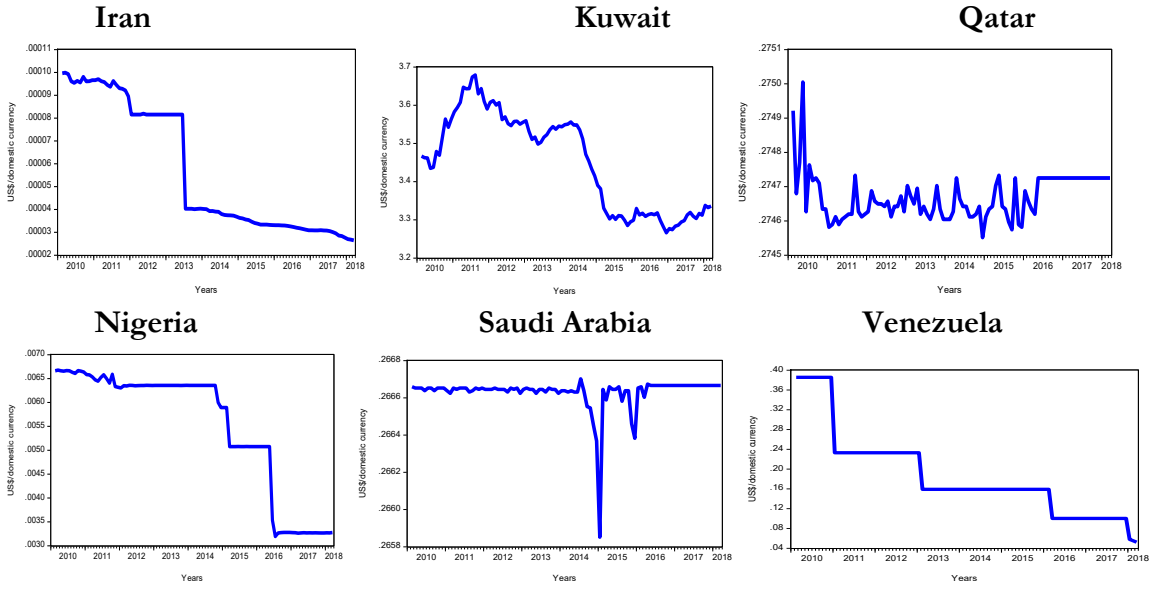
Stock price returns, calculated as the log of difference of the stock price was used as proxy for stock market activity. Exchange rate is defined as quantity of United State dollars per unit of each country's currency. Economic growth was computed as the log of difference of the gross domestic product. Monthly data of all the variables were extracted from the Global Economic Monitor (GEM), Bloomberg and International Financial Statistics (IFS) between February, 2010 and March, 2018.

RESULTS AND DISCUSSIONS

Trend, Patterns and Descriptive Analysis of the Variables

The monthly exchange rate did not show any serious volatility, except for Qatar where traces of unstable exchange rate was observed (Figure 1). This could be because the authorities in these countries (where exchange rate volatility is less pronounced) tend to intervene in the foreign exchange market to keep the rate within band.

Figure 1: Trends of Exchange rate across countries



It must be recalled that most OPEC countries operate managed floating exchange rate. The trend also indicates that the countries have been consistently experiencing exchange rate depreciation over time.

The growth rates of the countries exhibit large and small swings throughout the period under review (Figure 2). This implies that the GDP growth rates have not been stable over time in OPEC countries.

Figure 2: Trends of Growth rate across countries

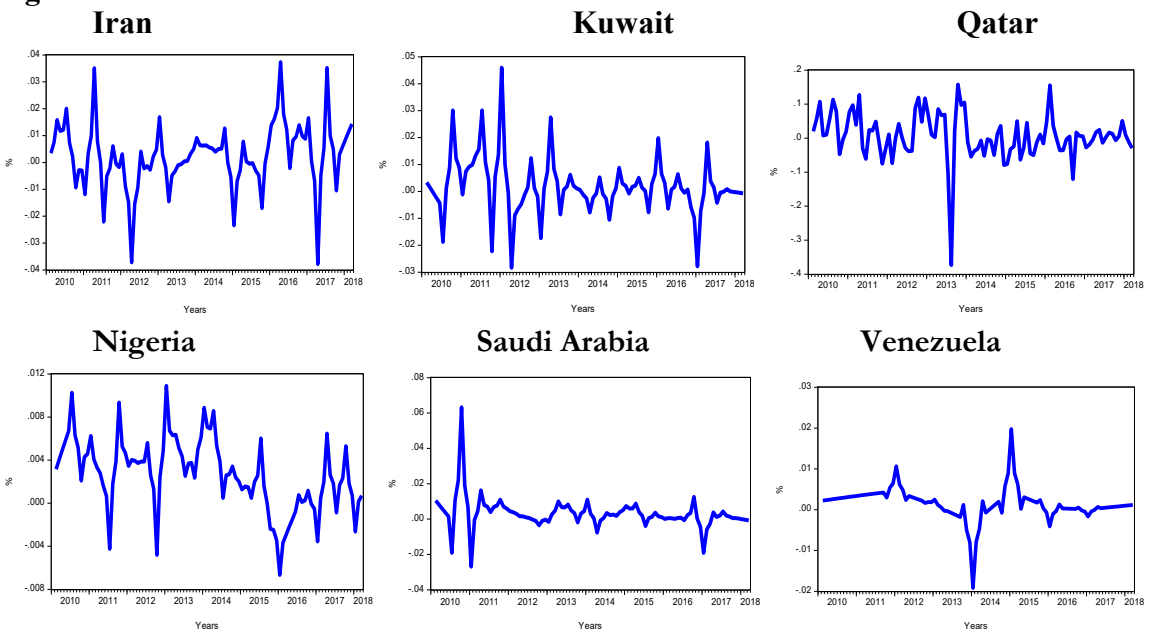
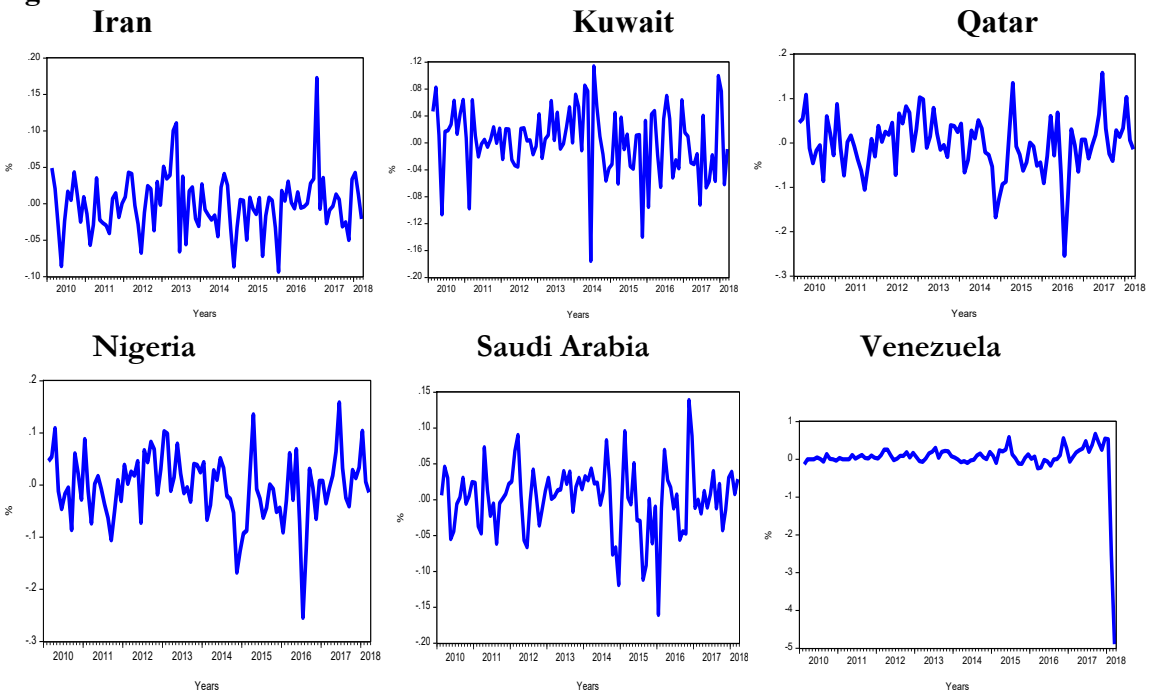


Figure 3: Trend of Stock Returns across countries



Stock returns of all the countries display high volatility with stock returns of Qatar, Saudi-Arabia and Nigeria being most volatile (Figure 3).

Average monthly exchange rate of dollar in terms of each country's currency range between 0.00006 (Iran) and 3.45 (Kuwait) (Table 1a). This implies that only Kuwaits's *Rial* was, on average, stronger than US dollar, posting more than three times the unit of dollar within the period. Similarly, none of these countries posted 1% monthly average GDP growth.

Table 1a: Descriptive properties of the variables

COUNTRY		IRAN			KUWAIT			QATAR	
VARIABLE	EXR	GRO	STO	EXR	GRO	STO	EXR	GRO	STO
Mean	0.00006	0.003	0.0069	3.45	0.002	-0.0005	0.275	0.0035	0.002
Median	0.00004	0.003	0.0053	3.47	0.001	0.0005	0.275	0.0029	0.006
Maximum	0.0001	0.037	0.1579	3.68	0.05	0.17	0.275	0.0414	0.11
Minimum	0.00003	-0.038	-0.3735	3.27	-0.03	-0.09	0.274	-0.0235	-0.17
Std. Dev.	0.00003	0.012	0.0676	0.13	0.01	0.03	0.00067	0.0086	0.05
Skewness	0.37	-0.30	-1.4922	-0.06	0.65	0.76	1.683	0.8057	-0.65
Kurtosis	1.29	5.51	11.9454	1.49	7.09	6.24	8.930	7.0754	4.07
Jarque-Bera	14.18	27.41	363.1162	9.33	75.58	52.52	189.889	78.4217	11.67
Probability	0.000	0.000	0.000	0.01	0.000	0.00	0.000	0.000	0.003
Observations	98	98	98	98	98	98	98	98	98

Note: EXR = bilateral exchange rate; GRO = economic growth; STO = stock price

Table 1b: Descriptive properties of the variables

COUNTRY	NIGERIA			SAUDI ARABIA			VENEZUELA		
VARIABLE	EXR	GRO	STO	EXR	GRO	STO	EXR	GRO	STO
Mean	0.006	0.001	-0.002	0.267	0.003	0.01	0.187	0.01	0.02
Median	0.006	0.002	-0.001	0.267	0.002	0.01	0.159	0.01	0.049
Maximum	0.007	0.010	0.158	0.267	0.063	0.13	0.386	0.01	0.677
Minimum	0.003	-0.008	-0.254	0.266	-0.027	0.16	0.052	0.02	-4.892
Std. Dev.	0.001	-0.003	0.063	0.000	0.008	0.04	0.089	0.01	0.592
Jarque-Bera	16.51	0.880	21.08	9201	1996.	15.3	19.09	449.	10917
Probability	0.000	0.644	0.000	0.000	0.000	0.00	0.000	0.00	0.000
Observations	98	98	98	98	98	98	98	98	98

Note: EXR = bilateral exchange rate; GRO = economic growth; STO = stock

The highest average monthly GDP growth was recorded in Qatar (0.0035) (Table 1a) followed by Saudi Arabia (0.0032) and then Nigeria (0.0026) (Table 1b). Kuwait and Nigeria experienced negative monthly returns while Iran recorded the highest average monthly stock returns (0.0069). It is also notable that the risk-return trade-off did not play out. This is true because there is non evidence of high returns (mean) consistent

with high risk (standard deviation). For instance, Iran had the highest returns (0.0069) but with relatively low risk (0.067) (Table 1a) compared with Venezuela that posted a return of 0.02 but with a risk of 0.592 (Table 1b).

Table 2: Augmented Dickey-Fuller (ADF) Test Results

COUNTRY	VARIABLES	LEVEL			IST DIFFERENCE			RE-MARKS
IRAN	LNEXR	-0.764	-2.138	1.826	-9.9***	-9.862***	-9.61***	I(1)
	GDP	-2.247	-2.726	-2.115**	-	-	-	I(0)
	STOCK	-7.536***	-7.783***	-7.502***	-	-	-	I(0)
KUWAIT	LNEXR	-0.400	-3.625**	-0.755	-	-	-	I(0)
	GDP	-1.854	-2.536	-1.680*	-	-	-	I(0)
	STOCK	-8.029***	-8.023***	-8.067***	-	-	-	I(0)
QATAR	LNEXR	-2.637*	-7.241***	0.205	-	-	-	I(0)
	GDP	-3.001**	-4.019**	-2.650***	-	-	-	I(0)
	STOCK	-10.879***	-11.132***	-10.911***				I(0)
NIGERIA	LNEXR	0.088	-1.677	-1.735	-8.13***	-8.175***	-7.966***	I(1)
	GDP	-1.927	-2.291	-1.673*	-	-	-	I(0)
	STOCK	-6.384***	-6.367***	-6.407***	-	-	-	I(0)
SAUDI ARABIA	LNEXR	-6.517***	-6.483***	-0.019	-	-	-	I(0)
	GDP	-2.326	-3.118	-2.075**	-	-	-	I(0)
	STOCK	-7.067***	-7.033***	-7.093***	-	-	-	I(0)
VENEZUE-LA	LNEXR	-0.214	-2.441	2.002	-9.81***	-9.801***	-9.423***	I(1)
	GDP	-2.014	-3.585**	-1.854*	-	-	-	I(0)
	STOCK	-2.862**	-2.381	-2.957***	-	-	-	I(0)

****, **, * represent significance levels at 1%, 5%, and 10% respectively. Model I, II, III.*

Iran had the highest average stock returns of 0.0069 but the risk attached to this return was lower than 0.089 that occurred in Saudi Arabia (Table 1). This suggests that there are other factors discouraging investors in investing in Saudi Arabia stock market.

All the series for all the countries except in Nigeria are not normally distributed, given the values and probabilities of the Jarque-Bera (Table 1). The implication of this is that the Ordinary Least Square (OLS) cannot be employed as the method of estimation. Non-normality of series violates the property of consistency of the OLS.

The unit root results indicate that Iranian, Nigerian and Venezuelan exchange rate are stationary at first difference considering all test options (Constant, Constant and trend, without constant and trend). Others are stationary at level but under different assumption (Table 2). Hence, the series are stationary at different level, thereby justifying the use of autoregressive distributed lag.

Estimation Results and Discussions:

Following the results of the unit root tests, the appropriate estimation methods were the Toda-Yamamoto (TY) model and VAR model. The use of the TY method was motivated by the mixed order of integration of the variables under consideration, while that of VAR was employed because all the variables were integrated of order zero and they were applicable to the estimation of all the countries being considered in this work.

Table 3a: Toda- Yamamoto Lag Order Selection Criteria

lags	Iran						Kuwait					
	LogL	**LR**	**FPE**	**AIC**	**SC**	**HQ**	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	338.21	NA	0	-7.29	-7.2	-7.25	614.73	NA	0	-13.59	-13.51	-13.56
1	531.59	369.93	0	-11.29	-10.97	-11.16	813.85	380.55	0	-17.82	-17.49*	-17.69
2	560.9	54.17	0	-11.73	**-11.16***	**-11.51**	818.83	9.19	0	-17.73	-17.15	-17.49
3	577.97	30.42	0	-11.91	-11.09	-11.58*	845.46	47.34	0	-18.12	-17.29	-17.79
4	588.2	17.58*	0.00*	-11.94*	-10.87	-11.51	866.89	36.68	0	-18.39	-17.31	-17.96
5	592	6.28	0	-11.83	-10.51	-11.29	869.66	4.55	0	**-18.26**	-16.93	-17.72
6	598.81	10.8	0	-11.78	-10.22	-11.15	879.13	14.93	0	-18.27	-16.69	-17.63
7							908.02	**43.66***	**0.00***	**-18.71***	-16.88	**-17.97***
8							913.26	7.57	0	-18.63	-16.55	-17.79

*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

Table 3b: Toda- Yamamoto Lag Order Selection Criteria

Lags	Qatar						Nigeria					
	LogL	**LR**	**FPE**	**AIC**	**SC**	**HQ**	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	1134.11	NA	0.00	-24.59	-24.51	-24.56	520.91	NA	0.00	-11.14	-11.14	-11.11
1		87.76	0.00*	-25.39*	-25.06*	-25.26	735.20	410.16	0.00	-15.55	-	-15.42*
2	1179.98 1184.39	8.14	0.00	-25.29	-24.72	-25.06	744.84	17.82	0.00	-15.57	15.23* -14.99	-15.34
3	1192.21	13.95	0.00	-25.27	-24.44	-24.93	755.82	19.59	0.00	-15.61	-14.79	-15.28
4	1202.03	16.86	0.00	-25.28	-24.21	-24.85	768.53	**21.87***	**0.00***	**-15.69***	-14.63	-15.26
5	1210.42	13.86	0.00	-25.27	-23.95	-24.74	775.76	11.98	0.00	-15.65	-14.34	-15.12
6	1221.98	**18.35***	0.00	-25.31	-23.76	-24.69						
7												
8												

*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 appropriate VAR lag order was estimated based on the five commonly used decision criteria, that is, Sequential Modified LR Test Statistic (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC) and Hannan-Quinn Criterion (HQ). Although uniform lag lengths were not chosen by all the information criteria, the best lag lengths that left the associated errors of white noise were chosen. The selected lag length in each of the models estimated was given a bold font in Tables 3a, 3b and 3c for all the countries and such lag length establishes the absence of serial correlation in the VAR model.

Table 3c: Toda- Yamamoto Lag Order Selection Criteria

Lags	Saudi Arabia						Venezuela					
	LogL	LR	FPE	AIC	SC	HQ	LogL	LR	FPE	AIC	SC	HQ
0	1034.11	NA	0.00	-22.91	-22.83	-22.88	246.02	NA	0.00	-5.40	-5.32	-5.37
1	1061.45	52.24	0.00	-23.32	-22.99*	-23.19	441.39	373.38	0.00	-9.54	-9.21*	-9.41
2	1065.24	6.99	0.00	-23.21	-22.62	-22.97	460.38	35.02	0.00	-9.76	-9.18	-9.53*
3	1092.66	48.74	0.00	-23.62	-22.78	-23.28	468.59	14.59	0.00	-9.74	-8.91	-9.41
4	1116.86	41.41	0.00	-23.95	-22.87	-23.52*	484.55	**27.30***	**0.00***	**-9.90***	-8.82	-9.46
5	1121.04	6.88	0.00	-23.85	-22.51	-23.30	486.25	2.80	0.00	-9.74	-8.41	-9.20
6	1134.87	21.82	0.00	-23.95	-22.37	-23.31	495.45	14.52	0.00	-9.74	-8.16	-9.11
7	1153.74	**28.52***	**0.00***	**-24.17***	.22.34	-23.43	505.12	`14.61	0.00	-9.76	-7.93	-9.02
8	1160.53	9.81	0.00	-24.12	-22.04	-23.28	507.96	4.11	0.00	-9.62	-7.54	-8.78

*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 exchange rate movements granger causes stock returns in Iran (Table 4a), but there is no significant causal relationship between exchange rate and economic growth or economic growth and stock returns. This result of a uni-directional relationship between exchange rate and stock price can be linked to the flow-oriented model that explains that it is exchange rate that causes stock returns. In this regard, exchange rate fluctuations affect both multinational and domestic firm's operations. In the case of multinational firms, a change in exchange rate will influence the value of firms' foreign operations via balance sheet as either profits or losses. Once firms declare profits or losses, the firm's stock prices will change. In Kuwait, there is no significant relationship among all the three series employed (Table 4a).

There is a uni-directional relationship between exchange rate and growth rate in Qatar (Table 4b). In particular, the direction of causality runs from exchange rate to growth rate in this country. There is only one significant causality result in Nigeria (Table 4b). Specifically, there is a uni-directional causation running from stock return to growth rate. This result is similar to the study of Anigbogu and Nduka (2014) where their causality results also suggest that stock market performance causes economic growth in Nigeria (Table 4b). The insignificant impact of stock return on exchange rate as seen from the result is consistent with the study carried out by Zubair (2013).

Table 4a Toda-Yamamoto Causality Test Result

Iran					Kuwait				
Dependent Variable: LNEXR				**Decision**	**Dependent Variable: LNEXR**				**Decision**
Null Hypothesis:	**d.f**	**Chi-sq.**	**Prob.**		**Null Hypothesis:**	**d.f**	**Chi-sq.**	**Prob.**	
STOCK RETURNS does not Granger cause LNEXR	5	2.67	0.75	Do not Reject	STOCK RETURNS does not Granger cause LNEXR	7	5.01	0.65	Do not Reject
GROWTH RATE does not Granger cause LNEXR	5	1.92	0.85	Do not Reject	GROWTH RATE does not Granger cause LNEXR	7	9.06	0.24	Do not Reject
Dependent Variable: STOCK RETURNS				**Decision**	**Dependent Variable: STOCK RETURNS**				**Decision**
Null Hypothesis:	**d.f**	**Chi-sq.**	**Prob.**		**Null Hypothesis:**	**d.f**	**Chi-sq.**	**Prob.**	
LNEXR does not Granger cause STOCK RETURNS	5	44.42	0.00***	Reject	LNEXR does not Granger cause STOCK RETURNS	7	1.79	0.97	Do not Reject
GROWTH RATE does not Granger cause STOCK RETURNS	5	1.67	0.89	Do not Reject	GROWTH RATE does not Granger cause STOCK RETURNS	7	8.37	0.30	Do not Reject
Dependent Variable: GROWTH RATE				**Decision**	**Dependent Variable: GROWTH RATE**				**Decision**
Null Hypothesis:	**d.f**	**Chi-sq.**	**Prob.**		**Null Hypothesis:**	**d.f**	**Chi-sq.**	**Prob.**	
LNEXR does not Granger cause GROWTH RATE	5	2.73	0.74	Do not Reject	LNEXR does not Granger cause GROWTH RATE	7	6.77	0.45	Do not Reject
STOCK RETURNS does not Granger cause GROWTH RATE	5	6.98	0.24	Do not Reject	STOCK RETURNS does not Granger cause GROWTH RATE	7	0.66	0.99	Do not Reject

*, **, *** denotes significance at 10%, 5% and 1% level respectively.

Table 4b: Toda-Yamamoto Causality Test Result

Qatar					Nigeria				
Dependent Variable: LNEXR				**Decision**	**Dependent Variable: LNEXR**				Decision
Null Hypothesis:	**d.f**	**Chi-sq.**	**Prob.**		**Null Hypothesis:**	**d.f**	**Chi-sq.**	**Prob.**	
STOCK RETURNS does not Granger cause LNEXR	6	4.476407	0.6125	Do not Reject	STOCK RETURNS does not Granger cause LNEXR	4	2.481936	0.6479	Do not Reject
GROWTH RATE does not Granger cause LNEXR	6	7.972071	0.2402	Do not Reject	GROWTH RATE does not Granger cause LNEXR	4	2.749461	0.6006	Do not Reject
Null Hypothesis:	**d.f**	**Chi-sq.**	**Prob.**		**Null Hypothesis:**	**d.f**	**Chi-sq.**	**Prob.**	
LNEXR does not Granger cause STOCK RETURNS	6	1.873164	0.9310	Do not Reject	LNEXR does not Granger cause STOCK RETURNS	4	6.431195	0.1692	Do not Reject
GROWTH RATE does not Granger cause STOCK RETURNS	6	5.129813	0.5273	Do not Reject	GROWTH RATE does not Granger cause STOCK RETURNS	4	6.431195	0.2764	Do not Reject
Null Hypothesis:	**d.f**	**Chi-sq.**	**Prob.**		**Null Hypothesis:**	**d.f**	**Chi-sq.**	**Prob.**	
LNEXR does not Granger cause GROWTH RATE	6	18.70685	0.0047***	Reject	LNEXR does not Granger cause GROWTH RATE	4	4.814851	0.3068	Do not Reject
STOCK RETURNS does not Granger cause GROWTH RATE	6	2.466444	0.8722	Do not Reject	STOCK RETURNS does not Granger cause GROWTH RATE	4	13.83189	0.0079***	Reject

*, **, *** denotes significance at 10%, 5% and 1% level respectively.

In the case of Saudi Arabia, there exists no causal relationship among the three series, in other words, none of these series causes one another (Table 4c). This is similar to the result of Kuwait where no significant relationship is seen among all variables. The results of the causality test in Venezuela were slightly different from others. In this case, exchange rate Granger causes stock returns, which is consistent with the flow-oriented model (Table 4c). Also, stock returns Granger causes exchange rate similar to stock-oriented model. Therefore, there is a bi-directional relationship between stock returns and exchange rate in Venezuela.

Table 4c: Toda-Yamamoto Causality Test Result

Saudi Arabia					Venezuela				
Dependent Variable: LNEXR				**Decision**	**Dependent Variable: LNEXR**				**Decision**
Null Hypothesis:	**d.f**	**Chi-sq.**	**Prob.**		**Null Hypothesis:**	**d.f**	**Chi-sq.**	**Prob.**	
STOCK RETURNS does not Granger cause LNEXR	7	11.98759	0.1010	Do not Reject	STOCK RETURNS does not Granger cause LNEXR	4	8.0783	0.0890*	Reject
GROWTH RATE does not Granger cause LNEXR	7	0.818512	0.9973	Do not Reject	GROWTH RATE does not Granger cause LNEXR	4	0.3573	0.9858	Do not Reject
Dependent Variable: STOCK RETURNS				**Decision**	**Dependent Variable: STOCK RETURNS**				**Decision**
Null Hypothesis:	**d.f**	**Chi-sq.**	**Prob.**		**Null Hypothesis:**	**d.f**	**Chi-sq.**	**Prob.**	
LNEXR does not Granger cause STOCK RETURNS	7	10.36431	0.1689	Do not Reject	LNEXR does not Granger cause STOCK RETURNS	4	20.800	0.003***	Reject
GROWTH RATE does not Granger cause STOCK RETURNS	7	3.123250	0.8734	Do not Reject	GROWTH RATE does not Granger cause STOCK RETURNS	4	1.0818	0.8972	Do not Reject
Dependent Variable: GROWTH RATE				**Decision**	**Dependent Variable: GROWTH RATE**				**Decision**
Null Hypothesis:	**d.f**	**Chi-sq.**	**Prob.**		**Null Hypothesis:**	**d.f**	**Chi-sq.**	**Prob.**	
LNEXR does not Granger cause GROWTH RATE	7	5.233052	0.6315	Do not Reject	LNEXR does not Granger cause GROWTH RATE	4	0.147132	0.997	Do not Reject
STOCK RETURNS does not Granger cause GROWTH RATE	7	7.580694	0.3710	Do not Reject	STOCK RETURNS does not Granger cause GROWTH RATE	4	2.824234	0.587	Do not Reject

*, **, *** denotes significance at 10%, 5% and 1% level respectively.

Post-Estimation

The main diagnostic test relevant for ensuring the efficiency of all VAR models is the serial correlation test. Thus, the post-estimation test results show that all the estimated models satisfied the underlying assumption of lack of serial correlation among the VAR residuals across their respective chosen lags (Table 5), hence, making the conclusions drawn from the Granger -causality tests reliable and suitable for policy formulation and implementation. For all the models, the adopted LM test indicates that the null hypothesis of no serial correlation cannot be rejected at 1% critical level.

Table 5 Residual Serial LM Diagnostics Test

Lags	Iran LM-Stat(Prob.)	Kuwait LM -Stat(Prob.)	Qatar LM-Stat(Prob.)	Nigeria LM -Stat(Prob.)	Saudi Arabia LM-Stat(Prob.)	Venezuela LM -Stat(Prob.)
1	29.37808 (0.0006)	10.22176 (0.3328)	14.61837 (0.1020)	12.52009 (0.1856)	13.04081 (0.1608)	13.64690 (0.1355)
2	14.92981 (0.0929)	7.559220 (0.5791)	3.514725 (0.9404)	11.79657 (0.2250)	7.968654 (0.5373)	23.08624 (0.0060)
3	21.68938 (0.0099)	15.26060 (0.0840)	18.92219 (0.0259)	24.33597 (0.0038)	16.60479 (0.0553)	23.13439 (0.0059)
4	12.27123 (0.1984)	5.212574 (0.8154)	14.98916 (0.0912)	3.728708 (0.9283)	8.536902 (0.4811)	14.10443 (0.1187)
5	8.385610 (0.4958)	15.72211 (0.0729)	13.91683 (0.1253)	15.77626 (0.0717)	6.477822 (0.6913)	4.967358 (0.8371)
6	14.79856 (0.0966)	3.183086 (0.9566)	5.573043 (0.7818)	19.67180 (0.0200)	18.42970 (0.0305)	5.853609 (0.7545)
7	14.74395 (0.0982)	4.386764 (0.8842)	4.894274 (0.8434)		4.311195 (0.8898)	6.823160 (0.6555)
8	14.12321 (0.1180)	2.809310 (0.9714)			9.053522 (0.4323)	
9		19.81081 (0.0191)				

CONCLUSION AND POLICY RECOMMENDATIONS

The study employed monthly data from February, 2010 to March, 2018 to assess the possible interdependence of exchange rate, stock returns and economic growth in six selected OPEC countries. Appropriate VAR model was estimated in the context of stock- and flow-oriented models. There is no causal relationship among the series in Kuwait, Iran and Saudi-Arabia. However, stock market causes economic growth in Nigeria. Unlike the case of Nigeria and other countries, there is a bi-causal relationship between exchange rate and stock market returns in Venezuela. In Qatar, exchange rate causes growth rate.

Causal relationship among exchange rate, stock market activity and growth differ across the OPEC, despite the major role oil revenue plays in the individual economies and also having relatively effective and emerging stock market. Countries whose growth is caused by stock market activity will have to be wary of oil price determination. Also, countries whose stock market is caused by exchange rate should be conscious of intervention in the exchange rate market.

Following from the conclusion, a couple of recommendations are imperative:
Government of Kuwait and Saudi Arabia should improve their stock market while monetary authorities should ensure the stability of exchange rate.

In Nigeria, a favorable policy that will enhance stock market is recommended because of the causal relationship running from the stock market to economic growth in this country.

In Iran, policies should be aimed at improving the exchange rate, depending on the situation at hand because any of the policies

made will affect the stock market.
In the case of Venezuela, the same recommendation as in Iran will apply but both the stock market and foreign exchange markets should be well monitored since the result shows that there is a bi-causal relationship between exchange rate and stock returns.

In Qatar, the policy makers should avoid exchange rate fluctuations so as to dampen its effect on economic growth. This can be done by setting lower and upper limit for exchange rate movement and ensure that the rate is within the band.

For the Cartel as a whole, since oil price produces eventual diverse effect on the economy, it will be imperative for them to come up with a favorable macroeconomic coordination that will dampen the negative causal effect of oil price changes. Such macroeconomic coordination could be centered around stock market activity and the real sector.

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