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Harrison O. Okafor

Central Bank of Nigeria, hookafor@cbn.gov.ng

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GEOPOLITICAL TENSIONS, CRUDE OIL PRICE AND OUTPUT DYNAMICS: IMPLICATIONS FOR FISCAL GOVERNANCE IN NIGERIA



Harrison O. Okafor Ph.D
Central Bank of Nigeria.

1.0 INTRODUCTION

Over the past four decades, a major feature of the global economic environment had been the asymmetric conjecture of the influence of geopolitical tension associated with the demand and supply of crude oil at the international market. The consequences of this could be gleaned in many ramifications particularly, crude oil price determination, quota dynamics associated with crude oil supply and global oil demand. Emerging issues from the literature suggests that geopolitical tensions associated with increasing economic and political influences have been linked to the dynamics of crude oil prices (Guase, 2015, Almoguera et al., 2011 and Fattouh, 2005). In other words, as countries try to use their economic and political might to influence their supply quota, it has continued to manifest profound implications on oil prices and economic governance for oil producing countries. For instance, the crisis between Iran and Iraq, Iran and Kuwait, Saudi Arabia and Iran, and US and Russia/Nigeria reinforces the elements of

ABSTRACT

This paper examined the linkages between geopolitical tensions, crude oil prices and oil output dynamics vis-à-vis the implication for fiscal governance in Nigeria. Within a strategic game theoretical framework, anchored on moral hazard assumptions (incentive problem) and applying a VAR model, findings indicate that geopolitical tensions affects Nigeria's bonny light crude oil price and exports. Results also revealed that the timing and impact of geopolitical tensions last fairly long thus, could affect fiscal revenue and economic governance in Nigeria. Therefore, the paper recommends that a complete diversification of the economy from oil will strengthen the nation's fiscal space and development planning.

Keywords: *Geopolitical Tension, Fiscal Governance and VAR Model*

Jel Classification: *F5, F6 and K2*

geopolitical tensions. Similarly, the tension between OPEC¹ and non-OPEC member in securing access and market shares are among the factors engendering possible oscillations in crude oil prices (Kristopher, 2015).

Oil price drastically declined from US\$110 per barrel (pb) in June 2014 to US\$44 per barrel by the end of November, 2015 and further to US\$27pb in February 2016 due mainly to geopolitics between the US and Russia, and in part to the hard stance of Iran and Saudi Arabia in controlling market shares. Recently, crude oil prices had a slight uptick to over US\$40pb following increased activities of the Niger Delta Avengers in Nigeria. In economies with huge reliance on oil for revenue, particularly Russia, Venezuela and Nigeria, geopolitical tensions have continued to adversely affect fiscal policy, planning and economic governance as well as stock market performance.

Consequently, given the importance of energy in economic development, most advanced and emerging economies are developing alternative sources of energy as a way of circumventing the challenges.

This paper attempts to broadly examine the linkages between geopolitical tensions, crude oil price and output dynamics vis-à-vis the implication for fiscal governance in Nigeria. Specifically, the paper tries to identify the different episodes of geopolitical tensions and its interactions with oil output and prices. Again, it assesses the impact of geopolitical tensions on oil price, oil export and stock market performance and their implications for fiscal governance in Nigeria.

A cursory look at the literature shows that empirical studies on the subject are scanty, particularly in Nigeria. Hence, this paper seeks to provide deep insight on the impact of oil geopolitics on Nigeria's fiscal

¹ Organisation of Oil Exporting Countries (OPEC), which regulates crude oil supply.

governance. Within the framework of a strategic game theoretical framework founded on moral hazard assumptions (incentive problem), findings indicates that geopolitical tensions affects oil price, oil exports and stock market performance. It also underpins Nigeria's revenue profile since she does not have strong influence on the price setting arrangement that has been taunted by the non-OPEC members and the powerful blocs in the oil market. Findings also revealed that the impact of geopolitical tension is highly persistence in terms of timing and thus, can affect fiscal revenue and governance in Nigeria. Therefore, a complete diversification of the economy from oil will strengthen the nation's fiscal space and development planning.

Following this introduction, section two espouses the literature on the subject while section three presents the stylised facts on oil geopolitics and other key variables. The methodology of analysis is contained in section four, while the empirical findings are presented in section five. The conclusion and recommendations are documented in section six.

2. LITERATURE REVIEW

Theoretically, crude oil price like any other commodity is usually influenced by market fundamentals and government regulations or decisions. The classicalists postulated that the interaction of the forces of demand and supply determines the prices of commodities². Given that crude oil is an important energy input to the production value chain for many economies in the world, crude oil price movement often mirrors the

global demand conditions and production possibility frontiers and capacities. This is closely related to the business cycles theory of economic fluctuations (Kyland and Prescott, 1977). Nonetheless, demand and supply conditions of crude oil also bear direct relationship with geopolitics associated with crude oil production and supply at the international market (Gause 2015; Kristopher 2015 and Husain (2015)). To a very large extent, these dynamics affect the behaviour of crude oil price and market stability over time. This is the concept known as the geopolitics of oil price (Guase, 2015). The theoretical import of this concept is founded in economic diplomacy and can be clearly understood as a game process (see, Iwayemi, 2009 and Turocy and Stengel, 2001). Iwayemi (2009) noted that economic agents' acts based on expected payoff and the information available to them that others do not have. Thus, key players in the market often deliberately create some tensions and conflicts (including domestic upheavals) to undermine stipulated supply and demand projections with a view to either raise or dampen oil prices.

In the literature, several factors have been identified as the main causes of crude oil price fluctuations (see Guase, 2015, Husain 2015 and Fattouh, 2006a and 2005). Fattouh (2005) argued that weather condition, global demand and economic developmental initiatives could affect global demand for crude oil and could have direct impact on the behaviour of oil price. On the other hand, Guase (2015) noted that geopolitical tensions and economic diplomacy are deliberate actions or power tussles that can be used to refrain or restrict oil producers' access to

the international market. It can come in the form of tacit collusion or conspiracy largely in the supply of crude oil in the market. For instance, Saudi Arabia and Iran had fought severally at the OPEC to protect each other's market shares and interest in the supply of crude oil at the international market. Russia, Iran, Oman, Nigeria, Venezuela and Angola had often faced one challenges or the other due to geopolitical tensions associated with the tactics to muzzle power to increase their crude oil supply quota at OPEC meetings.

Geopolitical tensions between and among nations affects global crude oil supply and price mechanisms with varying ramifications for the oil producing nations (Gause, 2015 and Kristopher, 2015). Classical elements of geopolitical tensions are often give and take but in most cases could engender some spillover effects on crude oil prices and exports, government revenue, stock markets performance and even output performance. In 1986, during the invasion of Kuwait by Iran, the sanction given to Iran led to the substantial increase in oil price, while the return of Iran to OPEC in the 1979 and 2015 also resulted in the substantial drop in soft oil prices.

On the other hand, the recent introduction of SHALE oil to the international market by the United States was a new dimension of oil geopolitics calculated at witting down the pseudo powers of Saudi Arabia, Iraq, Venezuela, Russia and Nigeria that depend largely on crude oil revenue for their public finance management (Husain et al., 2015 and Kristopher 2015). Husain et al., (2015) argued that weaker than expected demand over the increasing supply by OPEC and non-OPEC member led to the sustained decline in oil prices. It can therefore, be

²Hotelling theoretical perspective (see, Iwayemi, 2009 and Turocy and Stengel, 2001).

gleaned that oil politics is used to weaken the economic might of nations perceived to be a major threat to international economic diplomacy. Thus, sanctions are issued and reviewed over time depending on vested interests. For instance, Kristopher (2015) stressed that OPEC has also been threatened by non-OPEC members through unregulated supplies to the market to deliberately lower the energy prices.

Fattouh (2007) also argued that OPEC pricing power is not constant and varies according to oil market conditions. The paper noted that the recent changes in the international oil pricing system have diminished OPEC pricing power, especially when compared to the previous administered oil pricing system even though OPEC does not operate in a political vacuum. Fattouh (2006a) earlier argued that pricing systems in the past reflected the balance of power at those times and this present system is no exception. For many, the balance of political power can have an impact on OPEC behaviour. For instance, Doran (1980) hypothesises that there are limits on how much Saudi Arabia can increase its oil price because very high oil prices can be "damaging to their own interest because of the danger to the world economy and to their larger commercial involvements and because of the incentive to outside military pressure by distraught consumer governments" (p.91). He also argued that 'political and cultural similarity' has facilitated Saudi Arabia's role in forming coalitions regarding price preferences.

Although the literature accounts for a number of factors that affects crude oil prices (see Guass, 2015; Medel, 2015); Fattouh, 2005); and Almoguera, Douglas and Herrera 2011), none of these studies have empirically

examined the impact of geopolitical tensions on oil producing economies. However, anecdotal evidence suggests that geopolitical tensions could influence crude oil price behaviour and by implication country's public finances Guase, 2015; Medel, 2015 and Fattouh, 2005). These views can be grouped into the positive and negative. The positive side is that geopolitical tension could be used to raise production and supply quotas for the OPEC members which could also lead to rising/decline in oil prices. For instance, Guase (2015) noted that during the suspension of Iran by the OPEC, oil price maintained a rising trend in the market, which strengthened the revenue of oil producing nations and by extension their fiscal space. Abiola and Okafor (2013) showed that rising oil prices bears positive relationship with Nigeria's revenue profile over the years.

Nevertheless, geopolitical tensions often intensify the downward oscillations in crude oil prices and could also affect fiscal planning. Kristopher (2015) argued that unguided supply by non-OPEC members negatively affected oil prices. Economies with large market powers often use geopolitical manipulations to alter the market to their favour. It is along this trajectory that countries often come to the negotiating table to raise oil price. Gause (2015) assessing the role of geopolitical factors in oil price movement, stressed that oil price fall is the only thing that can bring Iran, Saudi Arabia and Russia to the negotiation table. The recent meetings by the leaders of OPEC in Qatar and Algeria were also called at the instance of the deliberate effort to reduce production quota and stabilise crude oil prices. The implications of oil price fluctuations traverse across varying ramifications especially public finances of largely oil

dependent economies. It can either constrain or boost revenues for oil producing economies particularly external reserves and exchange rate stability. It can also undermine the production capacity of oil producing nation. Geopolitical tension might increase or decrease revenue which is necessary for sound economic planning and management. Such conditions can weaken domestic political and economic governance and general economic performance. Geopolitics associated with crude oil price decline often result in regime changes. This is because it causes weak financial conditions and poor economic management. In other words, it results in change of governments. For instance, in Libya, Iran and Omar, governments are often overthrown during oil price fall. Husain et al., (2015) showed that lower oil prices affects public finances and financial market conditions of oil dependent economies.

Evidently, no empirical study has so far documented the impact of geopolitical tension on oil price and output dynamics particularly, in Nigeria. This could be as a result of measurement and estimation difficulties. Understanding this link could help in economic policy and planning particularly for huge oil dependent economies like Nigeria.

3. STYLISED FACTS ABOUT CRUDE OIL PRODUCTION AND PRICE DEVELOPMENTS IN NIGERIA

Crude oil production in Nigeria became prominent following the discovery of oil in Oloibiri, Bayelsa state in 1956. Although OPEC was formed in 1961, Nigeria joined in 1971 when she started shifting from agricultural based-economy to a high oil export-dependent economy. Following

the first major increase in crude oil price associated with the suspension of Iran by the OPEC, Nigeria enjoyed the huge revenue from oil. Figure 1 shows the various episodes of geopolitical crisis associated with crude oil market and prices. For ease of appreciation, this paper highlights five recent but major episodes that affected Nigeria oil market and their impact on key macroeconomic variables. These are the Iran crisis, Saudi Arabia/Iran invade Kuwait crisis, Asia oil demand crisis, the global financial crisis and the discovery of the US shale oil/ non-OPEC supply disruptions.

During the period 1973/1974 when Arab nations issued ban against countries supporting Israel and the beginning of the Iran-Iraq war in the 1980s as well as the cancellation of the production contract with the US by Iran, crude oil price rose significantly in the mid-1970s and early 1980s. This led to the Udoji award in the 1970s in Nigeria. In the same vein, when Saudi Arabia increased her market shares in 1986 couple with the end of the war between Iran and Iraq, increase production of both countries also resulted in supply glut and price decline. Oil price also rose in 1999, reflecting the recovery from the Asian financial crisis following increased demand in the region to recover and reconstruct their economies. Although oil price movements reflected global demand condition prior to 2007, crude oil price also plummeted due to substantial decline in crude oil demand by the US and other developed economies during the 2008/2009 global financial crisis. The recent discovery of the Shale oil by the US alongside non-OPEC increased crude supply in the market coupled with the lifting of supply ban on Iran, which reinforced another form of geopolitics in the oil market. Evidently, crude oil prices

followed similar trend with geopolitical crisis. Oil price rose from US\$9.35bp in 1974 to US\$12.2bp and US\$37.4bp in 1975 and 1980, respectively, before declining to US\$35.7bp in 1981 due to the Iran crisis. It fell to US\$14.4bp in 1986 from a high US\$35bp in 1981. However, oil price rose again from US\$14.9bp in 1988 to US\$23.2bp in 1990 before declining markedly to an average of US\$16.0bp between 1990 and 1995 due to the global economic conditions. Crude oil price carved to less than US\$20bp in during the 1997 and 1998 due largely to the Asian financial crisis.

Following significant recovery due to the increase global demand between 2002 and 2005, oil price rose steadily to near US\$40bp in 2005 and remained above US\$60bp in 2007. Another major development was the increase in crude oil prices to the peak of US\$112bp in 2012, US\$60bp in mid-2014 before it declined substantially to US\$40bp in 2015 and below US\$30bp in early 2016 due to supply glut in the market by non-OPEC members and the competing US Shale oil.

Nigeria produced an average of 1.3 million barrels per day (mbpd) in 1990 before it rose astronomically to 1.5 mbpd in 2000. By 2002, domestic crude production increased from 1.6 mbpd to 1.8 mbpd in 2006, reflecting increasing production and demand occasioned by the global economic recovery. In 2007, following the significant activities of the Niger Delta issues, crude oil production in Nigeria also declined. In 2008/2009, crude oil production stabilised due to the introduction of the Amnesty programme of the Federal Government. Crude production stabilised around 1.8 to 2.2 mbpd since 2012 following the stability in the Niger Delta region. Nonetheless, the recent activities of the Niger Delta

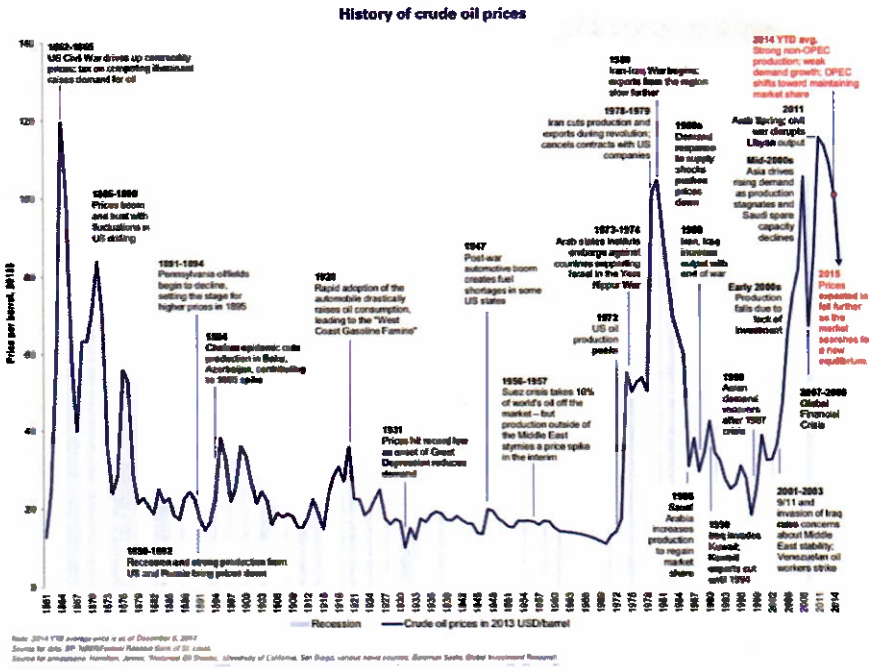
Avengers have driven crude oil production to an all-time low of 0.9 mbpd in the first half of 2016. To a very large extent, crude oil production and crude oil export have maintained definite pattern since 1999 as the local refineries were performing below capacity. The recent report by the NNPC indicated that the refining capacity of three refineries remained lower than 400,000 barrel per day since September 2014, the refineries resumed operation. Hence, it is evident that over 90 percent of the domestic crude production is sold at the international market with modest impact on the price of crude oil.

The link between stock market and oil price behaviour is also evident. Figure 2 shows that the all share index moves in the same direction with oil price movements. For instance, during the financial crisis in 2007 and the recent crude oil price crisis, stock market performance has been relatively poor reflecting the impact of oil price dynamics. Available evidence also revealed that government revenue from oil has considerably declined due to fall in oil price (See figure 3).

4. ANALYTICAL FRAMEWORK AND METHODOLOGY

Analytically, we assume a non-cooperative game theoretical framework anchored on a strategic form approach that has multiple rational key players, policy actions/strategies and pay-offs/outcomes from each possible combination of choices. Each player acts strategically based on the available information that others do not have. In the oil market, there are two categories of suppliers: the OPEC and non-OPEC members who act rationally to maximise market shares. Consequently, oil producing countries generally apply their strategies such as;

Figure 1: Episodes of Geopolitical Tensions and Oil Price Movement



cooperate to maximise possible actions including increase market shares, increase supply, reduce supply quota or/and flout the rules of engagement to refrain other producers from the market to raise or stabilise crude oil prices.

Thus, key players create tensions depending on their influence in the market when the incentive to raise oil prices is available and unknown to other players or cooperate to stabilise oil prices. These actions underline the behaviour of crude oil prices as founded in oil geopolitics. Intuitively, oil prices tend to rise during crisis period for producing nations and declines with supply glut and market stability.

4.1 Data, Sources and Description

Monthly data spanning 1998M1 to 2016M2 sourced from the OPEC database and the Central Bank of Nigeria statistical bulletin (various issues) were used for the analysis. The choice of the period was to account for major structural breaks in oil price behaviour and availability of data. The variables are the Bonny light crude oil price (US\$ pb), crude oil export (mb), all share index of stock market (unit), geopolitical tension (dummy variable). The dummy variable was generated based on the historical pattern in oil prices associated with geopolitics. The period of crises was given zero, while no crisis carries one. However, to avoid dummy trap the variable was interacted with Bonny light crude oil price to generate a new variable called political tension. To ensure that the variables are devoid of measurement error, some of the data were transformed to keep them in the same magnitude. The data were subjected to diagnostic checks such as the unit root test to ensure that the inferences drawn from the results are not misleading. The plot of

Figure 2: Oil Price, GPT and ASI

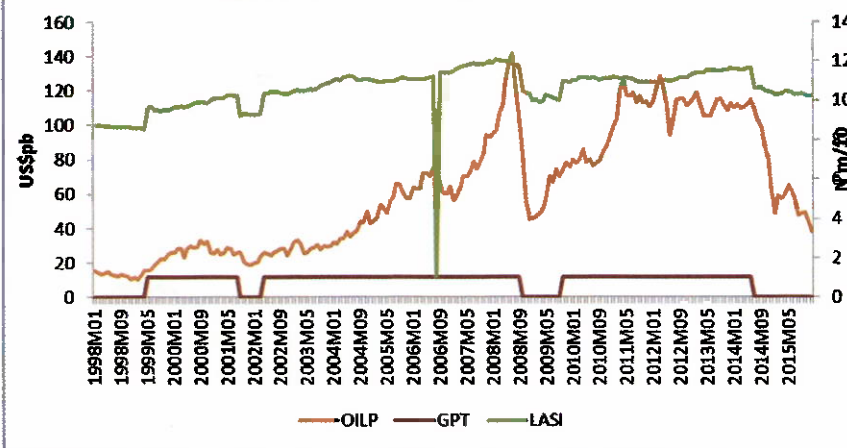
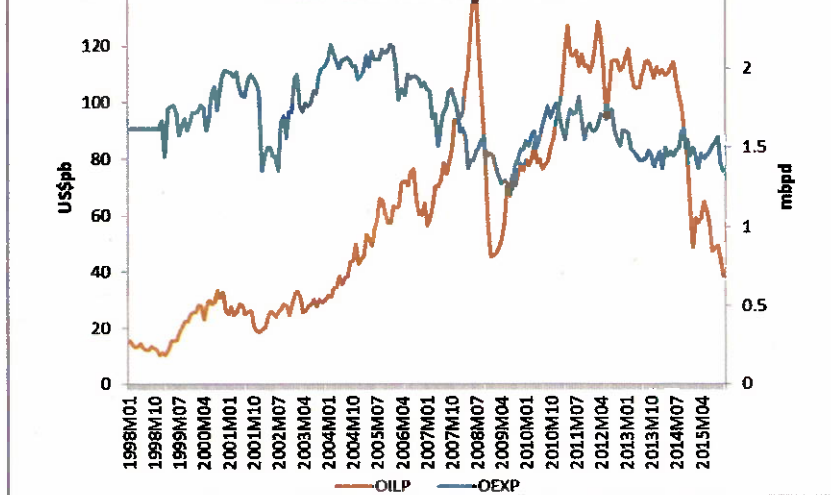


Figure 3: Crude Oil Prices and Exports



the variables was also carried out to observe their trend.

Model and Estimation technique
The vector auto-regressive model developed by (Sims, 1980) was adapted to examine the impact of oil geopolitics on selected key variables such as crude oil price, exports, and stock market index in Nigeria. The choice is because VAR enables us to determine the channels of transmission and measure impact of lagged dependent variable on other endogenous variables.

The VAR representation is specified as:

$$Y_t = aY_{t-1} + bX_t + v_t \quad \dots\dots (1)$$

where **Yt** is the vector of endogenous variables, **Xt** is the vector of exogenous variables and **vt** is the residual vector. In addition, **a** is a matrix that includes all the coefficients describing the relationships among the endogenous variables, and **b** is a matrix that includes all the coefficients describing the relationships among the endogenous and exogenous variables.

We transform equation (1) to a typical reduced-form VAR as proposed by Sims (1995), in a system of equations can be written in the form:

$$Y_t = A(L)Y_{t-1} + \varepsilon_t \quad \dots\dots (2)$$

Where **yt** is the column vector of observations at time (t) on all variables and is known as the vector of endogenous variables. **A(L)** is the matrix of coefficients to be estimated and the symbol ε_t represents the column vector of random disturbances values called innovations that may be contemporaneously correlated with each other and assumed to be non-autocorrelated over time.

Furthermore, equation (2) can be re-specified as:

$$Y_t = A_1Y_{t-1} + A_2Y_{t-2} + A_3Y_{t-3} + A_kY_{t-p} + \varepsilon_t \quad \dots\dots (3)$$

In a VAR model, each variable is regressed on its own lags and the lags of each of the other variables in the model. This provides a better insight into the dynamics of the system which allows for a feedback among the endogenous variables in the model. The VAR methodology has become a major workhorse for estimating the feedback effects among endogenous variables. Thus, we start with the estimation of an unrestricted VAR which enables us to generate the impulse response and variance decomposition of the shocks of the dependent variable on the endogenous variables. Hence, the impulse response of the variables and their historical decomposition was also estimated. Furthermore, granger-causality test was conducted to validate the nature of causality among the series.

5. EMPIRICAL ANALYSIS

Plot of the Variables and Unit Root test Result

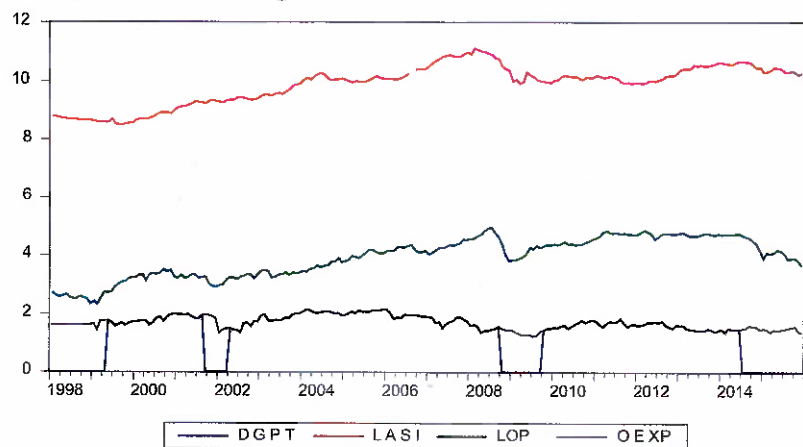
Figure 3 shows the plots of the series. It indicates that geopolitical tension has been a dominant feature in the global level. This paper assumes two variants of geopolitical tension.

The kind that lowers crude oil price, and that which exerts positive influence or raise the price of oil price at the global market. It is evident that there are three key episodes of the negative impact of geopolitical tensions over the period.

The unit root test results also indicate that all the variables are stationary after difference at 5 per cent level of significance (see appendix 1). In other words, this indicates that the variables are integrated of order I(1). This justifies the use of VAR to estimate the impact of geopolitical tension on the economy. In addition, root mean stability test was conducted to determine the appropriateness of the models. These tests confirmed the stability of the model and justify the choice of the model to forecast the future path of the endogenous variables in the equations.

The granger causality results are presented in appendix 2. The results reveal that geopolitical tension in oil politics granger cause the movement in all share index of stock market performance. There is a bidirectional causality running between geopolitical tension and oil price dynamics indicating that geopolitical tension can influence oil price, while oil price movement can also affect geopolitical tension given that

Figure 3: Plot of the Series



group of OPEC countries may collude to raise or moderate oil prices. The granger causality result further revealed that there is also bidirectional causality between geopolitics and crude oil exports in Nigeria. Thus, geopolitics is a key variable in the determination of crude oil prices and exports.

Although the study interacted the two variables, it reinstates the fact that during geopolitical tensions, crude oil supply may either reduce or increase through various forms of economic and political diplomacy. The result also suggests that a unidirectional causality running from crude oil export to the oil price justifying the classical demand and supply theory. Hence, an increase in crude supply could lead to a sharp fall in the prices of oil price. The variance decomposition and impulse response results are presented in the appendices 3 and 4. The results also reveal that there is a strong impact of geopolitical tension on the variables under consideration. It is evident that there is a one to

one impact on itself, while the result indicated that oil price, crude oil exports and all share index in Nigeria respond with the dynamics of geopolitical tension. Most significantly, the impact of the tension on the variables responds or varies with time reinforcing the influence of persistent in the behaviour. The results indicated that the effect is more significant from the 10th month and by the 20th month; it becomes nearly one to half. Therefore, this justifies the fact that geopolitical tension could affect government revenue and general economic governance. Intuitively, the impact could be the same whether geopolitical tension emanates from positive or negative dimension for oil prices.

6. CONCLUSION AND POLICY RECOMMENDATION

This paper examined the relationship between geopolitical tension and crude oil and output dynamics in Nigeria. Using a VAR model, it found that geopolitical tension affects crude oil price behaviour, and oil

output. The paper also revealed that geopolitical tension affects stock market performance in Nigeria. Furthermore, it is also revealed that the timing and impact of geopolitical tensions last fairly long thus, could affect fiscal revenue and economic governance in Nigeria.

Consequently, since oil price and output affect government revenue and GPT has direct implication with oil price, GPT could undermine fiscal planning and general economic governance. It, therefore, recommends that a complete diversification of the economy from oil and the domestic processing of the crude oil would not only generate revenue for better fiscal planning but provide the nation the opportunity of supplying refined petroleum products to other economies in Africa and Asia with greater capacity to create jobs and ultimately reduce unemployment. There is also the need to efficiently and effectively utilise oil revenue when the oil price is favourable as geopolitical tensions is part of the oil industry activities.

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Appendix 1: Unit Root Test Results

Variables	Augmented Dickey Fuller Test Values	Critical Values	Order of Integration
Oil Price	-9.8706	-3.4310	I(1)
All Share Index	-5.4341	-3.4319	I(1)
Oil Export	-16.1647	-3.4309	I(1)
Geopolitical Tension	-14.6052	-3.4309	I(1)

Computed by the author

Appendix 2: Granger Causality Results

Null Hypothesis:	Obs	F-Statistic	Prob.
LASI does not Granger Cause DGPT	207	0.70996	0.5860
DGPT does not Granger Cause LASI		3.06155	0.0178
LOP does not Granger Cause DGPT	212	4.27788	0.0024
DGPT does not Granger Cause LOP		2.81382	0.0265
OEXP does not Granger Cause DGPT	212	3.61190	0.0072
DGPT does not Granger Cause OEXP		2.38457	0.0526
LOP does not Granger Cause LASI	207	1.91987	0.1086
LASI does not Granger Cause LOP		1.63290	0.1674
OEXP does not Granger Cause LASI	207	0.66137	0.6195
LASI does not Granger Cause OEXP		0.78368	0.5370
OEXP does not Granger Cause LOP	212	3.02650	0.0188
LOP does not Granger Cause OEXP		1.04773	0.3837

Appendix 3: The Results of the VAR Decomposition and ImpulseResponse Results.

Variance Decomposition of DGPT:

Period	S.E.	DGPT	LOP	LASI	OEXP
1	0.276253	100.0000	0.000000	0.000000	0.000000
2	0.376206	99.94968	0.010746	0.016952	0.022620
3	0.444624	99.84951	0.033129	0.055808	0.061551
4	0.496332	99.71255	0.064809	0.115911	0.106728
5	0.537304	99.54779	0.103864	0.196440	0.151907
6	0.570691	99.36134	0.148714	0.296468	0.193483
7	0.598406	99.15733	0.198064	0.414984	0.229623
8	0.621711	98.93860	0.250842	0.550918	0.259642
9	0.641493	98.70712	0.306157	0.703153	0.283566
10	0.658406	98.46437	0.363258	0.870535	0.301834
11	0.672942	98.21151	0.421509	1.051878	0.315104
12	0.685488	97.94954	0.480365	1.245974	0.324119
13	0.696353	97.67942	0.539355	1.451594	0.329632
14	0.705787	97.40208	0.598067	1.667499	0.332353
15	0.713996	97.11848	0.656143	1.892443	0.332929
16	0.721153	96.82962	0.713267	2.125181	0.331928
17	0.727403	96.53653	0.769162	2.364473	0.329838
18	0.732869	96.24025	0.823587	2.609098	0.327068
19	0.737657	95.94186	0.876332	2.857855	0.323953
20	0.741858	95.64245	0.927216	3.109571	0.320765

Variance Decomposition of LOP:

Period	S.E.	DGPT	LOP	LASI	OEXP
1	0.087933	2.759791	97.24021	0.000000	0.000000
2	0.123157	5.861084	93.54119	0.013969	0.583761
3	0.150496	9.322296	89.06553	0.039632	1.572537
4	0.174100	12.79499	84.44582	0.071031	2.688159
5	0.195392	16.09407	80.02792	0.104186	3.773828
6	0.214995	19.13941	75.96957	0.136692	4.754330
7	0.233228	21.90989	72.32056	0.167212	5.602332
8	0.250281	24.41413	69.07490	0.195079	6.315892
9	0.266282	26.67370	66.20116	0.220021	6.905116
10	0.281327	28.71437	63.65882	0.241994	7.384823
11	0.295497	30.56170	61.40646	0.261083	7.770757
12	0.308861	32.23922	59.40555	0.277436	8.077795
13	0.321478	33.76772	57.62184	0.291238	8.319198
14	0.333403	35.16521	56.02569	0.302682	8.506414
15	0.344685	36.44713	54.59176	0.311968	8.649140
16	0.355368	37.62666	53.29856	0.319290	8.755494
17	0.365494	38.71504	52.12790	0.324834	8.832221
18	0.375098	39.72188	51.06444	0.328780	8.884903
19	0.384214	40.65541	50.09515	0.331296	8.918142
20	0.392871	41.52273	49.20900	0.332542	8.935732

Variance Decomposition of LASI:

Period	S.E.	DGPT	LOP	LASI	OEXP
1	0.066783	2.167159	0.644487	97.18835	0.000000
2	0.094532	3.883974	0.641485	95.46879	0.005747
3	0.116044	5.912484	0.644994	93.42843	0.014093
4	0.134435	8.149761	0.654308	91.17381	0.022124
5	0.150894	10.51558	0.668871	88.78691	0.028637
6	0.166012	12.94841	0.688225	86.33004	0.033334
7	0.180130	15.40171	0.711977	83.84996	0.036348
8	0.193456	17.84080	0.739786	81.38143	0.037980
9	0.206131	20.24023	0.771341	78.94986	0.038565
10	0.218247	22.58170	0.806359	76.57354	0.038405
11	0.229873	24.85241	0.844577	74.26527	0.037750
12	0.241057	27.04377	0.885752	72.03369	0.036794
13	0.251836	29.15040	0.929654	69.88427	0.035678
14	0.262236	31.16934	0.976070	67.82009	0.034503
15	0.272278	33.09945	1.024799	65.84242	0.033338
16	0.281981	34.94093	1.075652	63.95119	0.032232
17	0.291356	36.69498	1.128451	62.14536	0.031213
18	0.300417	38.36352	1.183030	60.42315	0.030302
19	0.309172	39.94898	1.239231	58.78228	0.029512
20	0.317630	41.45411	1.296904	57.22014	0.028852

Variance Decomposition of OEXP:

Period	S.E.	DGPT	LOP	LASI	OEXP
1	0.082459	5.293226	0.078073	0.199349	94.42935
2	0.109139	8.538572	0.192166	0.188384	91.08088
3	0.126317	12.04537	0.331961	0.170399	87.45227
4	0.138890	15.55272	0.481990	0.149997	83.81529
5	0.148731	18.88295	0.631162	0.131676	80.35421
6	0.156744	21.93240	0.772522	0.119354	77.17573
7	0.163425	24.65311	0.902366	0.116187	74.32833
8	0.169073	27.03439	1.019244	0.124574	71.82179
9	0.173883	29.08799	1.123127	0.146240	69.64265
10	0.177997	30.83776	1.214785	0.182341	67.76512
11	0.181520	32.31290	1.295383	0.233563	66.15815
12	0.184538	33.54395	1.366221	0.300207	64.78962
13	0.187120	34.56053	1.428589	0.382255	63.62862
14	0.189327	35.39023	1.483683	0.479421	62.64667
15	0.191211	36.05811	1.532575	0.591196	61.81812
16	0.192817	36.58666	1.576200	0.716881	61.12026
17	0.194183	36.99589	1.615355	0.855618	60.53314
18	0.195346	37.30350	1.650720	1.006416	60.03936
19	0.196336	37.52514	1.682859	1.168177	59.62382
20	0.197178	37.67461	1.712248	1.339716	59.27342

Cholesky Ordering: DGPT LOP LASI OEXP

Appendix 4: Impulse Response Result

Response to Generalized One S.D. Innovations

