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International oil price volatility and Nigeria's balance of payments

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Abstract

Despite various government efforts, unfavorable balance of payments positions has remained substantial in Nigeria creating the risks of financial vulnerabilities and substantial internal imbalances. Since oil is Nigeria's major revenue source, it is expedient to examine whether international oil price volatility was a major source of balance of payments (BoP) crisis in Nigeria from 1981 to 2020. The monetary theory of balance of payments formed the theoretical framework for this study and the generalized autoregressive conditional heteroscedasticity (GARCH) is used to derive values for international oil price volatility. Our result shows persistent volatility clustering in oil prices. In addition to estimating the effects of international oil price volatility on Nigeria's BoP, we disaggregated the BoP into its current and capital accounts in order to ascertain whether oil price volatility affected the two components differently. Vector autoregressive (VAR) technique is used to estimate the balance of payment equation model. Our results indicate that increasing volatility of oil price negatively and significantly impacted on balance of payment and its current account while it positively and significantly impacted on the capital account balance thus driving Nigeria's balance of payments disequilibrium. The study therefore recommends economic diversification as well as encouragement of alternative sources of energy to reduce domestic dependence on oil.

Keywords: balance of payment, economic growth, oil price volatility, terms of trade
JEL Classification: F32, F43, E32, F12

Introduction

Nigeria's macroeconomic goals are geared towards ensuring long-term stable economic progress. One of such key macroeconomic goals is the maintenance of a favorable balance of payment position. According to Dunn and Mutti (2004), a nation's balance of payments (BoP) is a summary statement of all economic transactions which have taken place during a given period between residents of that nation and residents of the outside world. This statement is of interest to economists and policy-makers because it provides useful information about the nation's international economic position and about a country's international relations. In particular, this statement may indicate whether the nation's external economic position is in a healthy state or not, and the type of problems that exist which may be a signal for some corrective actions. Basically, the BoP is divided into two major components: current account and capital account (Sloman, 2004). However, other scholars

adopt a three-component structure. Whether a BoP has two or three components depends on how the capital account is viewed by the reporting economy (Mark, 2000).

The greatest worry about the BoP is its inherent and characteristic disequilibrium. Disequilibrium in the balance of payments occurs when it records a surplus or a deficit. Most developing countries like Nigeria are concerned about stabilizing the BoP account in order to fortify and bolster macroeconomic policies. As noted by Mark (2000), the BoP position of a country indicates its proficiency to meet due pecuniary obligations hence the need to maintain its steadiness. More so, it reflects the adeptness of a nation to meet with financial obligations from other countries therefore its fluctuations are reflective of the level of stability in the nation's financial position. Maintaining its stability therefore demands a close monitoring of the BoP. This is crucial for the progress of developing countries as it helps to build up creditworthiness.

Literature documents several schools of thought about the dynamics of BoP. The monetarists view instability in BoP as a result of monetary factors like money supply whilst the Keynesians argue that it is real factors like income which causes instability in BoP. The IMF (2000) highlights that BoP disequilibrium reflects a disparity in the money market; as a result, an excess money supply causes an adverse effect on absorption as imports increase in a bid to get rid of excess money. In recent times, there is an increased attempt to understand the macroeconomic determinants of BoP through empirical procedures (Mussa, 1974; Onuchukwu & Kalu, 1999; Osoro, 2013; Degirmen & Saltik, 2017). This empirical search for the determinants of BoP stability is in part engineered by the conflicting views as to the primary causes of BoP disequilibrium. The conventional view is that current account factors stimulus such as exchange rate, the government's fiscal deficit, business competitiveness, and private behaviour such as the willingness of consumers to go into debt to finance extra consumption - are the primary causes of BoP disequilibrium.

An alternative view is that capital account drives BoP disequilibrium. For instance, where a global savings glut caused by savers in surplus countries, runs ahead of available investment opportunities and is pushed into a domestic economy resulting in excess consumption and asset price inflation (Bernanke, 2005). However, Duncan (2008) and Wolf (2009) argued that in oil-dependent economies, oil price volatility could be a source of substantial BoP crisis. As defined by Sadorsky (2006), oil price volatility is the standard deviation of oil prices in a given period. Economic uncertainty generated by extreme volatility of oil prices has important consequences for the global economy because oil is one of the strategic sources of energy for the socio-economic development of every nation (Nwokoye et al., 2019a). Oil resources serve as important inputs in most economic sectors; it is one of the sources electricity, and it also fuels all means of transportation (Nwokoye et al., 2017; Dimnwobi et al., 2017). Therefore, the volatility of oil prices could have significant implications on the balance of payments.

The position of Nigeria's balance of payment has been subject to constant fluctuations. Before independence, Nigeria's BoP issues were not conspicious. Then, the boom in Nigeria's cocoa, palm oil, cotton and groundnuts trades led to accumulation of foreign reserves while minimal exchange rate was required for importation of capital equipment. However, post-independence Nigeria has been experiencing adverse BoP problems. Between 1960 and early 1970s, Nigeria had deficits in both visible and invisible trade accounts leading to balance of payment deficits associated with weak terms of trade and consequent reduction

in its foreign reserves (Obioma, 1998) with poor trade negotiating power for its crude oil (Chuku et al., 2011).

Nigeria joined the Organization of Petroleum Exporting Countries (OPEC) in 1971 and from then till 1978, crude oil revenue compensated for high cost of substantial imports of visible and invisible items. However, the economy took a noticeable tumble in 1978 when there was a deficit of almost ₦1.4 billion. By 1979 the economy improved a little and there was a balance of payment surplus of over ₦1.8 billion and by late 1981 there was a noticeable fall in World demand due to the development of substitutes for oil (Taiwo et al. 2012). This led to a glut in the world oil market and balance of payment problems in Nigeriaas the BoP crisis continued with a deficit of ₦19.4 billion, ₦0.05 billion and ₦0.18 billion recorded in 1982, 193 and 1984 respectively.

The greater concern is that volatility in oil price has costly consequences for the macroeconomy (Olomola & Adejumo, 2006). Given the critical niche of the BoP in macroeconomic discussions, there is a genuine concern to examine the nexus between oil price volatility and the BoP in Nigeria. There are also concerns that the impact of oil price volatility on the balance of payments may be asymmetric. This is intuitive since the current accounts and the capital accounts may respond to oil price dynamics in dissimilar patterns. Against the backdrop, this study sought to address these research questions: What effects did international oil price volatility have on Nigeria's balance of payments? Are these effects same for Nigeria's capital and current account balances?

A literature search shows that studies on oil price volatility-BoP nexus are scarce for Nigeria. Where they exist, close observation shows that oil price volatility was proxied by oil price. Although this assumption is common in literature. This is a poor measure of volatility since volatility is a derived variable. Theoretically, the capital and current account are influenced by different factors. Thus, there is a need to examine the implication of oil price volatility for each component to obtain a further and deeper understanding of the BoP components that are more prone to volatility effect. This paper is therefore geared towards filling up the methodology gap as well as gap in scope. It is an effort to unravel the implication of oil price volatility for the balance of payments situation in Nigeria using appropriate econometric procedures and data measurements that provide assurances for a more robust research outcome.

The rest of the paper is structured as follows. Section two presents the literature review. Section three presents the research methods and data engaged in this study, while Section four presents the results. Section five concludes and puts forward some policy recommendations.

Empirical Literature Review

There is a death of scholarship in this area of study and this has resulted to paucity of reference points for studies on the impact of oil price volatility on Nigeria's balance of payments. Empirical works in this area of study are focused on the impact of: oil prices on trade balance (Le & Chang (2013) for the Malaysian, Singaporean and Japanese economies); oil price shocks/fluctuations on trade balance (Arouri et at. (2014) for the Indian economy; Baek et al. (2019) for four OPEC countries - Iran, Nigeria, Saudi Arabia, and Venezuela); oil volatility on the open economy (Degirmen & Saltik (2017) for the Turkish economy); oil price shocks on trade deficit (Ahad & Anwer (2019) for the Pakistan economy); oil price shocks on the macroeconomy (Yildirim & Arifli (2020) for Azerbaijan economy); oil price

fluctuations on fiscal and current account deficits (Eregha, et al. (2022) for selected African economies).

Studies on the Nigerian economy were not focused on the present area of interest. For instance, these studies concentrated on the impacts of: oil price shocks on its current account balance (Chuku et al., 2011); oil price volatility on economic development (Inyiama & Beatrice, 2012); oil price shocks and volatility on selected macroeconomic indicators (Taiwo et al., 2012); oil price on interest rate and exchange rate (Apere & Ijomah, 2013); crude oil price changes on domestic price level, economic output, and money supply (Omojolaibi, 2013); oil price volatility on the economic growth (Oriakhi & Iyoha, 2013); oil price volatility on real gross domestic product, interest rate, and exchange rate (Abdulkarem & Abdulhakeem, 2016).

This study is therefore justified in its quest to contribute to extant literature in two main strands: first, it looks at the impacts of oil price volatility on Nigeria's balance of payments. Second, it seeks to determine whether the impacts of oil price volatility on capital accounts differs from its impacts on current accounts for the Nigerian economy so that policies would be properly directed.

Theoretical framework

We adopt the monetary theory of balance of payments which brings out the real balance effect more cogently than other approaches to BoP determination, concentrating on the classical role of perfectly flexible prices, wages, and full employment (Obstfeld, & Rogoff, 1996). Monetary implications of a country's balance of payments disequilibria (surplus and deficit) reflect imbalances between demand for money and the supply of reserves in an economy because of central banks' monetization of domestic assets. If demand for money increases more rapidly than money supply based on government expansion of domestic assets, then a nation will experience trade and payment surplus (since supply of goods would exceed demand), vice versa. According to the monetary theory of balance of payments, demand for money (M_D) is a stable function of income (Y), prices (P) and rate of interest (i)

$M_D = f(Y, P, i)$; $f'(Y) > 0, f'(P) > 0 \text{ and } f'(i) < 0$ 1

Money supply (M_s) is a multiple of monetary base (m) which consists of domestic credit (D) and the country's foreign exchange reserves (R). For simplicity,

$M_s = D + R$ 2

Since at equilibrium demand for money equals money supply,

$M_d = D + R$ 3

A balance of payments deficit or surplus is represented by changes in the country's foreign exchange reserves. Thus

$\Delta R = DM_D - DD$ 4

or $\Delta R = B$ 5

where B is balance of payments and is the difference between change in demand for money (DM_d) and change in domestic credit (DD). A BoP deficit means a negative B which reduces R and money supply. Conversely, a BoP surplus reflects a positive B and increases R and money supply. BoP is at equilibrium when B is zero. Kandil (2009) argued that since the foreign reserve is a function of net

capital flow (NCF), net foreign assets (NFA), export commodity prices (Pe) and exchange rate pressure(ERP), Equation 5 can be rewritten as:

$B = f(\Delta R) = f(NCF, NFA, Pe, ERP)$ 6

Export commodity price depends on Nigeria's major export commodity thus Equation 6 can be rewritten as:

$B = f(\Delta R) = f(NCF, NFA, OILP, ERP)$ 7

Where *OILP* is international price of oil. Equation 7 suggests that changes in BoP equilibrium can be explained by changes in international oil price. In other words, if oil price volatility persists, BoP crisis may deepen and persist for a longer time.

Model specification

3.2.1. Balance of payments model

Following Kandil (2009) and Cavallo et al. (2014), the relationship among variables in Nigeria's BoP model can be set up in VAR form of order *p* consisting of a system of equations equal to the number of variables as:

$$X_t = \gamma_i + \sum_{i=1}^{P} A_i X_{t-p} + \varepsilon_t \quad 8$$

Where X_t is an *n* x 1 vector of macroeconomic variables including oil price volatility; γ_i is *n* x *1* vector of constants; A_i is *n* x *n* matrix of unknown slope parameters on lagged values of X_t to be estimated. ε_t is an *n* x *1* vector of uncorrelated structural innovations or shocks relating to each element of X_t with covariance matrix.

[1]From Equation 8, the following specific equations in VAR specification were estimated:

$$BoP_t = \gamma_1 + A_1\, BoP_{t-1} + A_2\, OILP_{t-1} + A_3 OILV_{t-1} + B_1 ER_{t-1} + B_2 RGDP_{t-1} + B_3 FOREX_{t-1} + B_4 ToT_{t-1} + B_5 CUA_{t-1} + B_6 CAA_{t-1} + \varepsilon_{1t} \quad 9$$

$$CUA_t = \gamma_2 + A_{1'}\, CUA_{t-1} + A_{2'}\, OILP_{t-1} + A_3 OILV_{t-1} + B_1 ER_{t-1} + B_2 RGDP_{t-1} + B_3 FOREX_{t-1} + B_4 ToT_{t-1} + B_5 BoP_{t-1} + B_6 CAA_{t-1} + \varepsilon_{2t} \quad 10$$

$$CAA_t = \gamma_3 + A_{1''}\, CAA_{t-1} + A_{2''}\, OILP_{t-1} + A_{3''} OILV_{t-1} + B_{1''} ER_{t-1} + B_{2''} RGDP_{t-1} + B_{3''} FOREX_{t-1} + B_{4''} ToT_{t-1} + B_{5''} BoP_{t-1} + B_{6''} CUA_{t-1} + \varepsilon_{3t} \quad 11$$

Where OILP and OILV are oil price and oil price volatility respectively which entered the model as deterministic covariates. OILP and OILV are assumed to be uncorrelated in the model (Chuku et al., 2011). ER, RGDP, FOREX and TOT, which entered the model as control variables, stand for the exchange rate, real gross domestic products, foreign exchange rate reserves and terms of trade; BoP, CUA and CAA, which entered the model as predicted variables, stand for balance of payments, current account and capital account respectively. Note that although VAR models have as many equations as there are endogenous variables, we only showed three equations (9), (10) and (11) which are the equations of interest in this study.

[1] VAR system requires setting up equations for each variable within the system. Here only the equations of interest were presented.

Oil price is expected to impact positively on balance of payment, capital account and current accounts balances (Barsky & Kilian, 2004) while oil price volatility is expected to negatively impact on BoP since increased volatility worsens BoP crisis.

3.2.2. Oil price volatility series

Following Engle (1982), Bollerselev (1986), and Raja and Selvam (2011), we specified the mean equation of international oil price within the framework of GARCH (1,1) as:

Mean Equation: $\mathrm{OILP_t} = \alpha_0 + OILP + \varepsilon_t$ 12

Conditional Variance Equation: $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$ 13

Where α ≥ 0, β ≥ 0

The non-negativity restriction on the parameters is to ensure that the variance remains positive for all realizations of the process. The GARCH (1,1) was used to estimate the volatility of international oil price. We assumed that disturbances derived from the mean (12) are not correlated. Thus, we estimated the mean equation above and then captured the squared residuals and its lag respectively. We then estimated the mean equation incorporating the variance through the GARCH (1,1) process. Therefore, the GARCH process of this equation takes the form specified in (12).

Since σ_t^2 is a one-period ahead forecast variance based on past information, it is called the conditional variance. The conditional variance equation specified in (13) is a function of three terms, namely, a constant term, ω ; news about volatility from the previous period, measured as the lag of the squared residuals from the mean equation, ε_{t-1}^2 : (the ARCH term); and last period's forecast variance, σ_{t-1}^2 (the GARCH term).

Estimation techniques and sources of data

The estimation procedure and techniques employed in this study is as follows. First, we test all the time series for the presence of unit root using the Augmented Dicker-Fuller test procedure. Then we carried out a cointegration test using Philip-Qualiaris two-stage regression approach. The next step is to estimate the main research model using the vector autoregressive (VAR) technique which was introduced to deal with the shortcomings embedded in large-scale simultaneous equations (Gottschalk, 2001). Simultaneous equations models could not explain the dynamic structure of time series variables while the identification process of equations and the exogeneity assumption in the underlying relationship among variables are questionable (Lütkepohl, 2005).

The dynamic interactions of variables in which all variables are treated *a priori* as endogenous and theoretically motivated restrictions imposed on contemporaneous relations among variables are examined using the VAR model such that the marginal effect of a shock to any of the variables in the system and on itself can be traced out over time using impulse response analysis. Impulse response functions are calculated from the estimates of the VAR. They show how current and future values of each variable in the VAR respond to a one-off unit increase in the current value of one of the structural shocks in the VAR holding other shocks constant. However, before we proceed to estimate the VAR model, we generated the international oil price volatility series using the generalized auto regressive conditional heteroscedasticity (GARCH) technique. The GARCH technique was used to extract the volatility series of international oil prices.

The study employed secondary data spanning from 1981 to 2018 in line with availability of data. Data were sourced from the Central Bank of Nigeria statistical bulletins, World Development Indicators and World Economic Outlook.

Presentation of Results

a. Time series properties of the data

We employed the unit root test, cointegration test and ARCH-LM test on the time series to understand the behaviour of the time series. These tests enabled us to utilize appropriate estimation procedures for optimal outcomes. All results, as presented on our tables and figure, were generated using Eviews version 10.1.

a. Stationarity test

To ascertain the stationarity of the time series, we employed both the Augmented Dicker-Fuller (ADF) test and the Philip-Perron (PP) test of a unit root. The results on Table 1 show that both the ADF and PP test of the unit root is asymmetric. Foreign exchange (FOREX), the exchange rate (ER), oil price (OILP), real GDP (RGDP), current account (CUA), capital account (CAA) and term of trade (TOT) were integrated of order one (I[1]) while the balance of payment (BOP) is integrated of order zero (I[0]). This result corroborates Verbeek (2008) conclusion that time series are a realization of stochastic processes.

Table 1: Summary Result of Stationarity Test

Variables	Statistics	Order of integration	statistics	Order of integration	Remark
Foreign exchange (FOREX)	-4.8402***	I(1)	-4.1389***	I(1)	Conform
Exchange rate (ER)	4.2168***	I(1)	-4.3801***	I(1)	Conform
Oil Price (OILP)	-6.1087***	I(1)	-6.1537***	I(1)	Conform
Real GDP (RGDP)	-26.3551**	I(1)	-25.8718**	I(1)	Conform
Current Account (CUA)	-7.7682**	I(1)	-11.8470**	I(1)	Conform
Capital Account (CAA)	-6.7245***	I(1)	-18.8212**	I(1)	Conform
Balance of Payment (BOP)	-3.6902**	I(0)	-3.5507**	I(0)	Conform
Term of Trade (TOT)	-5.0272***	I(1)	-5.0289	I(1)	Conform

Source: Author's computation using Eviews version 10.1

b. Cointegration test

To ascertain the existence of a long run relationship among the variables, we employed the test of cointegration. Specifically, the Philip-Oualiaris test was employed. As noted by Phillips and Oualiaris (1998) and Yang (2000), Philip-Oualiaris considered efficient in testing for cointegration among variables that are integrated of dissimilar other.

Table 2: Summary of Cointegration Test

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*	Remarks
Null Hypothesis (H_0): Series are not cointegrated					
Foreign exchange (FOREX)	-4.142246	0.6365	-22.81726	0.6733	Do not reject H_0
Exchange rate (ER)	-	0.0000	-	0.0001	Reject

	13.185799		45.93214		H_0
Oil Price (OILP)	-14.191459	0.0000	-93.65223	0.0000	Reject H_0
Real GDP (RGDP)	-3.309286	0.9113	-17.12133	0.9163	Do not reject H_0
Current Account (CUA)	-7.193753	0.0091	-38.36075	0.0257	Reject H_0
Capital Account (CAA)	-9.470138	0.0003	-69.28029	0.0000	Reject H_0
Balance of Payment (BOP)	-7.162359	0.0083	-37.63463	0.0426	Reject H_0
Term of Trade (TOT)	-4.238731	0.5954	-19.80855	0.8233	Do not reject H_0
Oil price volatility (OILPV)	-4.943432	0.3102	-27.65199	0.3899	Do not reject H_0

Source: Author's computation using Eviews version 10.1

Philip-Oualiaris cointegration test also specifies the equations that are cointegrated among a set of equations that are tested for cointegration. To reject the null hypothesis of no cointegration, the tau-statistic or z-statistic of an equation must be significant at a 5% level of significance. In the test of a vector of variables, it is required that the null hypothesis of no cointegration relationship be rejected for at least one equation. Tau-statistic or z-statistic is considered significant at a 5% level of significance if and only if the probability value is equal to or less than 0.05. As shown on Table 2, the probability values of both tau-statistic and z-statistic of the exchange rate (ER), oil price (OILP), current account (CUA), capital account (CAA) and balance of payment (BOP) equations were less than 0.05. In other words, the exchange rate, oil price, current account, capital account, and balance of payment variables were cointegrated. Thus, we rejected the null hypothesis of no cointegration and concluded that the time series were cointegrated.

c. ARCH-LM test

To use GARCH to estimate a model or extract volatility, there is a need to ascertain whether the dependent variable or the volatility variable has an ARCH effect. This is required since the GARCH model is designed for series that are heteroskedastic. We ran the ARCH-LM (Lagrange Multiplier) test on the oil price.

Table 3: Summary Statistics for ARCH-LM Test of Oil Price

Oil Price: Heteroskedasticity Test: ARCH: H_0: No ARCH effects			
F-statistic	53.01706	Prob. F(1,34)	0.0000
Obs*R-squared	83.01806	Prob. Chi-Square(1)	0.0000
Lag length	1		
Remarks	There is ARCH effect		

Source: Author's computation using Eviews version 10.1

Table 3 presents the summary statistics for the ARCH-LM test of heteroscedasticity which shows that F-statistics and Chi-square statistics (or Obs*R-square) are 53.01706 (with p-value of 0.0000) and 83.01806 (with p-value of 0.0000) respectively. Since the p-values of both statistics are less than 0.05, we reject the null hypothesis of no ARCH effects and conclude that oil price had ARCH effects. This implies that we could extract oil price volatility using GARCH.

Table 4: Summary statistics for ARCH-LM Test of Balance of Payments

Balance of Payment: Heteroskedasticity Test: ARCH: H_0: No ARCH effects

F-statistic	0.017067	Prob. F(1,34)	0.8968
Obs*R-squared	0.018062	Prob. Chi-Square (1)	0.8931
Lag length	1		
Remarks	There is no ARCH effect		

Source: Author's computation using Eviews version 10.1

Table 4 however, shows that the balance of payments does not have an ARCH effect. Therefore, we could not estimate the BoP equation using GARCH.

d. Extracting the volatility series using GARCH

To extract the oil price volatility series, we estimated a GARCH (1,1) model for oil price using Equations 3.13 and 3.14. The result is shown on Table 5.

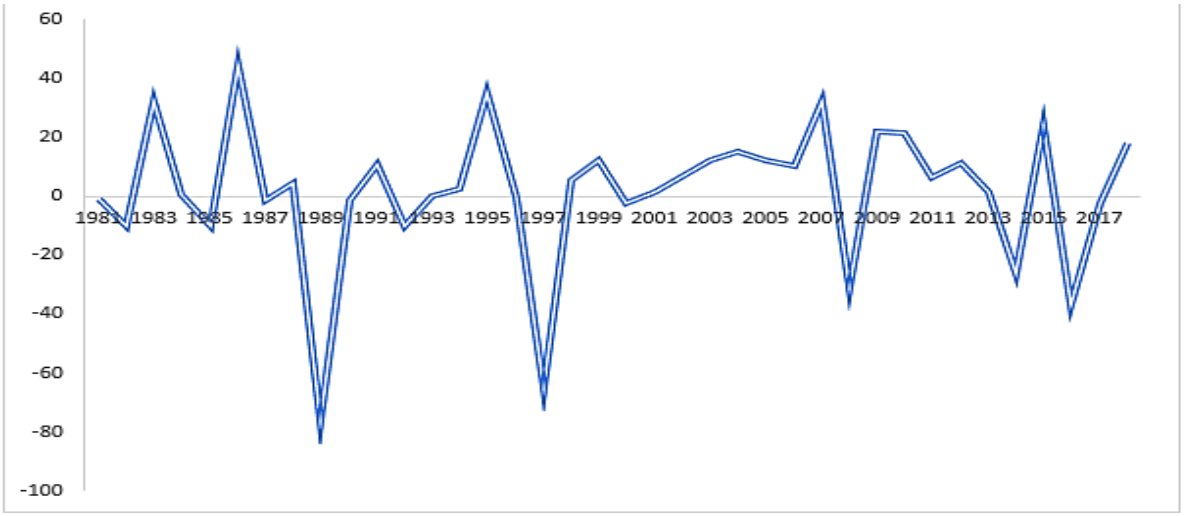
Table 5: GARCH Model of Oil Price Volatility

Variable	Coefficient	Std. Error	z-Statistic	Prob.
OILP(-1)	0.921897	0.046848	19.67841	0.0000
C	0.315584	0.399469	0.790009	0.4295
	Variance Equation			
ARCH (1)	1.00085	0.251074	3.986275	0.0000
GARCH (1)	0.00821	0.002462	3.336227	0.0008
C	0.224133	0.071568	3.131756	0.0022

Source: Author's computation using Eviews version 10.1

As shown on Table 5, the GARCH (1) parameter (0.0082) is about zero while the ARCH (1) parameter (1.0009) is about one and the sum of the two parameters (1.0091) is greater than one. Thus, the non-negativity restriction postulated in equation (3.13) is satisfied. The fulfilment of the non-negativity constraint further indicates that the volatility is persistent. The sum of the two estimated ARCH and GARCH coefficients being larger than one suggests that there was volatility clustering. This deduction from the estimates is also buttressed by the graph of the extracted volatility series shown in Figure 1. We, therefore, proceeded to use the predicted values of variance from the GARCH model as our measure of oil price volatility.

Figure 1: Oil Price Volatility Graph



Source: Author's computation using Eviews version 10.1

Impact of oil price volatility on Nigeria's balance of payments and its components

To estimate the impact of oil price volatility on the balance of payments and its components, we estimated a two-lag order vector autoregression model. The choice of two-lag order was based on the result of the lag order selection test shown on Table 6. The result shows that lag order two is the most preferred lag order. Consequently, the VAR model was estimated with the assumption that the VAR process follows an AR (2) process.

[2]Table 6: Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1577.897	NA	2.80e+29	93.34689	93.75092	93.48468
1	-1315.175	370.9021	7.50e+24	82.65734	86.69771	84.03522
2	-1158.003	138.6807*	2.66e+23*	78.17667*	85.85336*	80.79464*

Source: Author's computation using Eviews version 10.1

Impact of oil price volatility on current account balance

Table 7 is the summary of the VAR output for the current account equation. The result shows that oil price volatility positively impacted on current account balance.

Table 7: Summary of VAR Estimates for Current Account Balance

Variable	Coefficients	Standard Error	t-statistics
Balance of payment (BOP)	-0.300419	(0.50847)	[-0.59083]
Capital account (CAA)	0.166671	(0.45085)	[0.36968]
Current account (CUA)	-0.055384	(0.36665)	[-0.15105]
Exchange rate (ER)	0.224024	(0.07318)	[3.06116]
Foreign exchange (FOREX)	0.278759	(0.12946)	[2.15324]
Oil price (OILP)	0.738803	(0.69679)	[10.6030]
Oil price volatility (OILPV)	-0.404340	(0.10730)	[-3.76803]
Real GDP (RGDP)	0.510319	(0.16118)	[3.16611]
Term of Trade (TOT)	0.092778	0.00916	10.1255
Intercept (C)	7.977510	5.99846	1.32993
R-squared		0.636997	
Adj. R-squared		0.613370	
F-statistic		30.92831	
Obs		38	

Source: Author's computation using Eviews version 10.1

The result indicated that exchange rate depreciation by one unit improved current account balance by 0.22 units. Similarly, foreign exchange and oil prices positively impacted on current account balance. The results also show that one unit increases in foreign exchange and oil price improved current account balance by 0.28 units and 0.74 units respectively. Again, current account balance was a positive function of real GDP and terms of trade. Conversely, the results show that current account balance was a negative function of oil price volatility as the slope parameter estimate for oil price volatility was -0.0404. Invariably,

[2] * 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

reducing oil price volatility by 100% will lead to a 40% improvement in the current account balance.

4.2.2. Impact of oil price volatility on capital account balance

Table 8: Summary of VAR Estimates for Capital Account

Variable	Coefficients	Standard Error	t-statistics
Balance of payment (BOP)	0.122257	0.32500	0.37617
Capital account (CAA)	-0.222611	0.2881	-0.77248
Current account (CUA)	0.004193	0.23436	0.01789
Exchange rate (ER)	-0.113551	0.04678	-2.42750
Foreign exchange (FOREX)	0.000241	0.00016	1.54749
Oil price (OILP)	-0.103061	0.03480	-2.96114
Oil price volatility (OILPV)	0.173750	0.06208	2.79892
Real GDP (RGDP)	0.000246	0.00030	0.82522
Term of Trade (TOT)	0.072339	0.05857	1.23515
Intercept (C)	-11.67057	3.83410	-3.04389
R-squared		0.627936	
Adj. R-squared		0.600912	
F-statistic		20.982283	

Source: Author's computation using Eviews version 10.1

Results show that the slope parameter and standard error for the exchange rate were -0.113551 and 0.04678 respectively. Thus, increasing the exchange rate by 1 unit led to a decrease in capital account by 0.114 units. Similarly, parameter and standard error for oil price are -0.1031 and 0.0348 respectively suggesting that a one-unit increase in oil price led to a 0.103 decrease in capital account balance. Conversely, capital account balance was a positive function of oil price volatility as a one-unit increase in oil price volatility led to a 0.174 increase in capital account balance. Put differently, suppose oil price volatility increases by 100%, the capital account will increase by 17.4%.

4.2.3. Impact of oil price volatility on balance of payments

Table 9: Summary of VAR Estimates for Balance of Payments Equation

Variable	Coefficients	Standard Error	t-statistics
Balance of payment (BOP)	-0.252126	0.27907	-0.90344
Capital account (CAA)	0.279173	0.24745	1.12819
Current account (CUA)	0.018551	0.20124	0.09219
Exchange rate (ER)	0.948732	0.52471	18.0810
Foreign exchange (FOREX)	0.246787	0.04051	6.09274
Oil price (OILP)	0.093503	0.02715	3.44352
Oil price volatility (OILPV)	-0.148385	0.04592	-3.23172
Real GDP (RGDP)	-0.000879	0.00023	-3.85130
Term of Trade (TOT)	0.067697	0.00503	13.4613
Intercept (C)	-0.311359	3.29225	-0.09457
R-squared		0.707025	
Adj. R-squared		0.684659	
F-statistic		18.30431	
Obs		38	

Source: Author's computation using Eviews version 10.1

Table 9 show that Nigeria's balance of payments was a positive functions of exchange rate, foreign exchange earnings, oil price, and terms of trade with coefficients of 0.948, 0.247, 0.094 and 0.068 respectively. On the other hand, oil price volatility and real GDP negatively

impacted on balance of payments. Thus, a one-unit increase in oil price volatility led to a 0'148 decline in Nigeria's balance of payments. In other words, if oil price volatility rises by 100%, the balance of payments will deteriorate by 14.8%.

Discussion of Findings

The key finding of this study is that while oil price volatility negatively and significantly impacted on balance of payment and its current account but positively and significantly impacted on the capital account. Oil price volatility is a common phenomenon that could have implications for net-oil exporters and net-oil importers. According to Belkar et al. (2017), demand for and supply of crude oil have dramatic effects on its price. Slight increases in demand (or decreases in supply) pushes up oil prices intensely. Again, when demand drops, price drops radically. This shows that either increases in demand caused by a reviving economy or decreases in production caused by ageing oilfields or civil crisis (as experienced in the Middle East and Nigerian Niger Delta) results in increases in oil prices (Abraham, 2016). The major problem is the structural shift, uncertainties and high adjustment cost associated with such frequent and large fluctuations.

Suppose there is an unexpected huge fall in oil prices (think of the experience of 2015-2017). As an oil-exporting country, Nigeria experiences a fall in total value or earning from export. Given that oil export is the predominant source of export in Nigeria, a fall in export earnings is tantamount to a fall in revenue (Nwokoye et al., 2020; Nwokoye et al., 2022). This fall in revenue may further lead to the contraction of output. According to Nakov and Pescatori (2010), an exogenous oil price shock contracts output, similar to a negative productivity shock. This output decline is exactly equal to the efficient output contraction in response to the shock. Output contraction can result from a sharp fall in aggregate demand by the government. This soon spread to the real and financial sectors affecting investment demand and productivity. Government reduced wages (where wage rigidity does not hold) or owes staff emolument. Contractors are also owed. Consumer spending also declines. This cycle may dip an economy into a recession if it persists. As domestic production falls, export declines thereby leading to the current deficit.

Fall in export earning can also affect the external balance through its effect on the exchange rate. As export earnings fall, foreign exchange earnings decline. This could weaken the protective or fighting power of the monetary authority for intervening in the foreign exchange rate market, thereby leading to the depreciation of the local exchange rate. The classical doctrine predicts that such depreciation would lead to improvement of the current account and balance of payment. More specifically, when the currency depreciates, the competitiveness of the country's export goods increases in the foreign markets while import is believed to be exorbitant. This implies that there are two elements to be noted on depreciation its impact on external balance. Firstly, it is assumed that a country has export and import potential, and depreciation is price inelastic for exported and imported goods in foreign markets. Secondly, it is assumed that depreciation is supported by sound macroeconomic fundamentals and can maintain competitiveness in foreign markets i.e. the economy can produce more output for export.

In developing countries, these assumptions hardly apply. According to De Serres et al. (2015), it is further required that Marshall-Lerner Condition be met: exchange rate devaluation or depreciation will only cause a balance of trade improvement if the absolute sum of the long-term export and import demand elasticity is greater than unity. This is a major issue in developing countries. Nigeria does not have equal potential to export and import (Onuchukwu & Kalu, 1999). An increase in import price does not proportionately

discourage import, it imposes a high cost to the economy since import is largely inelastic. An increase in cost arising from high import prices dampens the production of export goods in the export goods industries. This is because most of the industrial inputs are imported. An increase in export prices arising from the high cost of production further complicates the current account and the balance of payment (Okafor et al., 2022). In other words, since the Marshall-Lerner condition hardly holds in Nigeria (Onuchukwu & Kalu, 1999), depreciation of exchange rate arising from oil price fall deteriorates the current account as well as the balance of payment

On the other hand, it has been argued that an unexpected increase in oil prices has not been beneficial to the Nigerian economy in the long run. Traditionally, it is expected that an increase in the oil price should lead to improvement in the balance of payment as well as the current account in net oil-exporter countries. This conclusion is based on the belief that increased oil revenue would boost domestic export supply thereby leading to improved current account and balance of payment. But given that the Nigerian economy is characterized by the resource-curse phenomenon (Nwokoye et al., 2019a), an increase in oil price may lead to the deindustrialization of the non-oil sector (Nwokoye et al., 2022). According to Sachs and Warner (1995), high resource dependence results in crowding out of the tradable manufacturing and agricultural sector. This view was theoretically formalized by Matsuyama (1992) for the agricultural sector and extended by Sachs and Warner (1995) to the case of natural resources in general. In their framework, the economy has three sectors: a tradable resource sector, a tradable non-resource manufacturing sector and a non-traded sector. Only the manufacturing sector is assumed to innovate resulting in labour-augmenting technological change. The greater the natural resource endowment and the revenues that a country receives from it, the greater the domestic demand for non-traded sector goods. As these goods cannot be imported, their prices tend to rise which leads to a greater allocation of labour and capital to the non-traded sector, reducing the stock of labour and capital inputs available for manufacturing. As only the manufacturing sector is a locus of innovation, technological progress and sustainable export, higher resource dependence and in turn a smaller manufacturing sector worsens the balance of payment crises.

Similarly, resource wealth and attempts to control it may trigger conflicts and civil wars in countries with fragile institutions and limited democratic tradition such as Nigeria. Some theories suggest that, in these cases, resource wealth may weaken states administratively and undermine their ability to prevent rebellions. Others focus on insurgents that could be incited to capture resource stocks to finance rebellions or establish an independent, often ethnically distinct state. As this tension intensifies, production of export goods declines while import of military goods increases, leading to the deterioration of the balance of payment.

Nwokoye et al. (2019a) also suggested that oil windfall may engender the Dutch-disease syndrome. In particular, commodity price booms may induce the so-called Dutch disease which is a form of resource curse driven by the appreciation of the oil exporters' currency. Higher export revenues result in a higher demand for national currency and its appreciation if exchange rates are flexible. Alternatively, in the case of fixed exchange rates, higher commodity and budget revenues coupled with lower interest rates - to preserve the exchange rate parity - translate into higher wages and inflation. The real appreciation deteriorates the competitiveness of non-commodity exports and profitability of the manufacturing sector, ultimately leading to a deterioration of the balance of payment.

More so, the uncertainty engendered by oil price volatility may lead to investment paucity thereby reducing potential exports. Most times, given that Nigeria is characterized by a poor institutional framework and a high level of corruption (Nwokoye et al, 2019b), oil windfalls

are rarely saved (the event of 2012-2014 windfall is an eloquent example) to serve as a buffer during the inevitable downturns. As oil price begins to plummet, Nigeria becomes beggarly and importation of debt capital escalates. This could explain the positive effect of oil price volatility on capital accounts. As oil price volatility increases economic woes in Nigeria, the resulting twin deficits may be financed by external borrowing which may reflect positive balances in the capital account (Okafor et al., 2022).

Conclusion

The main thrust of this work was to ascertain the effect of oil price volatility on the balance of payments in Nigeria between 1981 and 2018. The study disaggregated the balance of payments into current and capital accounts. Applying the vector autoregressive (VAR) technique, we conclude as follows. First, oil price volatility has a negative significant effect on the balance of payment in Nigeria. In other words, oil price volatility is a major cause of the balance of payment deficit in Nigeria. Second, oil price volatility also accentuates the current account crisis by reinforcing the current account deficit. Third, oil price volatility has a positive significant effect on the capital account balance in Nigeria. This suggests that the current account deficit caused by oil price volatility may lead to increased debt flow to finance such deficit. This in turn may indicate a prevalence of twin deficit (that is, concurrent deficits in the current account and fiscal deficit).

Based on the findings of this study, we make the following recommendations. First, Nigeria should embark on economic diversification which will not only encourage the sustainable supply of alternative sources of energy in Nigeria but also reduce domestic oil demand. This reduces the extent to which fluctuations in oil price affect domestic prices which may lead to inflation and subsequently unfavourable balance of payment positions. Second, Nigeria should also diversify towards human capital, manufacturing and commercial agriculture. Diversification will encourage local production, exportation and favourable terms of trade (Nwokoye et al., 2019b). This should ensure increased export volume and reduce the importation of oil. For example, Indonesia successfully diversified into the tradable manufacturing sector, supported by appropriate trade and business infrastructure policies. Spending resource revenues on infrastructure, and promoting domestic savings and inward investment, is part of the general 'annuity policy' recommended for Africa by the World Bank. That is, the calculated, parsimonious and well-informed spending, savings and investment (in other assets) strategy, which prioritizes human, social and physical capital creation and transformation of mineral wealth into financial assets that yield higher returns.

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