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Oil price and inflation in Nigeria (1991–2021): An empirical analysis

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Abstract
This paper investigates the empirical relationship between global oil prices and inflation in Nigeria from 1990 to 2022. The study utilizes a vector autoregressive (VAR) model of the Nigerian economy to assess how oil price fluctuations move through major channels of the economy to affect inflation. The model represents the interactions between six (6) variables: the real oil price, real GDP, M2 monetary aggregates, the spread between rates on FG bonds with a ten-year constant maturity and FG treasury bills with a three-month constant maturity, the size of fiscal deficit and the GDP deflator. Estimation used yearly data from the period 1991 to 2021.

Keyword: Inflation, oil price fluctuations, vector autoregressive (VAR) model, real GDP

Introduction

Unarguably, one of the peculiarities of the global oil market is the high fluctuation of prices due to OPEC's decision to increase or decrease production quotas for member countries as it controls almost 80% of the world's supply of oil reserves or the pull forces of demand and supply mechanism arising from major global economic and/or socio-political events such as the recent Russian – Ukrainian War which triggered substantial rise following the full-scale invasion by Russia and subsequent economic sanctions placed on it. The WTI crude oil price, for instance, increased to a monthly average of $114 per barrel in June, the highest price in real terms since September 2014 (EIA, 2022). Oil has remained an important commodity that drives economic activities globally, and thus, oil price movements are a major determinant of macroeconomic outcomes across countries. In Nigeria, the petroleum industry is the backbone of the economy. Currently, it contributes 80% of the revenues of the Federal Government of Nigeria (FGN), accounts for around 90% of foreign exchange receipts but only contributes less than 10% to gross domestic product, largely because only a small part of the oil and gas value chain is domesticated (Deloitte, 2021) [7]. With its position as the third largest exporter of crude oil in Africa (OPEC monthly oil market report (MOMR), 2022), it is expected that the oil price fluctuations will directly influence such major macroeconomic variables as aggregate demand, aggregate consumption, industrial output, unemployment, size of fiscal deficit, etc. with an attendant impact on the consumer price index (CPI) and indirectly through changes in the prices of goods and services which utilize oil and non-oil inputs.

In theory, positive oil price shocks in the international market have a tendency to be transmitted into the domestic macroeconomic conditions of the oil-exporting nations in the form of an increase in monetary aggregates, with profound implications on aggregate demand and consumer price index, increase in the cost of doing business, expansion of domestic output level arising from increased consumer and government spending, etc. To corroborate the theoretical postulation of positive oil price shocks on the domestic level of inflation, Oyeyemi (2013) [21], and Omolade, Ngalawa, and Kutu (2019) [18] established that oil price fluctuations have the tendency to increase the money supply in oil-producing countries with profound implications on consumer prices. Also, falling oil prices weaken the foreign earnings of oil-producing countries resulting in currency depreciation and rising inflation (Bala and Chin, 2018) [2]. With oil accounting for the largest share of foreign exchange earnings to the Nigerian economy, its role in determining the value of the foreign exchange rate of the Nigerian Naira cannot be over-emphasized. This is more pronounced when considering the fact that oil is an important source of energy for countries as well as the major export product of some economies.

According to Huntington (1985) [11], an oil price shock will worsen both measured inflation and unemployment in the short run, pushing the trade-off between the two variables outwards from the origin. Even though the government might attempt to use aggregate demand-side policies to return temporarily to the lower level of the unemployment rate, inflation will still be worsened as the economy moves towards a higher position on its Philips curve. In any economy, inflation and unemployment are always on the "front burner"; all economies will always desire to keep them both on a low rate mostly on a single-digit rate because this will tend to bring about stability in the macroeconomic policies of the country. This stability is pivotal to effectively achieving growth and development in the economy and also the attainment of its set out goals and objectives of its economic policies (Umaru and Zubairu, 2012) [23]. As one of the largest oil exporters in the OPEC bloc, the changes in the market conditions in the international oil market are expected to be transmitted into the domestic economy, resulting in fluctuations in certain macroeconomic variables such as inflation, unemployment, economic growth, etc. Along this line of thought, it is empirically established that oil price is one of the most volatile prices which has significant impact on macroeconomic behavior of many developed and developing economies (Ferderer, 1996; Guo & Kliesen, 2005). Further, Mork, Olsen and Mysen (1994) Hooker (1999), Guo and Kliesen, (2005), Narayan and Narayan (2007), Mehrara (2008), Salisu and Fasanya (2013) found

volatility clustering and confirm the existence of asymmetries in oil price volatility.

However, the massive decline in crude oil price from an annual average of 111 dollars per barrel in 2012 to about 53 dollars per barrel in 2016 (EIA, 2018) can be alluded to as the major reason for a decline in the share of oil revenue in total government revenue and not structural changes in the economy. Considering the over-reliance of the economy on oil vis-a-vis the volatility of the oil market; the Nigerian economy is exposed to external shocks from the oil market (Abubakar, 2017) [1]. This is apparent in the sharp decline in oil prices that led to the economy sliding into recession from Q1 2016 through to Q2 2017. This is more pronounced when considering the fact that oil is an important source of energy for driving economic growth as well as the major export product and foreign exchange earner for the Nigerian economy. The debate as to the effect as well as nature of fluctuations in the global oil prices (London Brent crude priced in US Dollar) on the inflation rate in Nigeria has continued to receive attention from economists and policymakers particularly, with recent developments in the international oil market occasioned by the rise and fall in oil prices, arising majorly from the ongoing Russian – Ukrainian War which triggered panic buying and wild price speculation in the global oil market.

Consequently, a study of this nature that focuses on assessing and measuring the empirical impact of global oil price fluctuations on the domestic inflation rate is imperative and timely against the backdrop of the recent fluctuations in the global price of crude oil at the instance of the Russian-Ukraine hostilities and the rise of headline inflation in Nigeria in January 2023 to 21.82% despite the cash crunch triggered by the naira redesign policy by the Central Bank of Nigeria. Continued emphasis by policymakers on policies that promotes the attainment of low and stable inflation is an important macroeconomic imperative as it promotes the efficient use of productive resources. When appropriate policies are implemented to keep inflation at a low and stable level, the substantial quantity of households and firms' time and resources committed to adopting costly strategies to hedge against inflation is deployed to an alternative and more productive use with a high potential for greater economic growth. Evidence suggests that low inflation may bring benefits in terms of higher growth or a higher level of output in the long run and benefits in terms of reducing poverty.

By and large, this study attempts to contribute to the debate on the impact of global oil price fluctuations on domestic inflation in Nigeria. The main objective of this study is to examine if there are significant interaction in the nexus between oil price and domestic inflation in Nigeria as measured by the consumer price index. Since the Nigerian economy is not totally isolated from the impact of fluctuations in international oil prices despite the continued implementation of fuel subsidy regimes, it should be expected that the dynamic pass-through of crude oil price fluctuations to the inflation rate (measured by consumer price index) is fundamental to monetary policy formulation to maintain a low and stable level of domestic prices. Specifically, this study seeks to examine if the responses of the consumer price index in Nigeria to fluctuations in crude oil price are still significant in light of recent global developments such as the Russian-Ukrainian hostilities, seasonal slowdown in world oil demand, and continued macroeconomic headwinds, etc and the domestic cash crunch in Nigeria triggered by the naira redesign policy of the Central Bank of Nigeria in Q1 2023.

This study uses impulse response functions based on a vector autoregressive (VAR) model of the Nigerian economy to analyze how oil price fluctuations move through major channels of the economy to affect inflation. The model represents the interactions between oil prices, real GDP, a monetary aggregate, consumer price index, the spread between long- and short-term interest rates, the size of fiscal deficit and the GDP deflator for the period 1990 through 2022. Our approach adds to the existing research on the aggregate effects of oil price shocks in several additional ways. The 33-year time period we use for the analysis includes periods in which oil prices fell sharply, as well as periods in which prices were rising due to developments in market conditions and the economic and/or socio-political events in oil-exporting countries. Following this introduction, the rest of this article is organized as follows: Section 2 reviewed the existing theoretical and empirical literature to put the study in a proper perspective and identify the research gap. This is followed by Section 3, which presents a trend analysis of the interaction between global oil prices and domestic inflation in Nigeria for the period under review. Section 4 centres on data and methodology by highlighting the study data, model specification and estimation procedure. Next is Section 5, which focuses on results and discussion. Section 6 concludes the paper with a summary of conclusion and presents policy recommendations.

Literature Review

1. Theoretical Review

Evidence from the theoretical literature suggests that oil prices contribute significantly to the national budgets of oil-producing countries. A high oil price encourages prosperity in such countries. Whether or not the oil-consuming countries move to other sources of energy and learn to control the demand for oil, crude oil prices and crude oil production may be lowered and prosperity will suffer. This has the potential to destabilize many of the governments of oil-producing countries through a decline in fiscal performance. Given the history of oil-supply shocks and indications that demand for gasoline is relatively stable, intuition suggests that price shocks are more likely to originate upstream and be transmitted downstream (Norman and Shin, 1991; Balkeefa, 1998).

The formation mechanism of oil prices determines the trends and characteristics of oil price fluctuations, and the early attention to oil economic issues in academia originated from the research on the formation mechanism of oil prices. In the early 20th century, the early stage of global industrial economic development, Hotelling, based on the essential properties of resource goods from the perspective of resource supply, established the depletable resource pricing model, marking the birth of energy economics (Hotelling, 1931). It was not until the outbreak of the oil crisis in the 1970s that scholars began to pay attention to the relationship between oil price fluctuations and macroeconomics. Hamilton pointed out that every recession in the U.S. economy was accompanied by a significant increase in oil prices after World War II [Hamilton, 1983] [10].

A stable relationship between oil price fluctuations and economic activity has undergone a dynamic change.

Scholars find reverse causality between macroeconomic variables and oil prices (Kilian, 2004), suggesting that the analysis of the impact of oil price shocks on economic activity cannot ignore the endogenous response of oil prices to global economic activity; it must consider the causes of oil price volatility. Kilian was the first to propose a structural decomposition approach based on the endogenous fluctuations in oil prices, assessing the impact of oil price fluctuations on economic activity in terms of oil supply, economic demand, and specific demand-driven oil price fluctuations (2009).

For the purposes of pricing, crude oil is generally classified based on the API gravity and sulfur content. For example, light sweet crude oil has low density, low viscosity (there are no exact numbers assigned to this because the classification is more practical and theoretical), and low sulfur content making it easier to transport and refine and, therefore, more expensive to purchase. For example, the petroleum industry generally classifies crude oil by the geographic location it is produced in (for instance. West Texas Intermediate, London Brent, or Oman Light), its API gravity, and its sulfur content. Light sweet (high API gravity) crude oil is more desirable than heavy sour (low API gravity) crude oil because it produces a higher yield of gasoline (Table 6.1), while sweet oil commands a higher price than sour oil because it has fewer environmental problems and requires less refining to meet sulfur standards imposed on fuels in consuming countries. Each crude oil has unique molecular characteristics that are understood by the use of crude oil assay analysis in petroleum laboratories.

Theoretical literature has identified some of the common reference crudes as – (i) West Texas Intermediate (WTI), a very high-quality, sweet, light oil delivered at Cushing, Oklahoma for North American oil, (ii) Brent Blend, comprising 15 oils from fields in the Brent and Ninian systems in the East Shetland Basin of the North Sea. The oil is landed at the Sullom Voe terminal in the Shetland Isles. Oil production from Europe, Africa, and Middle Eastern oil flowing west tends to be priced off the price of this oil, which forms a benchmark, (iii) Dubai-Oman, used as a benchmark for Middle East sour crude oil flowing to the Asia-Pacific region, (iv) Tapis (from Malaysia, used as a reference for light Far East oil), (v) Minas (from Indonesia, used as a reference for heavy Far East oil) and (vi) The OPEC Reference Basket, a weighted average of oil blends from various OPEC (The Organization of the Petroleum Exporting Countries) countries. There are declining amounts of these benchmark oils being produced each year, so other oils are more commonly delivered. While the reference price may be for West Texas Intermediate delivered at Cushing, the actual oil being traded may be discounted Canadian heavy oil delivered at Hardisty, Alberta, and for a Brent Blend delivered at the Shetlands, it may be a Russian Export Blend delivered at the port of Primorsk.

According to Speight (2011) [15], the price of a barrel of oil is highly dependent on both its grade, which is determined by factors such as its specific gravity or API, and its sulfur content. The location of the oil also plays a role in the ultimate price, and reference to the price of oil is usually either a reference to the spot price of benchmark crude oil, such as West Texas (light) crude oil traded on the New York Mercantile Exchange (NYMEX) for delivery in Cushing, Oklahoma; or the price of Brent (North Sea) crude oil traded on the International Petroleum Exchange (IPE) for delivery at Sullom Voe.

On the other hand, the United States Energy Information Administration (EIA) uses the Imported Refiner Acquisition Cost (the weighted average cost of all oil imported into the United States) as the world oil price. Not only is the price of crude oil subject to the composition of the crude, but the price of crude oil is the combination of the following factors: (i) the price set by the producer nations, (ii) continued high demand in the industrialized world as seen in the increase in gas-guzzling vehicles such as the SUV, (iii) Increased car ownership in the developing world where India and China are rapidly developing nations with need for petroleum and petroleum products, and 9iv) a host of international factors such as the Second Gulf War, and US-Iran tensions, to name only two of the last categories.

Crude oil prices have seen wide price swings over the past decade — especially over the past five years - whether it is due to apparent shortage or oversupply, (that is, supply and demand factors) (ITF, 2008). At the time of writing, prices have seen highs approaching $150 per barrel and are currently touching $40 per barrel, which makes the average price (a number per barrel placed on the table by some economists) seem meaningless. While the average price may be meaningful to the statisticians in Washington DC, the real price of crude oil is another matter because of the real price of petroleum products, such as gasoline, may be an affordable $1.50 per gallon or an expensive $4.00 per gallon and not a stagnant, reasonable average of $2.75 per gallon. Even when adjusted for inflation to current dollars, an average price per barrel bears little relationship to reality, especially when the consumer cannot afford the products or must go into financial hardship because of the need for crude oil products (Speight 2011) [15]

Similarly, Lutz, (2009) stated that changes in demand and supply could influence the oil market by either increasing or decreasing oil prices. World oil suppliers adjust free market activity. If supply surpasses demand, the excess is stored for the future. When demand exceeds supply, the stored excess can be used to take care of the excess demand, and the relationship between oil prices and oil suppliers considers remedies in either direction. Even though the non-OPEC producers supply 60% of oil in the world, they do not have the required reserves to control prices. They can just react to international market discrepancies. Nevertheless, the oil market prices are basically controlled by OPEC particularly when the non-OPEC countries' supply diminishes. Oil price is significantly influenced by the activities of OPEC. Oil price instability is largely due to OPEC activities as it supplies 40 percent of the oil in the international market and sets strategies for its member nations (Nigeria included) to meet worldwide demand. OPEC largely manipulate oil price by expanding or decreasing supply among its member nations. OPEC's decrease in supply allocation in 2006 is responsible for the 2007 and 2008 increments in oil prices (Fattouh 2011).

In the same vein, the US Energy Information Agency (2023) identifies several factors that influence oil markets and by implication drive the prices of crude oil in the global markets such as varieties of geopolitical and economic events in the oil-importing and the oil-exporting countries, the tendency for the oil prices to move in similar directions with arbitrage, unplanned disruptions in supply tightens world oil market and pushes prices higher, economic growth

has a strong impact on oil consumption in same manner changes in expectation of economic growth affects demand for oil and influences its prices from time to time, changes in Saudi Arabia crude oil production, changes in non-OPEC members oil production affects market conditions and leads to price fluctuations, crude oil plays a major role in commodity investment and commodity index investment flow have tended to move together with commodity prices, the years 2003-2008 experienced periods of very strong economic and oil demand growth, slow supply growth, and tight spare capacity which drove up crude oil prices before the outbreak of the 2008 global financial crisis.

Nuhu (2011) [17] in analyzing the relationship between oil prices and inflation in Nigeria noted that "high prices of oil in the previous years have led to bigger spending on projects, increasing money supply and high liquidity in the nearby market which leads to inflation. What is more, high prices in combination with the increase in spending as a consequence of normal size, the more the national income in a nation. Inflation manifest when the general demand for goods and services rises more rapidly than the supply, causing a decline in the quantity of idle productive resources. The short-run Phillips curve was used to depict the relationship between inflation and a measure of economic loss, alongside different factors that influence the price level. Oil prices are incorporated into the Phillips curve to assess the suggestion that oil prices are not just significant production, but they are also indications of inflationary pressures which may surpass its significance as a productive input. (Leblanc and Chinn, 2004)"

Sani Bawa *et al* (2020) [22] citing (Zivkov, Duraskovic and Manic, 2019) [26] noted that oil price shocks affect domestic inflation in countries through both direct and indirect channels: directly through increases in prices of refined oil products, which spill over to the Consumer Price Index (CPI), and indirectly through price changes in goods and services, which utilize oil or oil products as inputs in the production process. The direct impact would depend, among others, on the expenditure share of households on refined oil products over total expenditure. Alvarez *et al* (2011) have shown that the direct impacts tend to exhibit higher pass-through to inflation than the indirect impacts. Meanwhile, inflationary pressures emanating from rising oil prices through these channels (first-round effects) may trigger behavioural responses from firms and workers, leading to the revision of inflation expectations, increase in nominal wages, transferring the marginal increase in the cost of production to consumers and further changes in the price level through the second-round effects.

Corroborating this, Conflitti and Luciani, (2017) [6] state that oil price hikes may have an inflationary effect in four ways – an increase in production costs since energy cost (mostly fossil fuels) is an important component of production cost functions for most firms, higher inflation expectations because oil-related products account for about 10 percent of consumption, and so it is straightforward that they have an impact on short-term inflation expectations and direct impact on core inflation, demand for higher wages by workers to leverage the fall in living standards resulting from the increase in energy prices and an adverse supply shock if real wages do not decrease sufficiently, thus triggering an adjustment in employment. However, it can have a deflationary effect through a demand shock as higher oil prices tend to reduce net disposable income (income tax remaining constant), hence consumption and investment.

In conclusion, this review is significant to the objectives of the study as it highlights the key aspects of the relationship between oil price fluctuations (a rise in price following a shortage of supply and/or excess demand for crude oil by industrialized counties, and a host of other factors) and the trends of inflation in the domestic economy of the oil-producing nation. The review enables our understanding of the different channels by which the impact of an upsurge or plunge in crude oil prices is transmitted through several processes to the domestic economy in the form of inflation, changes in monetary aggregates, etc. It is evident that there have been many theoretical postulations on the true nature of the crude oil price and inflation relationship and these views have provided the basis for empirical testing and verification of the relationship by different scholars utilizing a vast array of methodological approaches.

2. Empirical Review

Several empirical studies have investigated the relationship between oil price fluctuations and changes in the level of macroeconomic variables such as inflation, monetary aggregates, economic growth, foreign exchange rate, etc. in both oil-exporting and oil-dependent economies. Earlier attempts include Hamilton (1983 [10], 1996, 2005), which provides evidence of a robust relationship between oil price increases and subsequent economic downturns in the United States (US), particularly after the Second World War. Under the pioneering work of Kilian (2009) [13], scholars such as Chen *et al*. (2018), Gong and Lin (2018) [8], and Kim and Vera (2019) have studied the macroeconomic impact of oil price shocks from different sources within the framework of their decomposition approach and found that oil price shocks from diverse sources will lead to a differential impact on economic variables. Li *et al*. explore the dynamic relationships between the three types of oil price shocks and investor sentiment using the structural vector autoregression (SVAR) model (Huang and Failler 2022).

Studies such as Brown, Oppedahl, and Yucel (1995) [3]; Dias (2013); Lu, Liu and Tseng (2013); Zhao *et al*. (2016) [25]; Conflitti and Luciani (2017) [6]; and Zivkov, Duraskovic, and Manic (2019) [26] reported significant positive impact of oil prices on inflation in advanced countries. Utilizing a vector autoregression (VAR) model and US data, Brown *et al*. (1995) [3] have shown that oil price shocks influence output and the price level, though, the country's monetary policy was able to accommodate the inflationary pressure from the shocks. Similarly, Dias (2013) estimates the effects of oil price shocks on economic variables including GDP, employment, and inflation using a structural VAR model for the Portuguese economy during the 1984 – 2012 period. Results from impulse response functions (IRFs) indicated, among others, that an increase in oil prices of approximately 13 percent, translated into higher inflation by 0.25 and 0.05 percentage points in the first and second periods, respectively. However, the impact reduces slowly from the third period, with virtually no long-term effect on the price level.

Lu *et al* (2013) examined the effect of oil price shocks on inflation in Taiwan utilizing a bivariate GARCH approach and data covering the 1986 – 2008 period. They reported that oil prices strongly Granger-caused inflation in Taiwan and revealed a persistent volatility spillover from oil price to

inflation during the period. Zhao *et al*. (2016) [25] built an open-economy dynamic stochastic general equilibrium (DSGE) model for the Chinese economy to assess the impact of oil price shocks on output and inflation. The study categorized four types of oil price shocks to include supply shocks driven by political events in OPEC countries, other oil supply shocks, aggregate shocks to the demand for industrial commodities, and demand shocks that are specific to the crude oil market. They revealed that the first shock mainly accounts for short-term changes to output and inflation in China, while the other three shocks lead to relatively long-term effects. Demand shocks that are specific to the crude oil market add the most to the variations in China's output and inflation.

Similarly, Conflitti and Luciani (2017) [6] examined the oil price pass-through to inflation in both the US and Euro area utilizing dynamic factor models and VAR. After distinguishing between the common and idiosyncratic effects of oil price shocks on inflation, the study showed that oil price influences inflation mainly through the common effect, the pass-through was small, though, it was significant and long-lasting. Zivkov *et al*. (2019) [26] also found that the pass-through of oil prices to inflation was relatively slow in eleven Central and Eastern European countries (the Czech Republic, Poland, Hungary, Slovakia, Lithuania, Latvia, Estonia, Romania, Bulgaria, Slovenia, and Croatia) during the 1996 – 2018 period. An increase in oil price by 100 percent was followed by a rise in inflation of 1 – 6 percentage points. Two countries (Slovakia and Bulgaria) that had the highest oil import/GDP ratios tended to have the highest and most consistent pass-through effects in the analysis.

Utilizing a VAR framework for the Russian economy, Ito (2010) [12] reveals that Russia is vulnerable to oil price shocks, as it contributed to mild inflation in the short-run in addition to its impact on the exchange rate and national output. Similarly, Abounoori, Nazarian, and Amiri (2014) examine the nature and causes of oil price pass-through into inflation in Iran. Results from their analysis show a positive and incomplete pass-through in both the short and long term, indicating that oil price hikes lead to an increase in inflation in Iran. In a comparative study, Sek, Teo and Wong (2015) and Sek and Lim (2016) distinguished between high and low-oil-dependent countries and investigated the impact of oil price shocks on inflation in the two groups of countries.

Along a similar line, Sek, Teo, and Wong (2015) utilizes a panel ARDL framework and discovered that the impact was distinct between the two groups – tended to be more severe for the high oil dependency group than the low oil dependency group, which are mostly oil producers. Sek and Lim (2016) also found that CPI inflation in oil-exporting countries does not respond to oil supply and demand shocks, whereas supply shocks can be a strong determinant of inflation in oil-importing countries. Niyimbanira (2013) [14] established a cointegrating relationship between oil prices and inflation in South Africa with unidirectional causality from oil prices to inflation. Shafique (2016), however, could not find any effect of crude oil price shocks on the producer price index of the oil-importing economy of Pakistan.

Using an unbalanced panel of 72 developed and developing economies, Choi *et al*. (2018) showed that a 10 percent increase in global oil inflation, would, on average, increase domestic inflation by about 0.4 percentage points, with the effect vanishing after two years. They revealed that the effect is asymmetric, with positive oil price shocks having a larger impact on inflation than negative ones. On the transmission channel for the shocks, their results indicated that the share of transport in the CPI basket and energy subsidies are the most important factors explaining cross-country variations in oil price shocks. Ibrahim (2015), Abdlaziz, Rahim and Adamu (2016) and Lacheheb and Sirag (2019) applied the NARDL approach to examine the oil price-inflation nexus in Malaysia, Indonesia and Algeria.

In Nigeria, Aliyu (2009) establishes an asymmetric impact of oil price shocks on real GDP, with positive changes having a larger impact on real GDP than negative changes. Alhassan and Kilishi (2016) have also shown that oil price shocks led to macroeconomic fluctuations in Nigeria. Narrowing down to inflation, Hooker (2002) finds evidence that fluctuations in oil prices contributed to the increase in US core inflation before 1981 and reduced afterward. Since then, several studies have investigated the relationship between oil prices and inflation in both advanced and developing economies utilizing different methodologies.

Furthermore, Olusegun (2008) had shown that oil price shocks significantly contributed to variations in oil revenues and national output. However, he opined that oil price shocks may not necessarily be inflationary, but recommended the application of fiscal policy measures in restoring stability in the domestic economy in the aftermath of an oil shock. Similarly, Odionye *et al*. (2019) had shown that the response of inflation to oil price shocks was negative in the initial instance, before turning positive after two periods. However, the exchange rate's response to oil price shocks was negative and persistent. Omotosho and Doguwa (2012) found that the announcement of fuel price hikes, food crises, exchange rate instability and upward review of wages of public sector employees were the major factors that caused high inflation volatility in Nigeria. Thus, the subsequent withdrawal of fuel subsidies in Nigeria and increases in the international prices of crude oil would culminate in higher domestic fuel prices and inflationary pressures in the country.

In a similar study, Ibrahim (2015) found that food price, oil price, and real GDP were cointegrated with asymmetries in the food price behaviour in Malaysia. The study established a significant relationship between oil price hikes and increases in food prices in both the long and short run, but could not find any significant influence of oil price decline on food prices both in the long and short run. Abdelaziz, Rahim and Adamu (2016) revealed evidence of a strong positive relationship between food and oil price increase in both the long run and short run. Their results indicated that a 10 percent increase in oil prices induced a 3.6 percent rise in food prices in the long run. Lacheheb and Sirag (2019) also found a non-linear effect of oil price on inflation, with oil price increases significantly impacting on inflation, while oil price declines do not have a significant impact.

By utilizing a New-Keynesian DSGE model to examine the macroeconomic implications of oil price shocks and the fuel subsidy regime in Nigeria, Omotosho (2019) [19] discovered that oil price shocks impacted on headline inflation, though, the contribution was minimal owing to incomplete pass-through of international oil prices to domestic fuel price. The study revealed that a negative oil price shock generated lower marginal cost and culminated in a fall in domestic inflation. However, a depreciation in the domestic currency

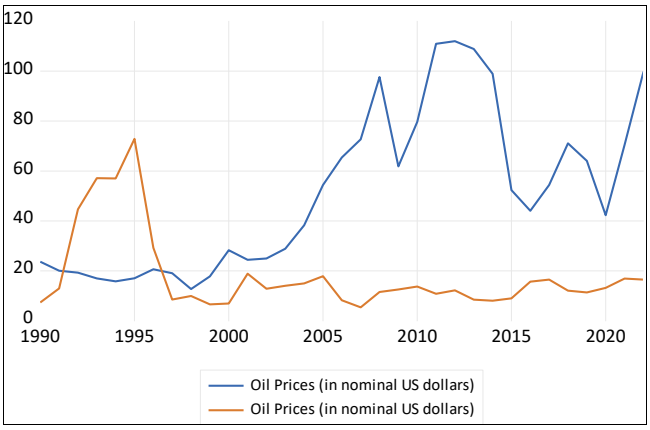
following a fall in oil prices caused import prices to rise, culminating in increases in the headline and core measures of inflation.

Another notable empirical study on the nexus between oil price fluctuations and domestic inflation is credited to Kelikume (2017) which examined the asymmetric effect of exchange rate and oil price shocks on inflation utilizing a vector error correction methodology (VECM). The study found, among others, that oil price hikes induced a 43 percent increase in inflation in a year, while a fall in oil prices leads to a 29 percent increase in inflation. Similarly, Bala and Chin (2018) [2] estimate the asymmetric impacts of oil price shocks on inflation in four African oil-producing countries - Algeria, Angola, Libya and Nigeria using the ARDL dynamic panels framework. The study discovered that both positive and negative oil price shocks positively influence inflation in these countries during the period, but the impact was more pronounced in periods of oil price declines. Similarly, Omolade *et al.* (2019) [18] applied a panel structural VAR framework and found that a sharp decline in oil prices has been accompanied by an increase in inflation in eight of Africa's oil-producing countries including Nigeria. The study revealed that the increase in inflation that followed these declines was more structural than monetary in nature.

In all, we can conclude based on the overwhelming evidence from the review of empirical literature that oil price shocks induce inflationary pressures, particularly in oil-importing countries. However, utilizing asymmetric approaches further reveals that positive oil price shocks tend to have a higher impact on consumer prices than negative ones. Studies on Nigeria dwelt on the impact of oil price shocks on such composite measures of inflation as headline inflation, core inflation, and food measures of inflation. But the impacts of oil price shocks on the aggregate consumer price index in Nigeria could be different as most commodities included in computing consumer price index are broad-based and their prices are vulnerable to changes in oil prices unlike most commodities included in headline and food inflation which are mostly produced locally. This study, therefore, contributes to the literature by investigating the impact of oil price shocks on inflation using the consumer price index in Nigeria by utilizing impulse response functions based on a vector autoregressive (VAR) model of the Nigerian economy to analyze how oil price fluctuations move through major channels of the economy to affect inflation.

Trends of International Oil Prices and Inflation in Nigeria (1990 – 2022)

Theoretically, the price of oil fluctuates according to three main factors: current supply, future supply, and expected global demand. Because production by OPEC members constitutes 40% of the world's oil output in the international market (US Energy Information Administration, 2023), it is expected that disruptions in the supply will trigger off imbalances in the global oil market equilibrium conditions to offset changes in the international prices of crude oil. Besides, the emergence of economic and socio-political events that impact either the supply of oil (such as the reduction of production quotas by OPEC, the development of shale oil supply in the US, Russia's invasion of Ukraine in February 2022, etc.) or causes unanticipated demand shocks (such factors include economic growth in oil importing countries, productivity slowdown in industrialized countries, the outbreak of the COVID-19 pandemic and its effect on global output slump, etc.). One reason crude oil prices can be volatile is that supply and demand are relatively inelastic, that is they are slow to respond to price signals, requiring bigger price moves to bring the market into balance. It is, therefore, safe to conclude that fluctuations in crude oil prices are not entirely determined by the laws of demand and supply, but by market sentiments towards oil futures and a host of other economic and geopolitical factors.



Source: Author's computation (2023)

Fig 1: Trends of international oil prices and inflation (measured by consumer price index) in Nigeria 1990 – 2022.

Available data indicates that crude oil prices experienced remarkable fluctuation between 1990 to 1998 reaching a peak of $23.68 in 1990 and an ebb of $12.72 recorded in 1998. The precipitant factor accountable for the sharp oscillation in prices during the period is Iraq's invasion of Kuwait which triggered off Gulf War causing a spike in crude oil prices. The cessation of the war coupled with the North American Free Trade Agreement (NAFTA) which allowed cheap oil from Mexico exerted downward pressures on crude oil prices and steadily declined to reach a low of $15.83 in 1994. Following the reduction of production quotas among OPEC members, the shortage of oil supply exerted upward pressure on prices peaking at $20.65 in 1996. Oil prices slumped again to a record 25-year low of $12.72 in 1998, the reasons being OPEC members' refusal to cut production to soak up the global glut of crude oil and the Asian financial crisis of 1997 – 1998 which had an indirect but profound impact on economic growth in Asian countries and the global oil demand.

Meanwhile, figures for the consumer price index (CPI) for Nigeria during the period under review fluctuated between 7.36% in 1990 to 9.99% in 1998 after reaching an all-time peak of 72.83% in 1995. The average consumer price index for Nigeria in the post-Gulf War era between 1992 to 1996 stood at 52.31% which reflected the consequences of the price fluctuations in the global crude oil market following the outbreak of the war. The slump in the oil price to a record low of $12.72 in 1998 is transmitted into the domestic economy as the consumer price index 8.52% from where it rose slightly to 9.99% in 1998. Nigeria recorded a record-high consumer price index of 72.83% in 1993 as an indirect result if the changes in the market conditions in the international oil market following the beginning of negotiations by OPEC members to reduce the supply of oil

to the world market. Similarly, the rise in oil prices was associated with slowing output growth or a deepening recession and somewhat higher inflation rates in both oil-dependent and oil-exporting countries, including Nigeria where the consumer price index peaked at 72.83% in 1995.

Furthermore, there was a further rebound in oil prices between 1999 to 2006 with the average annual price of the Brent blend rising from $17.81 in 1999 to a staggering $65.39 which represents an upward trajectory movement of 367%. Data from the World Bank Commodity Prices database shows that crude oil witnessed significant fluctuations over time with the Brent crude price recording an average of US$35.31 per barrel during the period. Reasons given for rapid fluctuations in oil prices include weak demand from Asia, increased production quota and supply from the member countries of the Organization of Petroleum Exporting Countries (OPEC), fear of increasing production from the Middle East and unstable global economy, and lower consumer confidence in the aftermath of the attacks in the US in September 2001.

Within these periods, even though the consumer price index in Nigeria remained at single-digit in 1999 and 2000, it increased significantly to 18.90 percent in 2001 and averaged 13.3 percent during the 1999 – 2005 period. Oil prices rose significantly to an average of US$75.4 per barrel during the 2006 – 2010 period due to increasing geopolitical tensions, activities of speculators, and a slide in the value of the United States dollar, among others. While it recorded US$90.69 per barrel in January 2008, the price declined significantly in the second half of 2008 owing to the global financial crisis and the accompanying uncertainties across the world. The global financial crisis of 2008 with its attendant spillover to 2009 and 2010 plunged oil prices from $ 97.64 in 2008 by almost 50% to $61.86 in 2009 due to a sharp decline in world oil demand arising from global output slump. The steep decline in oil prices led to falling revenues for oil-exporting countries with serious macroeconomic headwinds, including inflation, liquidation, and productivity slowdowns in major industrialized economies.

Meanwhile, Nigeria's level of inflation as measured by the consumer price index recorded single digits for most part of the period as CPI stood at 6.67%, 6.93%. 8.22% and 5.38% for 1999, 2000, 2006, and 2007 respectively, notwithstanding the sharp and precipitous increase in crude oil prices on the international stage. The reason for the insulation of the Nigerian economy against oil price shocks in the period could be the introduction of the fuel subsidy regime in 2000 which ensured that changes in the prices of crude does not substantially dictate the movement of certain macroeconomic variables in Nigeria, including inflation. In 2008, at the start of the global financial crisis, inflation was running a little above 5% - but this was primarily due to cost-push inflation arising from higher oil prices. A rise in oil and hence, petroleum prices. A rise in taxes. Firms have sought to maintain good cash flow by not cutting prices.

The rising demand for crude oil led to a substantial increase in prices, reaching an average of US$107.7 per barrel during the 2011 - 2014 period, while the inflation rate in Nigeria during the period ranged from 10.84% in 2011 and 8.06% in 2014, reflecting the fact that the economy is somewhat insulated against the impact of oil prices fluctuation on domestic macroeconomic variables. An attempt by the Nigerian government to adjust the pump price of petroleum to reflect rising crude oil prices was resisted by the populace, leading to massive government expenditure on fuel subsidies to stabilize the prices of petroleum products and avert rising domestic prices. The series of events accounts for the stableness in the consumer price index in Nigeria in the period, providing further evidence that the economy is insulated against international oil price shocks due to the dogged implementation of the fuel subsidy regime. Precisely, oil prices fluctuations in the period do not have a substantial adverse effect on the inflation rate in Nigeria as the consumer price index declined from 13.72% in 2010 to 10.84% in 2011, from where it falls continuously to 8.06 in 2014, indicating that the precipitous rise in the crude oil prices in the global market has no remarkable impact on the domestic level of inflation.

However, the global commodity shocks of 2014 - 2015 led to a significant decline in oil prices, with Brent crude recording an average of US$52.37 per barrel in 2015. An increase in global supplies pushed the price further to US$44.05 per barrel in 2016. Again, prices increased to US$71.07 per barrel in 2018, continuing the recovery in 2017, owing to increasing demand. The commodity shocks culminated in a significant decline in foreign exchange inflows and external reserve accumulation in Nigeria leading to the depreciation of the domestic currency and heightened inflationary pressures. Consequently, figures for the consumer price index in Nigeria trended upwards from 9.01% in 2015 reaching a high of 16.92% in 2017. But it slumped to an average of 11.74% between 2018 and 2019. One of the biggest casualties of the Covid-19 pandemic is the price of crude oil which plummeted from $64.03 at year-end 2019 to $42.30 in 2020, signifying a sharp decline of 51.37%. But the surge in the consumer price index from 11.39% in 2019 to 16.95% in 2021, indicating sustained inflation in the Nigerian economy (especially food inflation), is not only symptomatic of the global impact of the pandemic but also a result of multiple shocks that hit the food industry during the pandemic, a few of which are the thickening of borders, persistent pandemic and shortage of labour workforce.

Thus, Nigeria's inflation experience has largely reflected developments in crude oil prices over the years. The analysis showed that negative oil shocks have been followed by declining foreign exchange inflows and reserve accumulation, subsequently leading to exchange rate instability and rising inflationary pressures. However, rising oil prices culminated in stable exchange rates and a moderation in inflation. This largely indicates that positive and negative oil price fluctuations have distinct impacts on inflation in Nigeria.

Data and Methodology

1. Data

This study employs average annual data for the period 1990 to 2022 in the analysis. The data set utilized includes – the consumer price index (CPI) as a measure of inflation, the real GDP (using 2015 as the base year) as a measure of real output growth in the economy for the period under review, and the Brent Crude Oil prices ($/bbl) as a measure of crude oil prices since Crude Oil Brent is the benchmark classification for Nigerian oil in the international market. Data for the three variables are sourced from the World Bank Development Indicators database at https://data.worldbank.org/indicator and the World Bank

Commodity Markets database at https://www.worldbank.org/en/research/commodity-markets respectively.

Other data sets utilized for the study includes – the M2 money supply to proxy for the broad money supply, the risk premium on lending rate (lending rate minus treasury bill rates, %) which was used as a proxy for the spread between rates on FG bonds with a ten-year constant maturity and FG treasury bills with a three-month constant maturity and government overall budget surplus/deficit which was deployed to represent the size of fiscal deficit. These data were extracted from the 2022 edition of the Central Bank of Nigeria's Statistical Bulletin and Statistics database obtainable at statistics.cbn.gov.ng/cbn-online stats/. Estimation used yearly data from the period 1990 to 2022.

2. Analytical Framework and Estimation

To analyze the effects of oil price changes on inflation, we constructed a vector autoregressive (VAR) model to represent the relationships between oil prices, aggregate economic activity, and inflation. The model consists of six variables: the real price of oil, the consumer price index (inflation), real gross domestic product (GDP), a monetary aggregate, the size of the government fiscal deficit, and the spread between long- and short-term interest rates.

3. Model Specification

The model is based in part on the monetary equation of exchange:

$$MV=py \quad (1)$$

where M is the monetary aggregate; V is the velocity of the monetary aggregate; P is the aggregate price level; and Y is real GDP. Velocity is commonly represented as a function of interest rates because money demand is sensitive to the opportunity cost of holding money balances.

With some money balances paying interest rates, we include both a short-term interest rate and a spread variable. Because energy prices are incorporated into the calculation of the aggregate price level, changes in the real energy price can affect the aggregate price level directly. Nonetheless, this direct avenue cannot yield a permanent change in the aggregate price level. Under the monetary equation of exchange, a change in energy prices cannot have a permanent effect on the price level unless GDP, the monetary aggregate, or velocity are altered.' A change in real energy prices can have a permanent effect on the aggregate price level by altering real GDP. Higher energy prices reflect the increased scarcity of this productive input and reduce real GDP. Under a neutral monetary stance (defined here as one in which M·Vor nominal GDP is held constant), a change in real GDP will affect the aggregate price level. A reduction in real GDP increases the aggregate price level by an equal percentage.

As an initial step in our econometric work, we performed several diagnostic checks to assess the correct specification for the various series. We tested for stationarity using augmented Dickey-Fuller and Phillips-Perron tests and concluded that we could not reject the hypothesis that all of the series were integrated of the order of one. Thus, the first differences of the series were stationary. There are two approaches in using nonstationary data in a VAR model. One is to formulate an error-correction model in the first differences with cointegrating terms. An alternative to the error-correction approach is to estimate the VAR in levels, without explicitly modeling the cointegrating relationships. Given the length of the data series and the number of variables, we selected a VAR model in log levels. A case exists for examining the model in levels. The low power of cointegration tests and the resulting uncertainty about the number of cointegrating vectors conditions the test results from an error-correction model. Estimates from a levels model are not conditional upon the estimated number of cointegrating relationships and their estimated values. Although not all tests on a VAR model in levels have standard distributions, the tests presented in this paper do (Sims, Stock, and Watson, 1990).

The lag length of the VAR model was determined by testing various lag lengths against the alternative of one less lag. The method of testing was the likelihood ratio test corrected for small samples using Sims' (1980) suggestion. The resulting lag length was five. Restricting the model to four lags was rejected by a likelihood ratio test of X2 36=52.98 (p-value of 0.034) with a correction of 31. Also, testing for six lags versus five failed to reject the null hypothesis of five lags, because X2 36=36.51 (p-value of 0.445) with a correction of 37. The tests are valid because the null hypothesis can be represented by restrictions on stationary variables, as is required for the use of standard· distributions with the levels model (Campbell and Perron, 1991).

Meanwhile, the relationship between oil price increases and inflation is represented by β1, which is expected to be positive. This indicates that a priori, an increase in crude oil prices in the international market culminates in higher inflationary pressures. Similarly, the relationship between oil price declines and inflation is captured by β2, and is expected to also be positive, implying that a decline in oil prices leads to a lower marginal cost of production and a fall in inflation. However, falling oil prices weaken the foreign exchange earnings of oil-exporting countries which are import dependent, manifesting in the depreciation of the domestic currency and resulting in rising import prices and an increase in domestic inflation (See Bala and Chin, 2018 [2]; Omotosho, 2019) [19].

4. Impulse Responses

To examine the dynamics of monetary, interest rate, and oil price shocks to the Nigerian economy and inflation; we calculated impulse response functions. The impulse response function traces over time the effects on a variable of a given shock to the innovations from an equation in the VAR system. The persistence of a shock tells us how fast the system adjusts back to equilibrium. The faster a shock dampens, the faster the adjustment. We analyzed the effects of a one-time oil price shock (based on the Choleski decomposition of the covariance matrix) and traced the effects of this shock on each of the variables.

We used the estimated coefficients of the VAR system of equations and MonteCarlo integration with 1000 replications to compute confidence bands for the impulse response functions. The methodology follows Kloek and Van Dijk (1978) with the coefficient drawn directly from the estimated posterior distribution of the coefficients. This methodology yields 80-percent confidence bands for the impulse response functions of the variables in the model. These bands can be used to distinguish where the impulse response functions differ significantly from zero.

4. Variance Decomposition

The VAR approach also enables one to calculate the variance decomposition of the system. The information provided by the impulse response functions and variance decompositions is the same but presented in an alternate form. The forecast error variance is decomposed into the portion due to each of the innovation processes via a Choleski factorization.

Results and Discussion

Dependent Variable: RGDP
Method: Least Squares
Date: 05/11/23 Time: 04:17
Sample (adjusted): 1991 2021
Included observations: 31 after adjustments

Table 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.34E+10	2.13E+10	2.040027	0.0520
FSDF	95160545	15396729	6.180569	0.0000
INFL	-6.23E+08	4.24E+08	-1.470347	0.1539
M2	23925.69	2677.229	8.936739	0.0000
OPR	1.55E+09	3.54E+08	4.382068	0.0002
SPRD	41484486	2.27E+09	0.018265	0.9856
R-squared	0.971650	Mean dependent var		2.45E+11
Adjusted R-squared	0.965980	S.D. dependent var		1.84E+11
S.E. of regression	3.39E+10	Akaike info criterion		51.50140
Sum squared resid	2.87E+22	Schwarz criterion		51.77894
Log likelihood	-792.2717	Hannan-Quinn criter.		51.59187
F-statistic	171.3682	Durbin-Watson stat		1.943779
Prob(F-statistic)	0.000000			

This is a regression analysis output with the dependent variable "RGDP" (Real Gross Domestic Product) and five independent variables: "FSDF" (Fiscal Deficit), "INFL" (Inflation), "M2" (Money Supply), "OPR" (Oil Price), and "SPRD" (Spread between Lending and Deposit Rates). The analysis was conducted using the Ordinary Least Squares method with data from 1991 to 2021, resulting in a sample size of 31 after adjustments. The coefficients indicate the estimated effect of each independent variable on the dependent variable. The intercept term (C) has a coefficient of 4.34E+10, which represents the predicted value of RGDP when all independent variables are equal to zero.

The coefficient for "FSDF" is 95160545, indicating that a one-unit increase in FSDF is associated with an increase of 95160545 units in RGDP, holding all other independent variables constant. This coefficient is statistically significant at a 0.01 level. The coefficient for "INFL" is -6.23E+08, indicating that a one-unit increase in inflation is associated with a decrease of 6.23E+08 units in RGDP, holding all other independent variables constant. However, this coefficient is not statistically significant at a 0.05 level.

The coefficient for "M2" is 23925.69, indicating that a one-unit increase in money supply is associated with an increase of 23925.69 units in RGDP, holding all other independent variables constant. This coefficient is statistically significant at a 0.01 level. The coefficient for "OPR" is 1.55E+09, indicating that a one-unit increase in the oil price is associated with an increase of 1.55E+09 units in RGDP, holding all other independent variables constant. This coefficient is statistically significant at a 0.01 level. The coefficient for "SPRD" is 41484486, indicating that a one-unit increase in the spread between lending and deposit rates is associated with an increase of 41484486 units in RGDP, holding all other independent variables constant. However, this coefficient is not statistically significant at a 0.05 level.

The R-squared value of 0.971650 indicates that the independent variables explain 97.17% of the variation in the dependent variable. The Adjusted R-squared value of 0.965980 takes into account the number of independent variables in the model and is a more appropriate measure of model fit. The S.E. of regression (standard error of the estimate) is 3.39E+10, which represents the average distance that the data points fall from the regression line. The F-statistic of 171.3682 and its associated p-value of 0.000000 indicate that the regression model as a whole is statistically significant. The Durbin-Watson statistic of 1.943779 tests for autocorrelation in the residuals and indicates that there is no significant autocorrelation present

Vector Autoregression Estimates
Date: 05/11/23 Time: 04:34
Sample (adjusted): 1991 2021
Included observations: 30 after adjustments
Standard errors in () & t-statistics in []

Table 2

	RGDP
RGDP (-1)	0.673969
	(0.14288)
	[4.71700]
RGDP (-2)	-0.030401
	(0.11750)
	[-0.25873]
C	1.90E+09
	(1.5E+10)
	[0.12351]
FSDF	4406527.
	(1.6E+07)
INFL	-2.33E+08
	(2.7E+08)
	[-0.87312]
M2	2558.436
	(3587.09)
	[0.71323]
OPR	1.61E+09
	(2.3E+08)
	[7.04995]
SPRD	-6.15E+08
	(1.4E+09)
	[-0.43257]
R-squared	0.990583
Adj. R-squared	0.987587
Sum sq. resids	9.15E+21
S.E. equation	2.04E+10
F-statistic	330.6045
Log likelihood	-750.0773
Akaike AIC	50.53849
Schwarz SC	50.91214
Mean dependent	2.51E+11
S.D. dependent	1.83E+11

This is the output of a Vector Autoregression (VAR). The model includes 8 variables related to the economy, such as real gross domestic product, consumption, inflation, money supply, and others. The table shows the coefficient estimate,

standard error, and t-statistic for each variable, along with summary statistics about the model's fit. The model seems to fit the data well, with a high R-squared and most coefficients statistically significant. However, it is important to interpret the results carefully and consider the assumptions and limitations of the VAR model.
Impulse response

Estimation Proc
==========
LS 1 2 RGDP @ C FSDF INFL M2 OPR SPRD

VAR Model:
==========
RGDP = C(1,1)*RGDP(-1) + C(1,2)*RGDP(-2) + C(1,3) + C(1,4)*FSDF + C(1,5)*INFL + C(1,6)*M2 + C(1,7)*OPR + C(1,8)*SPRD

VAR Model - Substituted Coefficients:
==========
RGDP = 0.673968756947*RGDP (-1) - 0.0304011198601*RGDP (-2) + 1903791418.5 + 4406526.8842*FSDF - 232912506.337*INFL + 2558.43622146*M2 + 1607615416.76*OPR - 615475927.261*SPRD

This is the output of a Vector Autoregression (VAR) model estimated using least squares (LS) procedure. The model includes 8 variables related to the economy, such as real gross domestic product, consumption, inflation, money supply, and others. The VAR model equation is also shown, where each variable is regressed on its own lags and the other variables. The table shows the substituted coefficients of the VAR model equation, which are the estimated values of the slope for each variable and lag, along with a constant term. These coefficients can be used to make predictions or simulate the behavior of the model.

Vector Error Correction Estimates
Date: 05/11/23 Time: 04:43
Sample (adjusted): 1993 2021
Included observations: 29 after adjustments
Standard errors in () & t-statistics in []

Table 3

Cointegrating Eq:	CointEq1	
RGDP (-1)	1.000000	
FSDF (-1)	2.99E+09	
	(4.0E+08)	
	[7.37856]	
C	2.91E+12	
Error Correction:	D(RGDP)	D(FSDF)
CointEq1	-0.025991	-4.73E-11
	(0.00356)	(5.8E-11)
	[-7.29938]	[-0.81989]
D (RGDP (-1))	-0.243600	2.36E-09
	(0.16123)	(2.6E-09)
	[-1.51088]	[0.90161]
D (RGDP (-2))	-0.165514	1.52E-09
	(0.14180)	(2.3E-09)
	[-1.16720]	[0.66208]
D (FSDF (-1))	41213738	-0.394802
	(2.2E+07)	(0.35876)
	[1.86116]	[-1.10047]
D (FSDF (-2))	57356941	-0.095812
	(2.0E+07)	(0.32478)
	[2.86112]	[-0.29500]
C	4.76E+10	120.2769
	(1.3E+10)	(209.887)
	[3.67582]	[0.57306]
INFL	-2.85E+08	3.843711
	(2.2E+08)	(3.54192)
	[-1.30233]	[1.08521]
M2	-9888.531	-6.20E-05
	s(996.747)	(1.6E-05)
	[-9.92080]	[-3.83966]
OPR	1.83E+09	7.986161
	(1.9E+08)	(3.03369)
	[9.74763]	[2.63249]
SPRD	1.37E+09	-42.56772
	(1.3E+09)	(21.6335)
	[1.02744]	[-1.96768]
R-squared	0.895302	0.801015

Adj. R-squared	0.845709	0.706760
Sum sq. resids	4.62E+21	1213015.
S.E. equation	1.56E+10	252.6715
F-statistic	18.05278	8.498309
Log likelihood	-715.6560	-195.4484
Akaike AIC	50.04524	14.16886
Schwarz SC	50.51672	14.64034
Mean dependent	1.36E+10	-244.1095
S.D. dependent	3.97E+10	466.5995
Determinant resid covariance (dof adj.)		1.27E+25
Determinant resid covariance		5.46E+24
Log likelihood		-908.2220
Akaike information criterion		64.15324
Schwarz criterion		65.19050
Number of coefficients		22

The output shows the Vector Error Correction Estimates for a sample period from 1993 to 2021. The model consists of a cointegrating equation (CointEq1) and an error correction term that includes lagged variables of RGDP, FSDF, INFL, M2, OPR, and SPRD. The cointegrating equation indicates a long-run relationship between RGDP and FSDF, with a coefficient of 2.99E+09 and a t-statistic of 7.37856. The error correction term shows the short-run dynamics of the variables. The R-squared values indicate that the model explains 89.5% of the variation in RGDP and 80.1% of the variation in FSDF. The t-statistics for the coefficients show the significance level of each variable in the model.

Conclusion and Policy Recommendations

Fluctuations in oil prices in the international commodities market tend to affect all economies across the world including oil producers as well as oil-dependent nations. Global oil price fluctuations often impact domestic inflation in these economies through a number of channels. Given that Nigeria has abundant oil resources and hugely depends on those resources for foreign exchange earnings and government revenues, this study investigated the impact of oil price fluctuations on the consumer price index in Nigeria. The study utilized the Vector Autoregressive (VAR) approach and yearly data for the period 1991 – 2021. Empirical results from the VAR analysis indicated that oil price increases significantly impact consumer price index in Nigeria. These results suggest that global oil price increases tend to generate inflationary pressures in the country. Given the importance of oil in the production process, a rise in oil prices would increase the relative price of energy inputs leading to a rise in the cost of production in many countries, thereby increasing global inflationary pressures when the rising oil prices persist. In addition, significant increases in oil prices are accompanied by a transfer of income from oil-consuming to oil-producing economies, leading to economic booms in oil-exporting countries. In Nigeria, higher oil price culminates in a higher inflow of oil windfalls and larger government revenues accruing to the three tiers of government. This leads to significant increases in government outlays and rising inflationary pressures in the country. Similarly, rising oil prices culminate in an increase in money supply in Nigeria, leading to an equally rising inflation in such periods.

Inflation also responds positively to oil price drops in the main models, suggesting that oil price declines lead to a moderation in domestic inflation in Nigeria. Declines in oil prices are usually accompanied by reductions in production costs in many countries and lower oil earnings and government revenues in Nigeria, which serve to lower domestic inflation. However, additional results from the robustness analysis showed that oil price declines culminated in higher inflation in the country when the exchange rate variable was dropped from the models. This was possible as periods of rapid declines in oil prices in Nigeria are, sometimes, accompanied by significant depletion in foreign exchange reserves and the tendency for excess demand in the foreign exchange market, culminating in the depreciation of the domestic currency and higher inflation.

Given the observed impact of oil prices on government fiscal deficit and ultimately on consumer price index measure of inflation, this study recommends that the monetary policy actions of the Central Bank of Nigeria (CBN) should be focused on addressing inflation triggered by changing consumer price index and minimizing the size of fiscal deficit in periods of excessive oil price increases. The Central Bank should also strengthen its efforts aimed at implementing supply-side policies that have the tendency to ramp up the productive capacity of the economy to curtail the deleterious impact of rising prices emanating from oil price fluctuations. In addition, there is a need to ensure that the fiscal policy stance is not excessively procyclical in periods of rising oil prices, so as to complement the efforts of the monetary authority in moderating inflation. It is also recommended that government should nurture the political will to ensure the saving of excess oil proceeds and the building of external reserve buffers in periods of rising crude oil prices. The Central Bank of Nigeria would also need to sustain the implementation of appropriate policies in the foreign exchange market with a view to achieving stable exchange rates and ensuring the efficient management of foreign reserves during periods of declining oil prices.

References

1. Abubakar AB. Economic growth impact of Indian stock market: an econometric investigation. *Pacific Business Review International (Finance section),* 2016, 1(1).
2. Bala U, Chin L. Asymmetric impacts of oil price on inflation: An empirical study of African OPEC member countries. Energies,2018:11:3017:1-21.
3. Brown SPA, Oppedahl DB, Yucel MK. Oil Prices and Inflation" in *Federal Reserve Bank of Dallas Research Department Working Paper*,1995:95-10:1–28.

4. Central Bank of Nigeria. *Statistical Bulletin*, 2019.
5. Central Bank of Nigeria. *Quarterly Statistical Bulletin*, 2022.
6. Conflitti C, Luciani M. Oil price pass-through into core inflation." *Bank of Italy Occasional Paper*, 2017, 405.
7. Deloitte. Petroleum Industry Act: Nigeria's New Oil and Gas Regulatory Framework". Accessed on, 2021.
8. Gong X, Lin B. Time-varying effects of oil supply and demand shocks on China's macroeconomy." *Energy*, 2018, 149.
9. Gyang EJ, Anzaku EP, Baba-Iyakwari AD, Eze F. An analysis of the relationship between unemployment, inflation and economic growth" in *Bingham Journal of Economics and Allied Studies (BJEAS)*,2018:1(1):1–11.
10. Hamilton JD. Oil and the Macroeconomy since World War II" in *Journal of Political Economy*,1983:91:228–248.
11. Huntington HG. Oil prices and Inflation" in *Annual Review of Energy*,1985:10:317–319.
12. Ito K. The impact of oil price volatility on macroeconomic activity in Russia." *Economic Analysis Working Papers* 9(5), Economists Association of A Coruna, 2010.
13. Kilian L. Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market." *American Economic Review*,2009:99:1053–1069.
14. Niyimbanira F. An investigation of the relationship between oil prices and inflation in South Africa." *Mediterranean Journal of Social Sciences*,2013:4(6):105-111.
15. Speight JG. *An Introduction to Petroleum Technology, Economics, and Politics.* Massachusetts: Scrivener Publishing LLC, 2011.
16. Lu W, Liu T, Tseng C. Volatility transmissions between shocks to the oil price and inflation: evidence from a bivariate GARCH Approach." *Journal of Information and Optimization Sciences*,2013:31(4):927-939
17. Nuhu AB. The Impact of Oil Price Instability on Economic Growth (A Case of Nigeria)". An M.Sc thesis submitted to the Postgraduate School of Social Sciences, Economics Department, Near East University, Nicosia, Cyprus, 2011.
18. Omolade A, Ngalawa H, Kutu A. Crude oil price shocks and macroeconomic performance in Africa's oil-producing countries." *Cogent Economics and Finance*,2019:(7):1-17.
19. Omotosho BS. Oil price shocks, fuel subsidies and Macroeconomic instability in Nigeria." *CBN Journal of Applied Statistics*,2019:10(2):1–38. https://doi.org/10.33429/Cjas.10219.1/6
20. Otoakhla EI. Pass-through of crude oil shocks to consumer prices in Nigeria – Pre and Post 2008 global financial crisis" in *CBN Journal of Applied Statistics*,2020:11(2):115–143.
21. Oyeyemi AM. The growth implications of oil price shock in Nigeria. *Journal of Emerging Trends in Economics and Management Sciences* (JETEMS),2013:4(3):43-349.
22. Sani B, Ismaila SA, Tukur D, Sani IB, Yusuf JA. Asymmetric impact of oil price on inflation in Nigeria" in *CBN Journal of Applied Statistics*,2020:11(2):85–113.
23. Umaru A, Zubairu AA. An Empirical Analysis of the Relationship between Unemployment and Inflation in Nigeria. *Economic and Finance Review*,2012:1(12):42-61.
24. Zhang B, Ai X, Fang X, Chen S. The Transmission Mechanisms and Impacts of Oil Price Fluctuations: Evidence from DSGE Model. Energies,2022:15:6038. https://doi.org/10.3390/en15166038
25. Zhao L, Zhang H, Wang S, Xu S. The effects of oil price shocks on output and inflation in China." *Energy Economics*,2016:53:101-110.
26. Zivkov D, Duraskovic J, Manic S. How do oil price changes affect inflation in Central and Eastern European countries? A wavelet-based Markov switching approach." *Baltic Journal of Economics*,2019:19(1):84-104.