The Seybold Report

ISSN 1533-9211

DOI: 10.5281/zenodo.13934468

DYNAMICS OF STOCK MARKET DEPTH AND RETURNS TO CRUDE PRICE CHANGES IN NIGERIA

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Abstract

This study is set to investigate the responsiveness of stock market depth and liquidity to movement in prices of crude oil in Nigeria. Using a monthly series covering a 52-year period, 1970M01– 2022M12, the study adopts the ARDL model to measure not just the short-run elasticity but also the long-run and error correction profile of the investigated series. The results arising from the study indicate that favourable change in crude price upscales market liquidity and also deepens the market. The results suggest that the interconnectedness between the performance of the stock market and movement in crude price can be explored to the advantage of economies in the shape and form of Nigeria. Additionally, countries that export crude oil are by this alerted to the need to build safety nets against the adverse shocks that can come to the stock market in the event of a downward movement in crude price.

Keywords: Crude Price, All Share Index, Nigeria, Market Capitalisation and Crude Production.

1. INTRODUCTION

The dependence on energy of both emerging and developed economies indicates that oil price shocks have a significant impact on the variables of a country's economics. The oil market is the largest commodity market. The relationship between oil prices and stock returns received much interest since oil price shocks have a major impact on stocks and changes in price directly affect the inputs of the production process that affect the cost of production. The cost of production necessarily reflects the cash flow and profitability of the firm and eventually affects dividends and stock returns. Oil prices also have an indirect effect on stock prices; stock prices, in theory, equal the present value for future cash flows.

The oil market is very volatile a barrel of oil rose from around $20 per barrel at the beginning of October 2001 to its highest historical price of $145 per barrel during the global financial crisis in July 2008. The oil market continued to fluctuate, dropping to $30 per barrel in the oil crash of 2016 and then rising to $70 at the beginning of 2020. Therefore, the nature of the relationship between oil prices and stock returns have particular importance and represents an ongoing need for investigation. This relationship is of great importance to many parties: primarily policymakers, including local and international investors and various decision-makers, as well as for many products and service sectors within the economy.

Oil is an important source of energy that drives modern economies. A central question for economists and financial analysts is "how does the economy respond to changes in the price of oil"? The answer to this question is crucial for many decisions including the formulation of

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.13934468

macroeconomic policy, asset pricing, risk management and portfolio management. Despite a large body of literature on examining the effects of oil price shocks on the economy, less attention has been paid on studying the dynamic effects of oil price shocks on stock markets and especially on issues such as whether oil prices have any predictive power.

Ever since the discovery of oil in Oloibiri, Nigeria on Sunday, 15thJanuary,1956 and the coming on stream of its first oil field producing about 5,100 bpd in 1958, the oil and gas sector has continued to play a central role in the economic development of Nigeria and even in the current world economy. For instance, oil contributes about 90% of all foreign exchange earnings of Nigeria, account for as high as 20% of GDP, 80% of total government revenue and about 65% of total trade. Given the level of interdependence among Nations in today's global economy, fluctuations in crude oil prices in the international oil market are bound to have profound impact on different sectors of the economy including the stock markets and the foreign exchange markets. The nature and extent of this impact depends to a large extent on whether the country is an oil importing or oil exporting country. For oil importing countries, rising oil prices obviously leads to increases in production costs, lower output levels and lower stock returns whereas oil exporting countries would be happy with rising oil prices since this would translate to higher disposable incomes, consumption, investments and cash flows. Thus, the transmission mechanisms through which oil prices impact on real economic activity include both supply and demand channels (Ogbulu 2012). In addition, the magnitude of these supply side and demand side effects is in turn stronger the more the shock is perceived to be long lasting.

The stock market is seen as the barometer of the economy because stock prices respond to all kinds of risk including oil price risk (ALoui etal, 2012). There are numerous studies on the relationship between oil prices and economic activities. Since the stock market is an indicator of economic performance some studies examined the relationship between oil prices and stock market as a whole. Therefore characterization of the impact of oil price changes on sectoral equity is relevant for potentials investment opportunities, (Arouri et al, 2011). The impact of oil price changes is industry specific and time varying (Degiannakis et al, 2013; Mensi etal, 2017) which could be attributed to the nature of dependency of a particular sector on the price of oil that is either production side or demand side dependency. This means that the impact of oil price on sectoral equity markets depend on how the particular sector is exposed to oil price changes as an input or output. Hence, this heterogeneous exposure to oil prices provides diversification opportunities to minimize risk and maximize return through sectoral investing. Moreover, sectoral study is an integral part of investment based on fundamental analysis of stock.

Furthermore, oil price studies so far have focused on economies as importers or exporters. It is worthy of note to state that oil price changes impact on the economy in general and stock market in particular because the initiatives related to oil price changes. Thus any change in the price of the oil in an oil importing Country is expected to impact the equity market in general and sectoral equity in particular through the interest rate inflation which are the focus of the monetary policy of a Country.

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ISSN 1533-9211
DOI: 10.5281/zenodo.13934468

The importance of an economy specific study of oil price changes lies in how the financial market is pricing the equity assets in financial markets, the pricing of equity assets has a sectoral component, pricing of the financial assets depends on the market micro structure where they are traded which differs across the economy. Volatility in asset returns depends on the rate of information flows (Chen et.al 1986) which in return depends on the unique characteristics of the market and in turn depends on the unique characteristics of the market and institutional set up of the particular economy. There could be variation in the time required to process the information.

Thus, we may expect an economy specific pattern of impacts associated with oil prices changes on equity markets as a whole and on specific sectors.

The stock market is an essential component of the macroeconomy. It is important to understand the manner in which oil price shocks stir market volatility. Many researchers have explored the impact of oil price volatility on the stock market (e.g., Jones and Kaul 1996), inspiring others to investigate the effects of oil shocks on stock returns. Oil prices have disparate effects on stock returns in different countries or regions. For example, Sadorsky (1999) applied the VAR approach and found that both oil price shocks and oil price volatility have a crucial impact on US stock returns. Oil price volatility also has an asymmetrical effect on stock returns; Papapetrou (2001) showed that stock returns can be depressed by positive oil price shocks. Park and Ratti (2008) demonstrated that while stock returns in most countries decrease significantly within the same month when oil prices move, the Norwegian stock market shows a uniquely positive correlation with oil price. They found no evidence that the stock returns of oil importing countries in Europe respond asymmetrically to oil price volatility. Bjornland (2009) confirmed that stocks rose by 2.5% for every 10% increase in oil prices in Norway, a developing oil exporting country.

Narayan and Sharma (2011) explained that oil prices can impact stock prices (returns) through two channels. Firstly, oil is considered largely as an input in the production process. A rise in the oil price raises the cost of production and reduces the productivity of labour and capital (Yıldırım and Öztürk, 2014), which in turn will depress aggregate stock prices. Secondly, expected oil prices also affect stock returns through the discount rate, which comprises the expected inflation rate and the expected real interest rate. Oil prices thus affect both expected inflation and interest rates. Investors and other market participants are faced with uncertainties associated with volatility spill over via oil price or stock returns. Because of this, it remains a general agreement that investors, within a given time period, require a larger expected return from a security that is riskier (Glosten et al., 1993).

For a net importer of oil, a rise in oil price will put upward pressure on the country's domestic inflation rate and downward pressure on foreign exchange rate. A higher expected inflation rate causes the discount rate to rise, which has a negative effect on stock returns (Arouri et al., 2011).

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Gokmenoglu (2015) emphasized that understanding the volatility of crude oil price is very critical, because it may generate uncertainty in all sectors of the economy and may give rise to instability in the economy for both oil exporting and importing economies. Oil indexation has long been the leading pricing mechanism in the energy market. Oil is widely considered as the lifeblood of modern economies. As countries advance and modernise their demand for oil increases significantly.

Forecasting future oil demand is difficult but it is generally highly correlated with the growth in industrial production. Subsequently, countries experiencing rapid economic growth, like the emerging economies, are the ones most likely to considerably increase their demand for oil (Basher and Sadorsky, 2006). Gupta (2013) adds that oil price shock is broadly acknowledged to have significant influence on the economic activity of the country. For an oil dependent nation, the oil-supply poses strong signal to revenue generation and thriving economic activities. An increase in economic growth in developing countries, for instance, may be linked to a higher expected growth for commodity demand than an increase in growth in developed countries (Ratti and Vespignani, 2015).

A common intuition emerging from these studies is that since oil is one of the most important factors of production, any oil price increase will lead to increased production costs (Arouri and Nguyen 2010). These higher costs will be passed onto consumers, resulting in higher consumer prices. These inflationary pressures will lower aggregate demand, including consumption and investment spending, deteriorate consumer sentiment and thus, in turn, lead to a slowdown in overall economic activity (Barro 1984; Hamilton 1988, 1996, 2011; Abel 2001; Bernanke 2006). Clearly, stock markets tend to respond negatively in such economic downturns (Jones and Kaul 1996; Sadorsky 1999).

The relationship between oil prices and stock markets can also be explained as follows. According to economic theory, the price of any asset should be determined by the discounted value of expected future cash flows associated with it (Fisher 1930; Williams 1938). Therefore, it is expected that any factor that could affect the discounted value of cash flows of assets may have a significant influence on the prices of these assets. In this way, any increase in oil prices should result in a decline in stock prices. This is because higher oil prices would increase costs of production, which would result in a decrease in firms' earnings, and in sequence this would reduce the firms' value. In this case, any hike in the oil price would cause a reduction in equity prices.

Moreso, the effect of oil prices on stock prices can be the opposite for oil exporting countries. Essentially, oil price increases would not only increase earnings of those firms that produce oil but also increase the country's income. These increases in income are expected to bring a rise in consumer spending and investments and thus productivity and the level of employment which would, in turn, enhance the performance of the stock markets (see Jiménez Rodriguez and Sánchez 2005; Bjornland 2009; Filis *et al* 2011).

The nature of the impact of oil price changes on stock market returns depend on the cause of the oil price shock such as demand or supply driven shocks (Hamilton, 2009a, 2009b, Kilian

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DOI: 10.5281/zenodo.13934468

and Park, 2009). Basically pressure on the oil supply and demand creates supply shocks and demand shocks, respectively, in oil prices. The shock may be positive or negative, for instance a decision by organization of Petroleum Exporting Countries (OPEC) to cut oil production resulted to a 10% jump in oil prices (The Economic Times, 02/12/2016)

This is a supply shock with a positive input increase in oil prices. However, these shocks are not regular phenomena influencing oil prices. Hence, this behavior of oil prices may be described as tail risk of oil price change.

Positive oil price shocks refer to an increase in oil prices owing to a decrease in supply of oil or an increase in its demand. Similarly, negative oil price shocks refer to increases in supply of or decreases in demand for oil. The resulting effect on the stock market is largely dependent on the magnitude of oil prices changes (Gogineni, 2010). The stock market responds negatively to supply and demand side oil price shocks, whereas the impact of aggregate demand on these shocks is positive (Kilian and Park 2009; Lippi and Nobili, 2012).

Oil price Volatility will impact on stock prices by first of all affecting expected cash flow and discount rates. Since oil serves as an input in production process which can also affect the demand for the output any given industry and also at the national levels.

The study chose the main objective of investigating the impact of oil price volatility on stock market performance in Nigeria and the specific objectives are:

The significance of the study is because it has serious implications for investors, portfolio managers and policy makers. It offers great insight into building accurate asset pricing models and accurate forecasts of the return and volatility of crude oil and stock markets. This study will no doubt help portfolio managers and policy makers to adjust their actions to prevent contagion risks in the event of market crashes or crises. In the same vein the significance of the study would essentially benefit (Academics and Stock Market Operators).

The study will contribute to the enrichment of the literature on impact of oil price risk on stock market performance. This study would stir up researchers to investigate deeper on oil price shocks volatility and fluctuations and its impact on sectoral equity and returns. This study will serve as a body of reserved knowledge to be referred to by academics.

This study shall be helpful to stock market operators as a recipe / manual for stock prices and management considering the degree of oil price fluctuation. This means that oil price can directly and significantly affect cash flows.

2. REVIEW OF RELATED LITERATURE

The relationship between oil prices and stock markets can also be explained as follows.

According to economic theory, the price of any asset should be determined by the discounted value of expected future cash flows associated with it (Fisher, 1930; Williams, 1938). Sequel to this, it is expected that any factor that could affect the discounted value of cash flows of assets may have a great influence on prices of these assets. In this context, any increase in oil prices should result in a decline of stock prices. This is so because higher oil prices would

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increase costs of production, which would result to a reduction of a firms earnings, and in a sequence this would decrease the firms' value. In this case, any hike in the oil price would cause a decrease in equity prices.

Furthermore, the effect of oil prices on stock prices can be the opposite for oil exporting countries. In particular, oil price increases would not only increase earnings of those firms that produce oil but also increase the country's income. These increases in income are expected to bring a rise in consumer spending and investments and thus increases significantly the level of employment, which would, subsequently, enhance the performance of the stock markets (see Filis et al., 2011; Bjørnland, 2009; Jimenez-Rodriguez and Sanchez, 2005).

Another channel through which oil price would have an effect on stock markets is the uncertainty that oil price dynamics cause to the financial markets (Doran and Ronn, 2008; Ramey and Ramey, 1991; Friedman, 1977). Volatilities in inflation rates, arising from oil price shocks, would cause increases in uncertainty concerning variations in future prices, distort price signals and thus reduce the efficiency of the overall economic system. These all are expected to have an adverse impact on the performance of stock market. As a result, there is a negative relationship between stock prices and oil shocks. Oil price shocks can impact a firm's share prices through its impact on the investment behaviour of the firm as well. In fact, several studies including Glass and Cahn (1987), Mohn and Misund (2009), Elder and Serletis (2009, 2010), Yoon and Ratti (2011), and Henriques and Sadorsky (2011) have found statistically significant impacts of oil price uncertainty on firms' investment decisions. One can also predict a positive impact of oil price shocks on stock market performance. Oil price shocks lead to increasingly large economic risk (Hamilton, 1983). Since high risk is considered as an instrument of achieving higher economic growth, economies with high variance are also likely to have high growth on an average. In this context, oil price shocks are expected to be positively related to stock market performance (Black, 1987).

The nature of the response of stock markets to oil price shocks, however, would also depend on origins of the shocks. To be exact, the market would respond positively to the oil shocks those that originate from the demand side. On the other hand, stock markets would react negatively if the shocks originate from the supply side. For more on the nature of oil price shocks and their effects, see Kilian (2009) and Hamilton (2009b).

Kilian (2008b, 2009) maintained that there are three types of oil price shocks, namely, the *supply side*, *aggregate demand* and *precautionary demand* shocks. According to these studies *supply side* shocks are related to restrictions in oil supply by OPEC, via cartel behavior, as a strategy to vary oil prices. On the other hand, geopolitical unrest, primarily observed in the Middle-East region, does not lead to *supply-side* oil price shocks. On the contrary, they opined that these events that stir *precautionary demand* shocks, which result to the uncertainty that the geopolitical turbulence imposes on economic agents about the future availability of oil. To put it straight, Kilian and co-authors maintain that economic agents expect a shortage in oil supply soon after initiation of geopolitical unrest and, thus, they increase their demand for oil sporadically, driving oil prices to higher levels.

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The *aggregate demand shocks*, according to Kilian's studies are related to oil price changes which are influenced by movements in the global business cycle. For instance, the remarkable growth of the Chinese and other emerging economies from 2004 to 2007 greatly increased oil demand from these nations, while oil supply did not follow suit, driving oil prices to unprecedented levels. Similarly, the global economic recession during the Global Financial Crisis of 2007 - 2009 led to the collapse of oil prices, as the dramatic reduction of oil demand was not accompanied by a reduction in the supply of oil.

Hamilton (2009a, 2009b) maintains that oil prices change in response to either geopolitical or economic events, which suggests that oil prices change due to supply disruptions (*supply side* shocks) or economic growth/downturns (*demand side* shocks). Hamilton adopts a similar interpretation for his *demand side* shocks, as in the case of Kilian. However, unlike Kilian's evidence, Hamilton suggests that *supply side* shocks are driven by events such as the Yom Kippur War in 1973, the Iranian revolution in 1978, Iraq's invasion of Iran and Kuwait in 1980 and 1990, respectively, the Arab Spring in 2010 or Syrian unrest in 2011. Such shocks lead to major oil production disruptions, which are not accommodated by a similar reduction in the demand for oil and thus drive oil prices to higher levels.

On the other hand, some researchers, such as Kilian and Park (2009) identified the various oil price shocks and analyzed their effect on the stock markets. Regarding the theoretical justification about the impact of the different oil price shocks on the stock market returns. Gogineni (2007) concluded that oil prices are positively linked to stock prices, if oil price shocks reflect changes of the aggregate demand, but negatively if they reflect changes of supply. Based on this result, (Kilian, 2008; Kilian and Park, 2009) examined whether changes of the macroeconomic variables cause oil price changes, which resulted to the decomposition of oil price changes into structural shocks hidden behind such changes.

The contribution of Kilian and Park (2009) may also be justified by volatility in the oil market price is one of the most important risks which is essentially related to the instability of the major determinants, such as, the global supply of oil, the global demand of oil and the specific demand of oil. For this reason, Kilian (2009) maintained that oil prices are responding to factors, which affects stock prices based on this, oil price shocks should be decomposed. He discovered three types of shocks in the world oil market, a shock of oil supply, a shock of aggregate demand and a shock of speculative demand. Basically, he asserted that oil supply shocks caused by disruptions in supply reflect unexpected changes in the physical volume of oil. The aggregate demand shocks correspond to the evolution of demand for industrial products that are driven by fluctuation of the overall business cycle. The speculative demand shock reflects the changes of the oil prices, which are driven by speculative motives and prospective behavior.

Concerning the shock of the global oil supply, there is an increasing number of studies showing that there is no effect on the economy and financial markets (Degiannakis et al., 2014; Abhyankar et al., 2013; Kang and Ratti, 2013; Baumeister and Peersman, 2012; Basher et al., 2012; Lippi and Nobili, 2012; Kilian and Lewis, 2011; Kilian and Park, 2009; Hamilton, 2009; Kilian, 2009; Apergis and Miller, 2009; Mignon Lescaroux, 2009; Kilian, 2008, Barsky and

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Kilian, 2004). Nevertheless, Chen et al. (2014) focused on France, Germany, Japan, and the United States and asserted that supply shocks have a greater strong effect on the share prices.

In this context, a number of explanations have been offered. Some researchers (Rasch and Tatom, 1981; Brumo and Sachs, 1982; Darby, 1982) focused on the cost theory where the supply shock is considered the major channel through which the effects of oil prices are generated. In this case, the reduction in the world oil production makes it possible to increase the price of oil. Indeed, this increase is interpreted as an indicator of strength or increase of the scarcity of oil. In other words, when oil is less available on the market, the economic income slows down and consequently companies' cash flow and discount rates reflect the conditions of higher oil prices that can be influenced by shocks of the global oil supply (Apergis and Miller, 2009; Park and Ratti, 2008). Therefore, stock prices can significantly react to the volatility of the oil prices.

On the other hand, Kilian and Park (2009) is of the view that USA equity market returns have a negative reaction only to a speculative demand shock, while the global demand shock has a continuous positive effect. The negative impact of speculative demand shock can be explained by changes in the demand for precaution that is influenced by the unexpected reduction in global oil supply. More detailed discussions about the speculative demand shock can be seen in the studies of Kilian and Park (2009) which explains that this type of shock is mainly caused by the uncertainty of future supply, which allows, increasing at certain time the price of oil. This increase, in turn, allows for a decline in stock price.

In the past decades, an emerging literature review on financialization of oil markets is of the view that the oil as an asset class, which has become widely held by institutional investors seeking diversification benefits (Buyuksahin and Robe, 2010; Singleton, 2014). It is imperative that with the financialization of oil prices and the greater involvement of financial actors in the oil market, the nature of the information driving the development of oil prices has changed, and consequently the commodity prices such as oil prices are determined not only by their supply and demand but also by the financial market conditions that affect financial investment.

Indeed, only a few of studies are based on the ability of financial shocks to cause oil price fluctuations. Hakkio and Ketton (2009) and Davig and Hakkio (2010) concluded that the increase of financial shocks is associated with a considerable rise of the funding costs and a greater economic uncertainty resulting in an off fall of the asset prices, including those of oil. During the subprime crisis period, and in the context of a new international financial landscape dominated by the financialization of commodity markets, Chen et al. (2014) attempted to identify an exogenous shock resulting from unforeseen changes in the financial market conditions and review the macro economic impacts caused by fluctuation of oil prices. Their results showed that a positive financial shock caused a statistically significant decline of stock market returns in the United States, which illustrates the financialization of commodity markets (Henderson et al., 2014; Nissanke, 2012; Tank and Xiong, 2012; Morana, 2013; Basak and Pavlova, 2013). One consequence is that oil prices are not only determined by supply and demand, but also by the conditions of the financial markets.

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In an important contribution, Kilian and Park (2009) investigated the dynamic effects of oil price shocks (the supply shock, the aggregate demand shock, and the speculative demand shock) on the stock market returns of the United States for the period between 1973 and 2006. Their conclusion showed that the cumulative effects of the supply shocks and the aggregate demand shock account for about 22 percent of the variation of the US stock returns in the long term. More precisely, there is a negative response to a speculative demand shock, a positive effect of a global demand shock and a non-significant effect of oil supply shocks on the stock returns.

Gupta and Modise (2013) studied the dynamic relationship between oil price shocks and the stock market returns in South Africa by using a structural VAR approach for the period between January 1973 and December 2011. Their analysis of variance decomposition showed that the oil supply shocks contribute more to the variability of the real stock prices. Their results showed that the stock returns increase only with oil prices when global economic activity improves. In response to speculative demand shocks and oil supply shocks, the stock returns and the real price of oil move in exact opposite directions.

Recently, Effiong (2014) investigated the impact of the origin of oil price shocks on Nigeria's stock market for the period between 1995 and 2011 by using a structural Vector auto-regression model. The impulse response and the variance decomposition analysis showed that the response of the stock market to oil supply shocks is negative and non-significant, but significantly positive to the aggregate demand and oil specific shocks. The cumulative effects of the origin of oil price shocks represent 47% of the variation of Nigeria' stock market.

However, there are very few papers that examined the relationship between oil price shocks and the stock returns in the Greater China region (China, Hong Kong and Taiwan). In this regard, the research of Lin et al. (2009) examined the impact of oil price shocks on the stock market return in China during the period from 1973 to 2011 by using monthly data. Their conclusion is mixed. First, in contrast with the effect on the U.S. stock market, the authors found that only the global supply shock has a significant positive effect on China's stock returns whereas the speculative demand shock and the global demand shock have no significant impacts.

Stock price is the sum of the discounted values of expected future cash flows at different investment horizons, which is dependent on macroeconomic economic conditions such as interest rate, inflation, production cost, aggregate demand and investors' confidence (Arouri, Jouini and Nguyen, 2012; Badeeb and Lean, 2018).

In the past four decades, several African countries (Nigeria, Angola, Algeria, Egypt, Libya, Gabon, Chad, DR Congo, Ghana, Ivory Coast, Senegal, and South Africa) have emerged as oil producing countries at the regional or global levels. Essentially, Africa plays a significant role in crude oil production than use. Hitherto, the founding of African Petroleum Producers' Association (APPA) in 1987 as an institution that aids the sharing of knowledge and expertise for all African oil producers reflects the influence of oil market in African economies (Gourene and Mendy, 2018).

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Many studies are of the view that oil price shocks influence stock markets indirectly through macroeconomic variables such as inflation and economic growth. (Bjornland 2009) and (Jimenez-Rodriguez and Sanchez 2005), assert that a rise in the oil price is expected to have a positive impact in an oil exporting country, as the country's income will increase. Subsequently, the rising income is expected to generate a rise in expenditures and investments, which, in turn, creates greater productivity and unemployment (Filis et al. 2011). In this case, an oil price increase positively affects the stock markets' response.

In contrast, for an oil importing country, an increase in oil prices is expected to have an opposite effect (see Hooker 1996). In fact, an oil price increase will result in an increase in production costs, since oil is considered as the most important production input (Arouri and Nguyen 2010; Kim and Loungani 1992). The increasing cost will affect consumer's behavior, which will, in turn, reduce their demand and, thus, spending, due to higher consumer prices (Bernanke 2006); (Abel and Bernanke 2001); (Hamilton 1996); (Hamilton 1988a, 1988b); (Barro 1984). Reducing consumption would result in decreasing production and, in return, increasing unemployment (see, Lardic and Mignon 2006); (Brown and Yücel 2002); (Davis and Haltiwanger 2001). In this case, stock markets are expected to decline (see Sadorsky 1999; Jones and Kaul 1996).

Moreover, we should not overlook the impact of oil price shocks on stock markets due to the uncertainty they create for the financial world, depending on the forces pushing up oil prices (demand side or supply side). In fact, stock markets are expected to react positively to oil price shocks originating from an increase in global demand, and negatively if the shock originates from the supply side (Filis et al. 2011); (Hamilton 2009b); (Kilian and Park 2009).

3. THEORETICAL FRAMEWORK AND METHODOLOGY

Ross (1976) Arbitrage pricing theory constitute the core theoretical underpinning for this study.. This is the theory of asset pricing that describes how the expected return and the asset value be calculated. According to the theory the expected return on any financial asset can be expressed as the linear function of various macroeconomic variables or theoretical market indices. In the context of this study the stock market performance standing for expected return is made a function of crude price movement which has macroeconomic and theoretical market implication.

The functional relationship that is investigated in this study is presented thus:

$$ASI = f(\Delta CRUDEPRICE)$$

ASI is All Share Index which is a measurement of stock market returns and change in crude price as the explanatory variable. To account for stock market depth, the following functional relationship is also evaluated.

$$MCAP = f(\Delta CRUDEPRICE)$$

MCAP stands for Market Capitalisation which is a measurement of the depth or size of the

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ISSN 1533-9211
DOI: 10.5281/zenodo.13934468

stock market. This study covers the period 1970M01 – 2022M12, that is fifty-two years. Aside ensuring a long sample stretch, the time span covers different episodes of oil price changes including the period around which oil was discovered in Nigeria in commercial and exportable volume. The source of data for the study is the Central Bank of Nigeria Statistical Bulletin and Database. This is the most reliable repository for Nigeria-specific data set of financial and economic nature.

Applying the Autoregressive Distributed Lag Model as the estimation technique and presenting the functional relationships above in an estimation format appears thus:

$$ASI_t = \partial_o + \sum_{t=1}^{n=k} \partial_1 \Delta ASI_{t-1} + \sum_{t=1}^{n=k} \partial_2 \Delta CRUDEPRICE_{t-1} + \sum_{t=1}^{n=k} \partial_3 \Delta CRUDEPRODUCTION_{t-1} + \emptyset_1 ASI_{t-1} + \emptyset_2 CRUDEPRICE_{t-1} + \emptyset_3 CRUDEPRODUCTION_{t-1} + \varepsilon_{it}$$

The model for Depth or Size of the Market is presented as follows:

$$MCAP_t = \partial_o + \sum_{t=1}^{n=k} \partial_1 \Delta MCAP_{t-1} + \sum_{t=1}^{n=k} \partial_2 \Delta CRUDEPRICE_{t-1} + \sum_{t=1}^{n=k} \partial_3 \Delta CRUDEPRODUCTION_{t-1} + \emptyset_1 MCAP_{t-1} + \emptyset_2 CRUDEPRICE_{t-1} + \emptyset_3 CRUDEPRODUCTION_{t-1} + \varepsilon_{it}$$

$\partial_1 - \partial_3$ = Short-run parameters

$\emptyset_1 - \emptyset_3$ = long-run parameters

The estimation process follows four steps:

First, the pre-estimation tests are done. This includes the descriptive statistics, unit root tests, correlational matrix as well as graphical depictions of the trajectory in crude price and stock market performance indicators. These are significant first steps in determining the appropriateness of the series for any form of estimation.

The second stage in the estimation process is the use of the ARDL model to show the long-run and short run elasticities of stock market performance to movement in crude prices. The choice of the ARDL model is informed by its capacity to show robust results in the face of small or infinite samples. Also, the ARDL model show long-run and short-run elasticities simultaneously while having tolerance for series with different orders of integration especially I(0) and I(1) not I(2).

The analytical process is concluded with inferences drawn after the diagnostic tests of the estimates. The likelihood of auto-correlated residuals is checked using the BG- Serial

ISSN 1533-9211

DOI: 10.5281/zenodo.13934468

Correlation LM tests, the possible presence of heteroscedastic residuals is check using the Bruesch Pagan and Godfrey test for heteroscedasticity while the Regression Equation Specification Error (RESET) was used to confirm the correctness of the specified model.

4. RESULTS

The graphical depictions of the relation between crude price and the return and depth performance indicators of stock market performance is shown in Fig. 1 below:

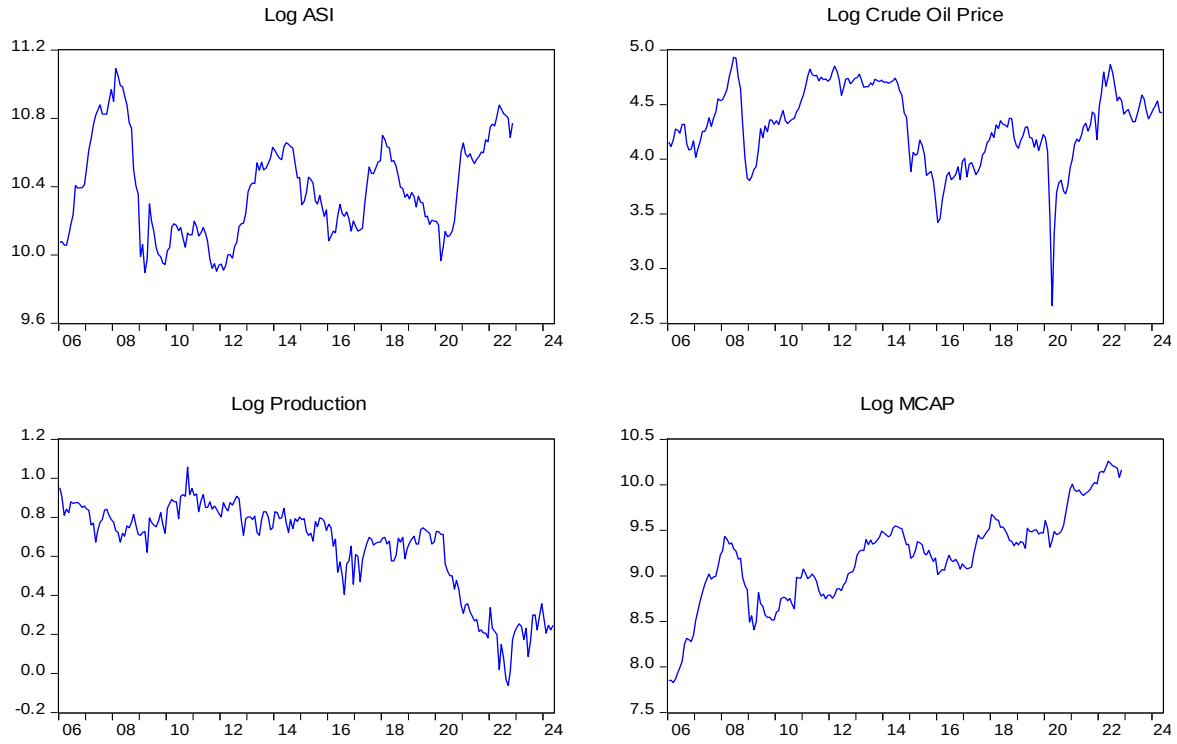

Figure 1: First differenced linear plot of the Variables of Interest

Fig. 1 provides graphical evidence that crude price and production as well as the stock market performance variables are oscillatory in trajectory. This is supported by the normality tests reported in table 1.

Table 1: Summary of Basic Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	RSD	Skewness	Kurtosis	Jarque-Bera
ASI	33443.98	31217.77	65652.38	19851.89	9934.65	0.30	0.85	3.12	24.81
COILPRICE	78.90	75.31	138.74	14.28	25.47	0.32	0.19	2.21	7.05
PRODUCTION	1.96	2.07	2.88	0.94	0.41	0.21	-0.76	2.60	22.72
MCAP	11049.27	10344.42	28567.59	2510.80	5559.99	0.50	1.18	4.29	61.17

ISSN 1533-9211

DOI: 10.5281/zenodo.13934468

Giving particular attention to the relative standard deviation, it can be deduced that the variables are all less oscillatory with relative standard deviation that is less than unity (1). This shows that the variables are stable enough for analyses. The mean/median relativity indicate the nearness of the values to themselves suggesting that the series are close knit though there is a departure form normality, this is consistent with the behaviour of financial and economic time series.

The linear association of the oil price and production series with the stock market indicators is shown in table 2.

Table 2: Correlational Matrix of Oil Price and Stock Market Indicators

Series	ASI	COILPRICE	PRODUCTION	MCAP
ASI	1	0.31	-0.38	0.55
COILPRICE	0.31	1	0.18	0.12
PRODUCTION	-0.38	0.18	1	-0.84
MCAP	0.55	0.12	-0.84	1

A positive linear association exists between stock market liquidity proxied by all share index and crude oil price on one hand and market depth (MCAP). This suggests that as crude price rises, the stock market benefits from enhanced liquidity and depth. Conversely, oil production is found to inversely relate to crude price implying that as price rises, production drops. Production also shares inverse linear association with market depth and liquidity respectively.

The stationarity properties of the series are shown in table 3. This is important in ensuring that the estimation outputs are not spurious and follows the correct asymptotic framework.

Table 3: Unit Root Test Results

Variables	ADF Statistics	Critical Values			Inference
		1%	5%	10%	
ASI	-13.93	-5.72	-5.18	-4.90	I(1)
MCAP	-13.28	-5.72	-5.18	-4.90	I(0)
PRODUCTION	-20.13	-5.72	-5.18	-4.90	I(1)
COILPRICE	-11.66	-5.72	-5.18	-4.89	I(1)

Market liquidity, crude price and crude production are found to be integrated of order one (1) while market depth is integrated of order zero. This is to say that the series have a mixed order of integration. By this, it is suitable to use the Autoregressive Distributed Lag Model (ARDL). This is because, apart from its other advantages, it accepts series with such mixed order of integration.

The elasticity of market depth and liquidity to crude price movement within the study period which is the focus of this study is shown in table 4.

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DOI: 10.5281/zenodo.13934468

Table 4: ARDL Estimates

Model 1: Dependent Variable: ASI			
Variable	**Coefficient**	**Std. Error**	**Prob.**
C	10.71	0.28	0.00
D(LOG(COILPRICE))	0.40	0.06	0.00
LOG(PRODUCTION)	-0.44	0.39	0.26
ECM	-0.46	0.02	0.00
R^2	0.60		
Adj R^2	0.55		
F-stat	6.22		
Het	1.17		
LM	2.43		
RESET	1.63		
Model 2: Dependent Variable: MCAP			
Variable	**Coefficient**	**Std. Error**	**Prob.**
C	10.37	0.35	0.00
D(LOG(COILPRICE))	0.84	0.29	0.03
LOG(PRODUCTION)	-1.47	0.49	0.00
ECM	-0.65	0.01	0.00
R^2	0.56		
Adj R^2	0.54		
F-stat	6.62		
Het	1.84		
LM	2.63		
RESET	0.18		

The first model with market liquidity (ASI) as the regress and show that crude price positively and significantly drives market liquidity. The elasticity coefficient is 40% implying that a percentage increase in crude price improves market liquidity by 40%. The error correction which is 46% for this model enters with the correct sign. Not only is the coefficient negatively signed, but the probability value is also less than 0.05 (level of significance). This shows that disequilibrium in market liquidity caused by movement in crude price is corrected by 46% every month with full equilibrium restored over a quarter of a year.

Looking at the second model with market depth (MCAP) as the regress and, it is observed that crude price positively and significantly deepens the stock market. The elasticity coefficient is 84% denoting that a percentage increase in crude price deepen the market by 84%. The error correction which is 65% for this model enters with the correct sign. The coefficient is negatively signed, and probability value is also less than 0.05 (level of significance). This shows that disequilibrium in market depth caused by movement in crude price is corrected by 64% every month with full equilibrium restored over two months. This result is found to be economically predictable as the error correction coefficient falls below 100%.

In sum, crude price is a positive and significant driver of the depth and liquidity of the Nigerian stock market. However, predicting the interaction between stock market indicators and crude price can best be done in a stable environment as evidenced by a stable and correctly specified

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DOI: 10.5281/zenodo.13934468

models. Hence, the two models are diagnosed and found to be efficient and stable as shown by the post-estimation tests reported at the lower wrung of the relevant tables. The absence of serial correlation is confirmed by the result of the BG-LM test; the absence of heteroscedastic residuals is shown by the Breusch and Pagan heteroscedasticity test while the Regression Equation Error Specification (RESET) tests proves that the model is without specification inadequacies.

5. CONCLUSIONS AND RECOMMENDATIONS

This study is set to investigate the responsiveness of stock market depth and liquidity to movement in prices of crude oil in Nigeria. The country is oil-dependent and as such, economic indicators and activities in the country tend to react to movement in crude prices.

Using a monthly series covering a 52-year period, 1970M01 – 2022M12, the study adopts the ARDL model to measure not just the short-run elasticity but also the long-run and error correction profile of the investigated series.

The results arising from the study indicate that favourable change in crude price upscales market liquidity and also deepens the market. This is made possible by the foreign inflow that a rise in crude price enhances for the Nigerian economy. This is to say that international financial inflows is increased as crude price rises which favourably affects the liquidity of the stock market while also deepening the market.

The findings of this study have implications for various market participants, policymakers, and international finance analyst. The results suggest that the interconnectedness between the performance of the stock market and movement in crude price can be explored to the advantage of economies in the shape and form of Nigeria.

Additionally, countries that export crude oil are by this alerted to the need to build safety nets against the adverse shocks that can come to the stock market in the event of a downward movement in crude price. This can be addressed through appropriate portfolio management which emphasizes stock with less vulnerabilities to movement in stock prices. This is to say that policymakers may also need to consider the possible spillover effects of shocks in oil prices on the stock markets and build counter measures to address that.

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