IMPACT OF OIL PRICE SHOCKS ON INVESTMENT IN NIGERIA

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ABSTRACT
This study estimates the impact and transmission channels of oil price shocks on investment and how it affects the Nigerian economy using annual data from 1970-2011. The study employed a multivariate VAR analysis using impulse response functions, variance decompositions and Granger Causality tests to examine the interrelationship among the variables. Evidence was found for unidirectional causality running from domestic investment to stabilize oil prices. Also, a bidirectional relationship between oil prices and savings was revealed by Granger Causality tests. However, the impulse response functions show that oil price shocks have little effect on Real GDP. Thus, we conclude that oil price shocks do not have a direct impact on Real GDP, but oil price shocks influence other variables that significantly influence Real GDP like investment and savings.

Keywords: Oil price shocks, Investment, Vector auto-regression, Granger Causality

JEL Classifications: C22, E22, P22
1.0 Introduction

Nigeria, the most populous black nation situated in western Africa is popularly known for her dominant source of revenue; Crude oil. Thus, Nigeria became increasingly dependent on oil revenue, which in the last few decades has experienced shocks in its price per barrel and production. With oil revenue as the mainstay of the Nigerian economy, shocks in oil prices are definitely of prime interest to economists in order to predict the effects of a drastic change—increase or decrease in oil price, on the Nigerian economy as a whole. Oil shock can be described as a sudden, unexpected change in oil price or production. This study, however, focuses on the effect of oil price shocks on investment in Nigeria.

Evidences from past decade show that oil price per barrel rose from US$25 in 2002 to US$55 in 2005 and an outrageous US$147 in mid-2008, declining sharply to US$46 (Akpan, 2009). Persistent oil shocks such as this could have extensive effects on the macro economy, thus inducing challenges for policy making—fiscal or monetary in both oil exporting and oil importing countries over the past forty years (Kim and Loughani, 1992; Taton, 1998; Mork, 1994; Hooker, 1996; Hamilton, 1996; Olomola, 2006).

Conclusions from previous studies show that while increases in oil price have a negative impact on oil importing economies, they have a positive impact on oil exporting economies although the impact of the oil price increase in the oil exporting country is mitigated by a reduction in demand as a result of the price increase. This is because although the increase in oil price would increase revenue for the exporting economy, the importing economies would naturally reduce the quantity demanded of crude oil which follows the law of demand which says that an increase in price would lead to a decrease in quantity demanded and vice-versa. Thus, the reduction in quantity demanded would reduce the total revenue earned from crude oil exports.

The media through which these shocks are felt in the economy can be classified into demand and supply sides. The supply side effects considers oil as a production input, thus an oil price increase would lead to an increase in the cost of production, which would result in reduction of output, hence reducing aggregate supply. This lowers economic activity and growth. The demand side effects however, focus on the effect of oil price shocks on consumption and investment. An increase in oil price leads to reduction in real disposable income and since consumption and investment are positively related to income, a reduction in income would
lead to a reduction in consumption and investment in the economy. This reduces aggregate demand hence, slowing down the growth of an economy.

The above scenario however, focuses on the effects of oil shocks on the importing country. In the case of an oil exporting economy such as Nigeria, an increase in oil price per barrel combined with supply quota fixed by Organization of Petroleum Exporting Countries (OPEC), results in a boom in oil proceeds making available more funds for consumption and investment in the exporting country, thus enhancing economic performance which could result in growth and if consistent, development.

Results from previous studies in this area seem to establish a link between oil price increases and recessions on the oil importing economies, not necessarily as a direct effect of the oil shock but through its various transmission channels into the economy. These transmission channels include: huge fiscal debts resulting in unfavourable balance of payment position, hike in prices resulting in inflation, reduction in savings, hence, investment due to the rise of prices and so on. Also, an asymmetric relationship was identified between oil shocks and economic growth, in the sense that a negative shock has a larger effect on economic growth than a positive shock does. This means that oil price increases (negative shock for oil-importing economies) have a larger impact on the economy than oil price reductions. This study therefore seeks to examine the net effect of oil price shocks on investment activities in Nigeria, thus, focusing on the demand side effects of oil price shocks in Nigeria.

The role of investment is very crucial to economic growth and development, economic development depends on level of investment in the economy. Theoretically, we expect that the level of investment be positively related to income. Thus, an increase in income should lead to an increase in investment which in turn would lead to higher income. The major cause of underdevelopment in this country is the level of investment. Investment both public and private is one of the major sources of growth in any nation. This is because it increases wealth of an individual, creates more jobs, increases national income and develops human capital. However, very scant literature considers the demand side effects of oil shocks.

Investment is regarded as the most volatile component of national income; therefore it presents an avenue to be manipulated in order to get desired output. The Nigerian economy being highly dependent on revenue from crude oil exports is highly susceptible to changes in oil prices. Thus, this study seeks to examine the relationship between crude oil prices and domestic investment in Nigeria. This study would, therefore, fill this gap in literature and
recommend policies on how shocks in oil price can be manipulated to stimulate domestic investment in the economy.

Till date, few studies have considered the effects of oil price shocks on investment in Nigeria; therefore, this study exists to fill this gap in literature. The research problem, hence, arises from identifying the effects and transmission channels of oil price shocks on investment and how it affects the economy. Also, this research work seeks to determine the effect of oil price shocks on savings and its subsequent effects on investment and the economy as a whole.

2.0 Review of Literature
2.1 Introduction

The topic of oil price changes, volatility and shocks has been a very controversial topic among different scholars. This chapter entails the review of the existing body of knowledge concerning the effects of oil price shocks on the economy, particularly investment. Relevant issues to be discussed in this aspect shall include the review of definitional issues, a reviews theoretical issues such as the Hotelling rule, Income Transfer channel, Sectoral Shifts, Uncertainty and Irreversible Investment channel etc. and reviews methodological and empirical works of previous scholars, starting with examining the impact of oil shocks on aggregate activities of foreign countries, the asymmetric impact of oil shocks, impact of oil shocks on Nigeria’s macro-economy, impact of oil price shocks on foreign economies, impact of oil price shocks on the Nigerian stock market and impact of oil price shocks on uncertainty and finally investment. However, the area of impact of oil price shocks on investment in Nigeria has been unexplored; therefore, this study will fill this gap.

External shocks can be defined as a large unanticipated change in world economic conditions which impacts upon a national economy. Shocks could come in different forms such as a shift in the terms of trade, a slowdown in the growth of world export demand and an increase in interest rates set by world financial markets. Oil shocks are of great concern to most economies because a sudden hike in prices has been found to cause a fall in global output. Oil price shocks could also be defined as a large boost in the relative international price of oil. Nordhaus (2007), defined oil-price shock as an inward shift in the supply curve for crude oil that is triggered by political events exogenous to the oil market and the macro economy.
An oil price shock may have real effects, as a higher oil price may affect output through the aggregate production function by reducing the net amount of energy used in the production. In addition, aggregate demand, of which investment is a major part, may also change in response to energy price changes. An oil price increase will typically lead to a transfer of income from the oil importing countries to the oil exporting countries. This reduction in income would cause rational consumers in oil importing countries to cut back on their consumption spending and investment, hence, reducing aggregate demand and output. However, to the extent that the increase in income in the oil exporting country will increase demand from the additional income transferred to them from the oil importing country, the global effect would be minimized (Bohi, 1989 and Mork, 1994). The level of demand may also change due to actions taken by government in response to change in oil prices. To illustrate this point, to offset the increase in the general price level that might have been observed after the second oil price shock, several countries pursued tight monetary policy, which may itself have lowered real activity (Bjornland, 2000).

Investment, on the other hand, refers to an addition to the stock of capital goods in a public or private sector over a given time period. This according to Routledge refers to net investment; gross investment includes both the net investment and replacement asset to keep the stock intact. However, Parker (2010) says that purchase of financial assets is not investment from a social point of view because financial assets do not represent real net wealth for the economy. This is because, the investment of the buyer means the disinvestment of the seller, thus the asset and liabilities of the whole economy balances each other, so aggregate, or social, investment does not rise. Therefore, Parker (2010) says that investment refers to transactions that increase the magnitude of the aggregate wealth of the economy. This includes mainly the purchase (or production) of new real durable assets such as factories and machines.

According to Parker (2010), there are three major categories of investment, which are: business fixed investment, inventory investment and residential investment (Parker, 2010). Of these three categories, the business fixed investment receives the most consideration. Business Fixed Investment refers to the purchase of new structures and equipment by business firms for production purposes. Inventory investment, on the other hand, consists of increases in stock of unsold goods or idle input materials. This is quite different from business fixed investment because inventory capital usually has a very short life span. A very unique feature of inventory investment is that it often occurs unintentionally, because, unsold
goods are counted as part of inventory investment, whether the firm bought them intending to stock up goods or just simply ended up selling less than expected.

According to Parker (2010), there are three major ways of financing investment, which are: (1) internal funding using accumulated profits, (2) borrowing either from banks or through the issue of financial assets and (3) issuing of new shares of stock – equity, preferred stock, redeemable stock etc. Each and every one of these methods imposes some form of costs on the firm, whether implicit or explicit costs. Borrowing to finance investment would incur explicit interest cost for the firm. Internal funding, however, carries implicit cost, that is, the cost of the interest that could have been earned on the amount of funds if it was saved in a fixed deposit account in the bank or if was used to purchase financial asset for the firm. Issuing of new shares of stock entails implicit costs, because, it dilutes the shareholding of existing shareholders.

It is important to note that under the assumptions of perfect competition, that is, in a perfect capital market, all borrowers and lenders pay and receive uniform interest rate; thus, the cost of financing the firm through borrowing or internal funding is the same. However, there is a difference between financing investment through borrowing and internally generated funds. The fundamental difference is that borrowed fund must be repaid at a predetermined interest rate, that is, the principal sum and the interest accrued on it, even if the investment goes bad, while for internally generated funds, the principal amount is considered lost. This suggests that firms would prefer to finance their investment through internally generated funds and bear all the risks alone than to finance their investment through borrowing and risk going bankrupt, when a huge sum of amount is borrowed for an investment and it has a probability of going bad (Parker, 2010).

The extent to which a company finances its investment through borrowed funds is known as leverage decision. A company could be said to be highly geared if a large proportion of funds used for investment is financed from borrowed sources and lowly geared if otherwise. In practice, the leverage decision of a firm, that is, whether highly geared or lowly geared, determines the attractiveness of the firm to potential investors (Parker, 2010). However, under the assumptions of perfect capital market, there is no information asymmetry, that is, full information is available to all parties involved in the transaction, and there is uniform interest rate for both borrowers and lenders, the investment decision of a firm is independent of the leverage decision of the firm. This is known as the Modigliani-Miller theorem.
The theorem was propounded by Nobel laureates Franco Modigliani and Merton Miller in their famous Nobel award-winning paper of 1958. This theorem states that, under the conditions of perfect market, the cost of investment to a firm is the same, regardless of which of the three methods of finance it chooses (see Modigliani and Miller, 1958). The Modigliani-Miller theorem shows that under perfect conditions, the decision to invest is independent of the decision about how to finance that investment, since the value of the firm remains the same in spite of whether the firm issues bonds or uses accumulated profit or the proceeds from issuing new equity. This independence allows macroeconomists to focus only on the firm’s investment decision, leaving the analysis of the decision about how to raise funds to finance specialists (Parker, 2010).

2.2 Review of Theoretical Literature

Adeniyi (2010) highlights 4 channels of influence of oil price on the economy. These channels are as follows: real balance channel, income transfer channel, endogenous monetary policy response and sectoral shifts hypothesis. These theories reflect how oil prices affect the macro economy. The real balance channel puts forward that oil price increases lead to higher inflation and with a given money supply, it results to amount of real balances being lowered in the economy, that is, the real value of the money is devalued. The lower real balances then produce recessions through the familiar monetary channel – increased interest rates leading to depressed investment spending, reduced aggregate demand and a resultant fall in output (Pierce and Enzler 1974; Hall and Taylor 1991).

Income transfer channel explains that oil price increases lead to a transfer of income from net oil-importing economies to net oil-exporting countries. This results in a reduction in consumption expenditure in the importing countries since the purchasing power of consumers has been eroded by the hike in oil prices. This income transfer from the importing economy to the exporting economy reduces aggregate demand. On the other hand, some researchers have opined that endogenous monetary policy responses are very important. Hence, real output declines which usually characterize oil price increases are viewed as a result of counter inflationary responses of monetary policy (Darby 1982; Bohi 1991). Responses of regulatory monetary authority such as buying back government bonds and raising interest rates; reduce money supply thus lowering aggregate output. The argument is that the oil price increases do not entirely account for the observed recessions but it is the reaction of the monetary policy that reinforces output declines (Adeniyi, 2010).
The sectoral shifts hypothesis posits that changes in oil prices perform better in explaining observed variations in output growth (Loungani, 1986). Within this framework, price shocks lead to a temporary surge in aggregate unemployment pending improvement in conditions in their sector rather than outright movement into positively affected sectors within the economy (Hamilton, 1988; Adeniyi 2010). Papapetrou (2001) says that oil price shocks have an immediate negative effect on industrial production and employment growth. Federer (1996) in Sauter and Awerbuch (2003) indicated that “aggregate unemployment rises when price shocks become more variable”. Thus, an increase in unemployment reduces the income available to the economy as a whole, therefore, reducing private investment and aggregate investment.

Other channels through which oil price shocks affect the economy include: Dutch-Disease channel, Hotelling rule and Irreversibility and Uncertainty channel. Dutch disease can be defined as an adverse effect of natural resource boom on other sectors of the economy such as the industrial, manufacturing and agricultural sector (Ezeala-Harrison, 1993). Positive oil price shocks lead to an appreciation of real exchange rates of the exporting economy, thereby squeezing the non-tradable sector (Olomola, 2006; Akpan, 2009). This means than positive shocks for an exporting economy like Nigeria, results in appreciation of real exchange rates, thus drawing resources from other sectors to the mining sector. Therefore, since investment in the mining sector is capital-intensive, individuals are discouraged from investment, hence, reducing private investment in the economy.

Hotelling rule states that the most socially and economically profitable extraction path of a non-renewable resource is one along which the price of the resource, determined by the marginal net revenue from the sale of the resource, increases at the rate of interest. It describes the time path of natural resource extraction which maximizes the value of resource stock (Gaudet and Gerard, 2007). The rule was derived from the work of Harold Hotelling in his work “The Economics of Exhaustible Resources” (Hotelling, 1931). In Jeffrey A. Krautkraemer’s words, “Hotelling’s formal analysis of nonrenewable resource depletion generates some basic implications for how the finite availability of a nonrenewable resource affects the resource price and extraction paths” (Krautkraemer, 1998).

The assumptions of the Hotelling model include: perfect competitive markets for the nonrenewable resource (no market collusion of any kind); no information asymmetry about current and future demand, market prices etc; marginal cost is constant; and market demand
is constant in each time period. According to Veldhuizen and Sonnemans (2012), the Hotelling rule says that nonrenewable resource prices must grow at the prevailing rate of interest, so that the assumption of zero marginal costs will hold. That way, extracting a marginal unit in the present means a loss in today’s prices plus the interest over today’s price, and this is equal to the benefit of extracting a marginal unit in the future. This confirms the rule which says that the optimal price is at the point where the producer is indifferent about selling today or in the future. This is also known as the dynamic efficient price. The Hotelling rule has been criticized on the basis of its assumptions being unrealistic, for instance, the assumptions of perfect competition, no information asymmetry etc. However, if the assumptions are relaxed, it would be applicable in real life situations (Veldhuizen and Sonnemans, 2012).

According to Guo and Kliesen (2005), oil price shocks raises uncertainty about future oil prices and thus delays in business investment. In Elder et al (2009), uncertainty about energy prices will induce optimizing firms to postpone irreversible investment decisions as long as the expected value of additional information surpasses the expected short-run return to current investment (Henry, 1974; Bernanke, 1983). Also, Bernanke (1983) in Elder et al (2009) suggests that, negative oil shocks, that is, lower oil prices, may not be expansionary for oil-importing countries in the short-run, if the oil shock creates uncertainty about prices. Therefore, oil price shocks, both positive and negative shocks, increases uncertainty in the economy, thereby causing delayed investment. Hence, oil price shocks, lowers aggregate investment by raising uncertainty levels in the economy.

Many scholars have explored the topic of the effects of oil shocks on the economy. Gounder and Bartleet (2007), considered the impact of oil shocks on economic growth in New Zealand, an oil-importing country. The paper examined the impact of oil price shocks on a number of macro-variables such as real exchange rate, inflation, real wage growth and GDP growth. Three oil price measures were considered, given the various theoretical implications of oil shocks on economic growth. The study considered the effect of changes of world oil prices on the economy of New Zealand over the period 1989-2006. The study employed quarterly data using the multivariate framework using Vector Autoregressive (VAR) methodology. This facilitated the analysis of the direct economic impact of oil shocks, as well as the indirect linkages. Using Wald and Likelihood ratio tests of Granger Causality, asymmetric price increase and net oil price variables are significant for the economy as a whole while price decreases are not. Error variance decompositions and impulse response
functions were also utilized to reaffirm the link between oil price shocks and economic growth (Gounder and Bartleet, 2007).

Rodriguez and Sanchez (2003), also employing a multivariate VAR, considered the effect of oil price shocks on OECD countries (individual G-7 countries, Norway and the euro area as a whole), dividing them into oil-importing and oil exporting countries. Results from the study shows that while oil shocks have similar effects (oil shocks have negative impact on economic growth) on oil-importing economies, a noticeable difference was noticed between two oil-exporters in the sample: Norway and United Kingdom (UK). While UK experienced a negative effect on her economic growth, Norway experienced a positive effect on her economy. This was explained by the fact that the real exchange rate of UK rose significantly than that of Norway, thus resulting in the Dutch-disease effect on the UK. With respect to the size of the shocks, US recorded the largest shocks using the linear specification model, while the euro-area countries (France, Germany and Italy), seem to be affected in a magnitude compared to US using non-linear specification model (Rodriguez and Sanchez, 2003).

Bjornland (2000) also carried out a study on Germany, Norway, the UK and the USA using a VAR model to analyze the effect of aggregate demand, aggregate supply and oil price shocks. This study agreed with the results of Rodriguez and Sanchez, that oil price shocks had a negative impact on all the countries in this study apart from Norway. For Germany, the UK and the USA, the 1973-1974 oil price shock played an important role in explaining the recessions of the mid-1970s. However, the study figured that the recessions in the early 1980s was caused by other demand and supply disturbances. The long-run effects of the shocks were also considered, with oil price shocks having insignificant effects on Norway in the long run and having negative effects on other countries in the long run (ten years). According to Bjornland, the cause of the difference in response to oil shock in Norway and the UK is the priority of the governments when setting macroeconomic policies (Bjornland, 2000).

Bataa (2010) carried out a study on impact of oil shocks on Gulf Cooperation Council, whose economies account for 40 percent of world oil reserves (Bataa, 2010). This report identified the transmission channels through which oil price shocks affect the economy. These channels are: supply shock, real balance effect, monetary policy response, income transfers, adjustment cost and uncertainty effect. This report also compared the impact of the last oil shock to the global economy, to the previous ones. According to Bataa, high oil prices were as a result of a strong economy, thus the shock arose out of excess demand rather than
inadequate supply, therefore suggesting that demand shocks are less disruptive to the economy than supply shocks (Bataa, 2010).

Balke et al (2010) employed Bayesian estimation with a dynamic stochastic general equilibrium model of world economic activity, to identify the various sources of oil shocks and economic fluctuation and assess their effects on US economy. They find out that oil price shocks are best understood as endogenous. Also, they found out that US output fluctuations owe mostly to domestic shocks, with productivity shocks contributing to the weakness experienced in the 1970s and 1980s and the strength exhibited in the 2000s (Balke et al, 2010).

Papapetrou (2009) examined the asymmetric effects of oil price shocks on the economy of Greece during the period 1982:1 to 2008:8. The Greek economy is highly dependent on oil-imports, thus is more vulnerable than other countries to changes in oil prices. The study made use of a Regime Switching model (RS-R) and a threshold regression model (TA-R), to capture the dependence of the structure of the series both in terms of constant and variance. The empirical evidence suggests that the negative correlation between oil prices and economic activity strengths during the period of rapid oil changes and high oil price change volatility (Papapetrou, 2009).

The impact of oil price shocks on Nigeria’s macro-economy has been investigated by a lot of scholars (Olomola 2006; Ojapinwa and Ejumedia 2011; Aliyu 2011; Akpan 2009; Gunu and Kilishi, 2010; Adeniyi et al 2012; Iwayemi and Fowowe 2011). Gunu and Kilishi (2010) examined the impact of oil price shocks on macroeconomic variables such as: Real GDP, Money supply, unemployment and consumer price index, using a VAR model. The results found showed that oil prices had significant impact on three key macroeconomic variables: RGDP, money supply and unemployment, thus indicating that the economy is highly vulnerable to oil shocks. They proposed diversification of the economy in order to minimize the effects of the oil shocks (Gunu and Kilishi, 2010).

Ojapinwa and Ejemudia (2010) examined the industrial impact of oil price shocks in Nigeria from 1970-2009 using VAR impulse response. The study concluded that oil price, inflation and exchange rate had the potential of causing significant changes in industrial output in Nigeria, while it also revealed that money supply did not significantly determine industrial output. Policy implications from the study include that attention should be given to proper management of exchange rate and inflation (Ojapinwa and Ejemudia, 2010).
Olomola (2006), Iwayemi and Fowowe (2010), and Akpan (2009) established from their findings that oil price shocks do not affect output in Nigeria by using VAR approach. This was contrary to findings from various countries where oil prices significantly affect output. However, the empirical results showed that oil price shocks significantly influence real exchange rates. According to Olomola (2006), “The implication is that a high real oil price may give rise to wealth effect that appreciates the real exchange rate. This may squeeze the tradable sector, giving rise to the Dutch Disease”. Akpan (2009) show a strong positive relationship between positive oil price changes and real government expenditures.

Aliyu (2011) employed Granger causality tests and multivariate VAR analysis to assess the effects of oil price shocks on real macroeconomic activity. He found evidence of both linear and non-linear effects of oil price shocks on economic growth. Asymmetric oil price increases in the non-linear models are found to have positive impact on real GDP growth of a larger magnitude than asymmetric oil decreases affect real GDP (Aliyu 2011).

Adeniyi (2010) carried out a pioneer attempt at introducing threshold effects to the linkage between oil price shocks and output growth in Nigeria. The study adopted the regime dependent multivariate threshold autoregressive model, together with the characteristic impulse response functions and forecast error variance decomposition using quarterly data from 1985 to 2008. The results of the study show that oil price shocks do not account for a significant portion of observed movements in macroeconomic aggregates. This according to Adeniyi (2010) implied the enclave nature of Nigeria’s oil sector with weak linkages. Therefore, the need to spend revenue productively is imperative if favourable effect on real output growth is envisioned (Adeniyi, 2010).

A number of authors have also considered the effect of oil price shocks on stock prices in foreign countries (Sadorsky, 1999; Ratti and Park, 2008; Afshar et al, 2008; Fang et al, 2009; Achraf and Boujelbene, 2010; Arouri et al, 2010). Sadorsky (1999) examined the effect of oil price shocks on economic activity using VAR and impulse response functions. The results from the Impulse response functions used in the study show that oil price movements are important in explaining movement in stock returns. According to Sadorsky, oil price shocks explain a larger fraction of the forecast error variance in real stock returns than interest rates. The results suggests that positive shocks depress real stock returns, while shocks in real stock returns in turn have positive impacts on interest rates and industrial production (Sadorsky,
Afshar et al (2008) found that contrary to previous literatures in shocks, oil price decreases had significant impact on stock returns and not oil price increases.

Achraf and Boujelbene (2010) also examined the effect of oil price shocks on US and 26 other mature and emerging economies using a multivariate VAR analysis. For US and 18 other countries (Germany, Netherlands, Portugal, Belgium, Greece, Denmark, Norway, Canada, Russia, Singapore, Korea etc), oil price shocks have positive and statistically significant impact on real stock returns at the rate of 5 percent level in the same month. However, oil price shocks have negative and statistically significant impact on real stock returns for UK, France, Italy, Sweden, Switzerland and Japan (Achraf and Boujelbene, 2010). In Ratti and Park (2008), Norway as an oil exporter showed statistically significant positive response to oil price increase. They also found out in their study that oil price increases depressed the real stock returns of the European countries in their case study. They did not find evidence for asymmetric effects in European countries on real stock returns for positive or negative oil shocks (Ratti and Park, 2008).

Fang et al, (2009) carried out a research work on the relationship of oil price shocks on the Chinese stock market. They employed monthly data from 1997:7 to 2008:9 using VAR. Interestingly; they found out from their study that only global supply shocks had a significant positive effect on China’s stock return, while global demand shocks and oil price related shocks had no significant impact on the stock returns. The insignificance of these shocks were explained by the fact that the positive expectation effect of China’s fast economic growth may almost be decayed by the negative effect of precautionary demand driven effect (Fang et al, 2009; Wang and Firth, 2004). Arouri et al, (2010) carried out a similar study on GCC countries and found out that stock market returns significantly react to oil price changes in Oman, Qatar, Saudi Arabia and UAE. However, it was discovered that oil price changes do not affect stock market returns in Bahrain and Kuwait. They also established that relationships between oil prices and stock markets in these countries are nonlinear and switching according to oil prices. This means that they could not identify a particular direction of relationship between oil shocks and stock returns because the direction of the relationship was always changing per regime (Arouri et al, 2010).

Recently, interest has been shown in the area of effect of oil prices on Nigerian Stock Exchange market (Adebiyi et al, 2010; Asaolu and Ilo, 2012; Layade and Okoruwa, 2012; Adaramola, 2012; Muritala et al, 2012). Adaramola (2012) carried out a study examining the
long run and short run effect of oil shocks on the Nigerian stock market for the period 1985:1-2009:4 using Johansen co-integration tests. Using a bi-variate model, results show that oil price shocks have a positive significant effect on the stock return in the short-run and a significant negative effect in the long-run. Also, results from the Granger Causality tests show strong evidence that the causations runs from oil price shocks to stock returns, hence, suggesting that stock prices are explained by oil price volatility and shocks (Adaramola, 2012).

Adebiyi et al, (2010) estimates the effects of oil price shocks and exchange rate on real market returns in Nigeria for the period 1985:1 to 2008:4 using multivariate VAR analysis. Results from the study show an immediate and significant negative response of real stock returns to oil price shocks in Nigeria. Results from their Granger causality test is consistent with Adaramola (2012), with causality running from oil price shocks to stock returns. Also, it is important to note that causality runs from stock returns to real exchange rate, which implies that authorities can focus on domestic economic policies to stabilize the stock market. They also found strong evidence that indicates that the impact of interest rate shocks on the stock market is greater than the impact of oil price shocks, hence monetary policy responds to oil price shocks by raising the interest rates, leading to a decline in real stock returns (Adebiyi et al, 2010).

Asaolu and Ilo, (2012) analyzes the relationship between oil price and stock returns using co-integration and VECM framework from 1984-2007. Their findings show that Nigeria still experiences the golden rule-“oil up, stock down”, which should only apply to oil-importing countries. This could be traceable to the failure to translate huge foreign earnings from oil into improved industrial sector. Also, the failure to develop the local refinery thereby resulting in importation of refined oil products could also be a good explanation for this. The way forward out of this challenge is to complete construction of our abandoned refinery projects, so that we can refine our crude oil locally and reduce importation of refined petroleum products (Asaolu and Ilo, 2012).

Henry (1974) and Bernanke (1983) in Bredin et al (2009) established theoretical foundations that show that, uncertainty about energy prices such as oil will induce optimizing firms to postpone irreversible investment decisions as long as the expected value of additional information exceeds the expected short run return to current investment. The result of the study showed that oil price uncertainty has had a negative and significant effect on industrial
Lee, Kang and Ratti (2011) reaffirm the above findings by carrying out a research on the effect of oil price shocks, firm uncertainty and investment. The study finds that a rise in uncertainty significantly delays investment. According to Lee et al (2011), while growth in real oil price is not significant, the time-varying individual firm’s stock price volatility identified with oil price shocks is highly significant. This means that steady increases do not delay investment, rather, uncertainty created by sudden shocks in prices (oil prices), results in reduced investment. “A rise in firm uncertainty decreases both short and long run firm investment, indicating that oil price shocks affect the US economy because they identify important geopolitical or economic events that have significant implications for the future US economy”- (Lee et al, 2011).

3.0 Theoretical Framework and Methodology

This aspect explains in detail the theoretical framework and research methodology employed in this study. The Keynesian Aggregate Expenditure model and the Vector Autoregressive model are also explained in detail.

3.1 Theoretical Framework

The Keynesian Aggregate Expenditure Model

John Maynard Keynes developed the aggregate expenditure model in response to the Great Depression of the 1930s. Keynes believed that the cause of the depression was low aggregate spending in the economy. In order to fully understand the effect of investment expenditures on the economy, a two-sector simplified model will be examined in this chapter. The two-sector model comprises households and firms. In this model, there is no government sector, therefore income earned by households is equal to their disposable income (income after tax), which is either consumed or saved. The fraction of household’s income that is saved is invested by the firms, that is, savings equal investment in a two-sector economy. Algebraically, this can be written as:

\[ Y = C + S \]
\[ Y = C + I \]

Therefore, \( S = I \)

According to Keynes, the Consumption function is relatively stable, thus changes in income earnings of households affect their savings and in turn, investment. An increase in income will result in households spending only a fraction of the increase (Marginal Propensity to Consume, MPC) and save the rest and vice-versa. This would in turn result in higher or lower investment respectively, as a result of the increase and decrease in savings. Determinants of investment spending include: profit expectation, interest rates, uncertainty about future costs and revenue etc. Thus, Investment is the most volatile component of aggregate expenditure. This, therefore means that in order to change expenditure level, it is more effective to effect these changes through investment rather than through consumption.

Equilibrium level is reached when aggregate expenditures equal aggregate output. It is important to note however that equilibrium output does not necessarily mean full employment in the economy. Keynes said that during periods of recessions, it is possible for equilibrium output to fall below the full employment level, and if this persists, would lead to depression in the economy. The amount by which equilibrium output falls below full employment output is known as recessionary gap, while the amount by which equilibrium output exceeds full employment is known as inflationary gap. To correct a recessionary or inflationary gap, Keynes believed that aggregate spending must increase or decrease so that full employment is attained.

Oil price shocks increase uncertainty in the economy thus reducing investment in the economy. Through the multiplier effect, the change in investment leads to a magnified effect on the economy. Thus, oil price shocks have negative effect on investment by raising uncertainty levels about prices.

3.2 Model Specification

The primary aim of this study is to examine the impact of oil price shocks on domestic investment in Nigeria. Gross Capital Formation (GCF), therefore, would be used as proxy for domestic investment. GCF comprises increase in stocks and Gross Fixed Capital Formation (GFCF). Shocks are unobserved, unanticipated changes in a variable. Thus, oil price shocks are unobserved, unanticipated jumps or declines in oil prices. Oil prices, therefore, cannot be omitted from the model. A key determinant of investment is interest rate which is measured by maximum lending rate. Interest rate is important because it determines primarily, the
willingness of people to invest or not, hence, the need to investigate whether oil price shocks affect interest rates or not.

Another variable of interest in this study is exchange rate (using official exchange rate which captures US dollars in terms of Naira) so as to examine whether oil price shocks affect the value of local currency and how this affect investment in Nigeria. According to the Keynesian aggregate expenditure model stated earlier, investment is a function of savings, thus, it is essential to include savings in the model. Finally, the model cannot be complete without considering real output of the economy measured by real gross domestic product. The essence of considering the impact of oil price shocks on investment is so as to determine its effect on the performance of the economy as a whole. Thus, real output was included in the model in order to examine the direct or indirect relationship of oil price shocks on the economy.

The model to be estimated in this study, examines GCF (a proxy for Investment) as a function of interest rate (IR), oil price (OP), official exchange rate (EXR), savings (SAV), and real Gross Domestic Product (RGDP). This is represented thus:

\[ GCF = f(\text{OP, IR, EXR, SAV, RGDP}) \]

where GCF: Gross Capital Formation, OP: Oil Price, EXR: Official Exchange Rate, IR: Interest Rate, SAV: Savings, RGDP: Real Gross Domestic Product

3.3 Technique of Estimation

Vector Autoregressive model was developed by Sims (1980) in response to the problem of simultaneity among variables in a system. According to Sims, if there is true simultaneity among variables, they should all be treated on an equal footing; there should be no a priori distinction between endogenous and exogenous variables. The term autoregressive is due to appearance of the lagged value of the dependent variable on the right-hand side and the term vector is due to the fact that we are dealing with two or more variables.

According to Ogundipe and Egbertokun (2013), many empirical works in recent times have found it necessary to ensure that all the variables in a model are stationary. This is because, it has been found out in previous studies that the use of non-stationary time-series data results
in spurious regression results. The normal approach to this problem is by differencing all the variables that have unit root and test for cointegration. However, Sims (1980) recommended against differencing. He opined that differencing “throws away” information concerning variables (Ender, 1995). According to him, the goal of the VAR analysis is to determine the interrelationship among variables in the system and not parameter estimates.

To estimate this model, we consider a Vector Autoregressive model developed by Sims (1980). The VAR model in its general form is given as:

\[ Z_t = \alpha + \sum_{j=1}^{p} \beta_j Z_{t-j} + u_t \]

where, \( Z_t = [\text{GCF OP IR EXR SAV RGDP}] \) is a vector of endogenous variables, \( \alpha \) is an \((n \times 1)\) vector of constants, \( \beta \) is an \((n \times n)\) matrix of coefficients, \( p \) is the number of lag and \( U_t \) is an \((n \times 1)\) vector of error term. Also, it is important to note that \( u \) is an independently and identically distributed (iid) with zero mean, i.e \( \text{E}(u_t) = 0 \) and \( \text{E}(u_t, u_s) = 0 \) for \( t \neq s \).

The VAR system can be transformed into its moving average (MA) representation in order to analyse the system’s response to oil price shocks (Jiminez-Rodriguez & Sanchez, 2004; Olomola, 2006) which is: \( Z_t = \mu + \sum_{t=0}^{\infty} y_t \varepsilon_{t-1} \)

where \( y_0 \), is the identity matrix, \( \mu \) is the mean of the process. The MA representation is used to obtain the forecast error variance decomposition and the impulse response function. The variance decomposition shows the proportion of the unanticipated change of a variable that is attributable to its own lags and shocks to other variables in the system (Olomola, 2006).

Thus the VAR model adapted from Ojapinwa and Ejumedia (2011) can be specified as follows:

\[
\begin{align*}
\text{OP}_t &= \alpha_0 + \sum_{i=1}^{n-i} \alpha_1 \text{OP}_{t-j} + \sum_{i=1}^{n-i} \alpha_2 \text{GCF}_{t-j} + \sum_{i=1}^{n-i} \alpha_3 \text{IR}_{t-j} + \sum_{i=1}^{n-i} \alpha_4 \text{EXR}_{t-j} + \\
&\quad + \sum_{j=1}^{n-i} \alpha_5 \text{SAV}_{t-j} + \sum_{j=1}^{n-i} \alpha_6 \text{RGDP}_{t-j} + U_{1t} \\
\text{GCF}_t &= \beta_0 + \sum_{i=1}^{n-i} \beta_1 \text{OP}_{t-j} + \sum_{i=1}^{n-i} \beta_2 \text{GCF}_{t-j} + \sum_{i=1}^{n-i} \beta_3 \text{IR}_{t-j} + \sum_{i=1}^{n-i} \beta_4 \text{EXR}_{t-j} + \\
&\quad + \sum_{j=1}^{n-i} \beta_5 \text{SAV}_{t-j} + \sum_{j=1}^{n-i} \beta_6 \text{RGDP}_{t-j} + U_{2t} \\
\text{IR}_t &= \omega_0 + \sum_{i=1}^{n-i} \omega_1 \text{OP}_{t-j} + \sum_{i=1}^{n-i} \omega_2 \text{GCF}_{t-j} + \sum_{i=1}^{n-i} \omega_3 \text{IR}_{t-j} + \sum_{i=1}^{n-i} \omega_4 \text{EXR}_{t-j} + \\
&\quad + \sum_{j=1}^{n-i} \omega_5 \text{SAV}_{t-j} + \sum_{j=1}^{n-i} \omega_6 \text{RGDP}_{t-j} + U_{3t}
\end{align*}
\]
\[ \text{EXR}_t = \theta_0 + \sum_{j=1}^{n} \theta_1 \text{OP}_{t-j} + \sum_{j=1}^{n} \theta_2 \text{GCF}_{t-j} + \sum_{j=1}^{n} \theta_3 \text{IR}_{t-j} + \sum_{j=1}^{n} \theta_4 \text{EXR}_{t-j} + \sum_{j=1}^{n} \theta_5 \text{SAV}_{t-j} + \sum_{j=1}^{n} \theta_6 \text{RGDP}_{t-j} + U_{4t} \]

\[ \text{SAV}_t = \zeta_0 + \sum_{j=1}^{n} \zeta_1 \text{OP}_{t-j} + \sum_{j=1}^{n} \zeta_2 \text{GCF}_{t-j} + \sum_{j=1}^{n} \zeta_3 \text{IR}_{t-j} + \sum_{j=1}^{n} \zeta_4 \text{EXR}_{t-j} + \sum_{j=1}^{n} \zeta_5 \text{SAV}_{t-j} + \sum_{j=1}^{n} \zeta_6 \text{RGDP}_{t-j} + U_{5t} \]

\[ \text{RGDP}_t = \upsilon_0 + \sum_{j=1}^{n} \upsilon_1 \text{OP}_{t-j} + \sum_{j=1}^{n} \upsilon_2 \text{GCF}_{t-j} + \sum_{j=1}^{n} \upsilon_3 \text{IR}_{t-j} + \sum_{j=1}^{n} \upsilon_4 \text{EXR}_{t-j} + \sum_{j=1}^{n} \upsilon_5 \text{SAV}_{t-j} + \sum_{j=1}^{n} \upsilon_6 \text{RGDP}_{t-j} + U_{6t} \]

Where \( \alpha_i, \beta_i, \omega_i, \theta_i, \zeta_i \) and \( \upsilon_i \) (where \( i = 1,2,3,4,5,6 \)) are the unknown parameters, \( \alpha_i, \beta_i, \omega_i, \theta_i, \zeta_i \) and \( \upsilon_i \) (where \( i = 0 \)) are the constant or intercept terms, \( U \) represents the stochastic error terms, \( n \) is the number of lags and GFCF, IR, OP, RER, ASI, RGDP are as defined above.

Data Sources and Measurement

The data used in the empirical investigation of our study were adopted from the Central Bank of Nigeria (CBN) Statistical Bulletin, the United Nations Statistical Division and the World Bank Development Indicators.

<table>
<thead>
<tr>
<th>S/N</th>
<th>VARIABLES</th>
<th>DEFINITION</th>
<th>MEASUREMENT</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>GCF</td>
<td>Gross Capital Formation</td>
<td>N\text{‘} Millions</td>
<td>UN Statistical Division</td>
</tr>
<tr>
<td>2.</td>
<td>OILP</td>
<td>Oil Price</td>
<td>US$ per barrel</td>
<td>BP Statistical Review of World Energy 2012</td>
</tr>
<tr>
<td>3.</td>
<td>INTR</td>
<td>Interest Rate (Maximum lending rates was used as a proxy)</td>
<td>Percentages</td>
<td>CBN Statistical Bulletin 2011</td>
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<td>4.</td>
<td>EXR</td>
<td>Official Exchange Rate</td>
<td>in terms of US$</td>
<td>CBN Statistical Bulletin 2011</td>
</tr>
<tr>
<td>5.</td>
<td>SAVINGS</td>
<td>Total domestic savings</td>
<td>N\text{‘} Millions</td>
<td>CBN Statistical Bulletin 2011</td>
</tr>
<tr>
<td>6.</td>
<td>RGDP</td>
<td>Real Gross Domestic Product</td>
<td>N\text{‘} Millions</td>
<td>CBN Statistical Bulletin 2011</td>
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</tbody>
</table>

4.0 Discussion of Result

4.1 Preliminary Analysis of Data

Preliminary analysis was conducted with the aim to determine the normality of the data, measures of central tendency and measures of dispersion. The mean and median are measures of central tendency and they indicate the average value of the sample. Standard deviation is
the positive square root of variance. It is a measure of dispersion, that is, it shows the extent of the deviation from the mean. Skewness, kurtosis and Jarque-Bera show the normality of the distribution. A distribution is said to be normal when skewness is approximately zero and kurtosis is three. Also the probability of the Jarque-Bera statistics tells whether the distribution is normal or not. The null hypothesis of the Jarque-Bera test says that the distribution is a normal one. Therefore if the probability is less than 0.05, we reject the null hypothesis and conclude that the distribution is not normal.

From table 1 below, using the probability of the Jarque-Bera statistics, the variables are relatively normal with exception of oil prices, exchange rate and savings. The fact that oil prices are highly susceptible to shocks could explain why the distribution is not normal. Exchange rate is also known to be susceptible to large amounts of volatility, which can even be inferred from the minimum and maximum values of the data. Also, savings react to oil price shocks and other fluctuations in the economy, thus, the abnormality of the distribution can be expected.

Table 2: Preliminary Analysis of data

<table>
<thead>
<tr>
<th></th>
<th>GCF</th>
<th>INTR</th>
<th>EXR</th>
<th>RGDP</th>
<th>OILP</th>
<th>SAVINGS</th>
</tr>
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<td>Mean</td>
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<td>17.75571</td>
<td>43.90908</td>
<td>281644.8</td>
<td>29.65024</td>
<td>771441.9</td>
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<tr>
<td>Median</td>
<td>47287.76</td>
<td>18.95000</td>
<td>8.973650</td>
<td>266464.6</td>
<td>20.63500</td>
<td>33694.70</td>
</tr>
<tr>
<td>Maximum</td>
<td>142424.8</td>
<td>36.09000</td>
<td>153.8616</td>
<td>834161.8</td>
<td>113.6500</td>
<td>6531913.</td>
</tr>
<tr>
<td>Minimum</td>
<td>6613.970</td>
<td>6.000000</td>
<td>0.546400</td>
<td>4219.000</td>
<td>1.670000</td>
<td>411.8000</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>40069.87</td>
<td>7.197530</td>
<td>57.49835</td>
<td>228538.7</td>
<td>25.57734</td>
<td>411.8000</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.559385</td>
<td>0.358502</td>
<td>0.866495</td>
<td>0.728310</td>
<td>1.716508</td>
<td>2.491521</td>
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<tr>
<td>Kurtosis</td>
<td>1.968766</td>
<td>2.457416</td>
<td>1.934537</td>
<td>2.775401</td>
<td>5.495626</td>
<td>7.910236</td>
</tr>
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<td>Jarque-Bera</td>
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<td>1.414862</td>
<td>7.242311</td>
<td>3.801325</td>
<td>31.52406</td>
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<td>Probability</td>
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<td>0.492909</td>
<td>0.026752</td>
<td>0.149470</td>
<td>0.000000</td>
<td>0.000000</td>
</tr>
<tr>
<td>Observations</td>
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<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
</tr>
</tbody>
</table>

Source: Author’s computation using E-Views 5

4.2 Vector Autoregressive (VAR) Estimation

According to Alege (2010), the main strength of the Vector Autoregressive model lies in the fact that it helps to observe impulse response mechanisms, study variance decomposition of variables in the system, for forecasting, causality and policy analysis (Alege and Osabuohien, 2010). Table 3 below shows the VAR estimates, this can be interpreted considering the summary statistics such as: F-statistic, t-statistic, Adjusted R² and the like. F-statistic shows the joint significance of all the variables in the model, that is, whether the variable jointly explain the dependent variable or not. The t-statistic, however, performs a similar role to that of the F-statistic but on an individual level. The t-statistic indicates the individual significance
of the variable in explaining the dependent variable. The adjusted $R^2$ measures the goodness-of-fit of the data, that is, how well the data fits the model.

Table 3 as in the appendix below shows that the data fits the model very well, because only about 23 percent of the model is not explained by the data, according to adjusted $R^2$ (0.766). However, a look at the t-statistics seems to show that most of the variables are insignificant in explaining each other. This confirms the position of Sims (1980) in Ogundipe and Alege (2013) that the goal of VAR analysis is to determine the interrelationship among variables and not the parameter estimates. Thus, the impulse response functions, variance decomposition and granger causality tests would be used to examine the interrelationships among the variables in the model.

4.2.1 Impulse Response Functions
Impulse response functions show the response of variables to one standard-deviation shock in itself and in other variables in the model over a particular time period. According to Alege (2010), impulse response functions trace out how the endogenous variables of the model respond to shocks which the economy undergoes within a given period. Simply put, it traces out how the change in one variable impacts other endogenous variables. In this study, we shall be making use of Cholesky one standard-deviation innovation over a time period of ten years. This study also considered both the use of multiple graphs to see how the variables respond individually and combined graphs to see how they respond together. The multiple graphs also show the upper and lower boundary using positive and negative two standard errors.

From the graphs below, we can see that Gross Capital Formation (GCF) is highly influenced by its own shock compared to other variables. However, it responds negatively to interest rate with the impact being felt most five or six years after the shock. GCF also responds significantly to a shock in exchange rate although this shock is silent for the first two years and thereafter, responds positively to exchange rate shocks. GCF response to RGDP is surprisingly negative but little, with most of the shock being felt in the second and third year and consistently reduces to zero over the years that follow. GCF also responds positively to oil price shocks immediately, that is, in the first year and peaks in the second year, but the effect wears out after the seventh year. Finally, the impulse response function shows a very significant positive response of GCF to shocks in savings. This is expected because savings is
the primary determinant of investment. Thus, GCF rises steadily and peaks in the sixth year and declines steadily thereafter.

Interest rate (INTR) is also majorly influenced by its own shocks with most of the impact felt in the first year, dropping sharply in the second year and declining steadily subsequently. We can also deduce a negative response of interest rate to gross capital formation from the impulse response function. It responds immediately but most of the impact is felt within the second to fourth year and afterwards recedes to zero in the years that follow. Interest rate also has a negative relationship with exchange rate, however, the effect of a shock in exchange rate on interest rate is very little. The response of interest rate to real gross domestic product (RGDP) is positive and relatively stable over the ten year period. Interest rates response to oil price shocks is initially negative for the first three years, becomes zero in years four to six and positive subsequently. The results also show a negative response of interest rates to shocks in savings which is felt from the second year.

Exchange rate (EXR) responds negatively to shocks in GCF and is relatively stable over the ten year period. This means that as domestic investment increases (GCF), the value of Naira appreciates that is we pay less naira to buy one US dollar. Exchange rate is significantly positively related to interest rates. Shocks in interest rates are felt immediately and continue to rise steadily over the ten year period. Shocks in RGDP also trigger steady increase in exchange rate over the years, however the magnitude of the effect is minimal. Exchange rates respond negatively to oil price shocks just like it does to GCF. The response is very little but steady throughout the ten year period. Exchange rates initially show positive responses to shocks in savings but after the eighth year, it becomes negative.

Real Gross Domestic Product (RGDP) from the results is not so responsive to shocks in GCF; however, more significant effect can be noticed from the seventh year. RGDP responds significantly to shocks in interest rate. We can deduce a positive relationship that rises steadily over time. The response of RGDP to EXR is quite interesting. Very little effect is felt in the first year but from the second year, RGDP rises persistently over the ten year period. This supports the fact that devaluation of currency leads to increase in real output. The results also show that RGDP is sensitive to oil price shocks. It also shows a positive relationship oil price. The net-effect of shocks in savings on RGDP is quite ambiguous, because it shows a negative response from year one to year five and positive response from year six to year ten.
Initially savings has a negative response to GCF in the first two periods but then responds positively from the third period to the tenth period. Savings has a negative relationship with interest rate, although, this effect is only felt from the third year. EXR has quite a significant effect on savings, although, savings responds significantly to shocks in EXR from the fourth year and rises consistently from then on. A shock in RGDP would lead to a consistent rise in savings throughout the ten year period. Oil price shocks results in steady rise in savings over the years. Shocks in its own variable (savings) indicate a relatively stable function over the time horizon.

Oil prices react to shocks in GCF positively, rising steadily in the first year and then peaking in the second year and drops significantly in the fourth year and becomes relatively stable after that. Oil prices do not significantly respond to shocks in interest rates. Oil prices rise persistently when shocks in EXR occur. This shows quite a significant positive relationship between EXR and oil price. Oil prices do not really respond to shocks in RGDP. Very little effect is felt in the first year and this effect zeroes out in the subsequent period. Oil prices respond positively to shocks in oil prices. The response, however, is not so stable over the ten-year period. Shocks in savings results in a negative response from year one to year three, while from year four, it begins to respond positively to shocks in savings.

The combined graphs combine the individual responses of all the variables to a shock in each of the endogenous variables. The combined impulse response graphs help to examine the impact of a standard deviation shock in one variable on all other endogenous variables in the model at a glance. The graphs below summarises the multiple impulse response graphs shown and explained above in detail. A shock in interest rate, real output and savings reveal that other variables respond significantly to these shocks and begin to converge to a steady state of equilibrium far into the horizon.

However, shocks in investment, exchange rate and oil prices do not seem to indicate any form of convergence, even with extension of the forecast period. This can be explained by the frequent shocks and volatility of oil prices and exchange rates. Thus, the results show that other variables do not converge to a steady state of equilibrium over time. This could be because of persistent shocks in oil prices and exchange rate. A closer look at the graphs show that investment rises sharply on impact of shocks in oil price, steadies in the second and third periods and then begin to decline persistently over the horizon.
As it has been stated earlier, the combined graphs show more clearly that interest rate and real gross domestic product do not respond significantly to shocks in oil prices. However, exchange rate rises steadily on impact and into the horizon. Also, savings initially decline in the first two periods but afterwards begin to rise persistently into the horizon. Thus, we can conclude that shocks in interest rate, real gross domestic product and savings lead to a convergence to a steady state of equilibrium in the endogenous variables, while shocks in investment oil prices and exchange rate result in a divergence in these variables.

4.2.2 Variance Decomposition

Variance decomposition shows the proportion of the forecast error variance of a variable that can be attributed to its own innovations and that of other variables (Iwayemi and Fowowe, 2010). It shows the percentage error in one variable due to one standard deviation shock of the variable itself (own shocks or variations) and other variables in the system (Alege, 2010). It is majorly used for the purpose of making reasonable forecasts of variables in the model over a specified time period. From the table below, it can be seen that a hundred percent of changes in GCF is explained by changes in own variable in the first year, but in the fourth, seventh and tenth year, the proportion explained by GCF falls to 81 percent, 63 percent and 53 percent respectively. Also, the results reveal that only about 6 percent of changes in GCF is explained by changes in savings, although this increases to 23 percent in the tenth year. This means that Gross Capital Formation is majorly influenced by changes in its own variable and changes in determinants of investment such as savings would be felt at later periods, thus, appropriate timing of policy by government is essential.

Table 3 also shows that almost a hundred percent of changes in interest rate are explained by changes in its own self. However, by the fourth and seventh period, GCF is seen to explain about 11 percent of changes in interest rates and savings only begin to significantly influence interest rate in the tenth period. Interest rate is also seen to cause about 12 percent and 17 percent of changes in exchange rate from the seventh and tenth quarter respectively. This indicates that variations in interest rates would affect official exchange rates over time.

The variance decomposition shows that although RGDP accounts for about 87 percent of its own variations in the first year, it drops sharply to explaining only about 38 percent of its own variations in the fourth period and only 19 percent in the tenth period. This result reveals that variations in RGDP is mainly caused by other macro-variables such as exchange rate, interest rate and oil prices, but other variables such as gross capital formation and savings do
not significantly explain changes RGDP, hence, policymakers should take this into consideration when making policies that target increasing real gross domestic product.

Variations in oil prices are explained majorly by gross capital formation exchange rate and savings. Interest rates and RGDP have little effect on oil price forecast. GCF explains as much as 47 percent of variations in oil price in the fourth year and exchange rate explains about 30 percent of oil price shocks in the tenth year. Savings also explain about 21 percent of variations in oil prices in the tenth period. This imply that oil price shocks are not necessarily caused or explained by RGDP or interest rate but influenced significantly by variations in gross capital formation and exchange rates.

From the results displayed in the table below, it can be seen that GCF has an immediate effect on savings though little (about 7 percent), but this proportion increases over the years to about 20 percent in the seventh period and drops to about 15 percent in the tenth year. Oil prices also show some degree of influence on savings, explaining about 17 percent of changes in savings in the fourth year. It can also be seen that exchange rate explains about 27 percent of variations in savings in the tenth period. The effect of exchange rate and oil prices on savings seem to indicate the fact that people are willing to save more when there is more money in the economy which can be caused by oil boom or by devaluation of currency.

TABLE 4: Variance Decomposition

<table>
<thead>
<tr>
<th></th>
<th>GCF</th>
<th>INTR</th>
<th>EXR</th>
<th>RGDP</th>
<th>OILP</th>
<th>SAVINGS</th>
</tr>
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<tbody>
<tr>
<td>GCF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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Granger Causality Tests

Granger causality test is used to determine whether there is feedback or causation from one variable to another and the direction of such causality (Olayiwola and Okodua, 2009). Pairwise Granger Causality test was used to determine whether there is any form of causality between the variables and the direction of such causality. The results showed a unidirectional causality running from GCF to oil price, meaning that GCF granger causes oil price. Also, exchange rate was found to granger cause oil price and savings. It is important to note that a bi-directional causality was found between savings and oil price. This means that oil price granger causes savings and savings granger causes oil price.

Table 5: Granger Causality Test

<table>
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<th>Null Hypothesis</th>
<th>Obs</th>
<th>F-statistic</th>
<th>Prob</th>
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<tr>
<td>GCF does not Granger Cause OILP</td>
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<td>9.24607</td>
<td>0.006*</td>
</tr>
<tr>
<td>EXR does not Granger Cause RGDP</td>
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<td>3.12638</td>
<td>0.05633***</td>
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<tr>
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<td>40</td>
<td>4.01195</td>
<td>0.02699**</td>
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<tr>
<td>EXR does not Granger Cause SAVINGS</td>
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<td>7.91918</td>
<td>0.00145*</td>
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<td>2.87157</td>
<td>0.07002***</td>
</tr>
<tr>
<td>SAVINGS does not Granger Cause OILP</td>
<td>40</td>
<td>6.40573</td>
<td>0.00426*</td>
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<td>OILP does not Granger Cause SAVINGS</td>
<td>40</td>
<td>30.8221</td>
<td>1.9E-08*</td>
</tr>
</tbody>
</table>

* significance at 1 percent level ** significance at 5 percent level *** significance at 10 percent level

Summary of results

From the above analysis, it can be seen clearly that while Gross capital formation significantly explains oil prices which is affirms the fact that GCF granger causes oil price as it has been seen in the foregoing analysis, oil price shocks do not significantly explain investment which can be confirmed from the impulse response functions, variance decompositions and Granger Causality tests. This indicates a unidirectional causality running from GCF to oil prices. Therefore, policymakers should bear this in mind when making policies that the level of domestic investment has a significant impact on oil prices. Thus, policies that stimulate investment should be encouraged.

The results also show that RGDP does not significantly respond to oil price shocks but to other variables such as exchange rate, interest rate savings which are influenced by oil price shocks. This means that the effect of oil price shocks on RGDP is indirect, thus, it is not the oil price shock itself but the effect of oil price shocks on the other variables that affect RGDP. Also, our tests found evidence of a bi-causal relationship between savings and oil prices.
Thus, oil price shocks affect the level of savings in the economy, which in turn affect the level of domestic investment in the economy and subsequently influencing real output. This therefore, helps to explain the transmission mechanism of oil price shocks to real output (measured by RGDP). Policy makers should therefore implement policies that stimulate savings such as increasing savings rate, reducing lending rates (interest rate) to stimulate investment, so as to facilitate growth in the economy.

5.0 Policy recommendation and conclusion

From our empirical research, tests and results, we can now conclude as to whether the hypothesis of the study have been accepted or rejected. This study has three hypotheses; the first hypothesis seeks to examine the effect of oil shocks on savings in Nigeria. The Granger causality tests show evidence of a bi-directional relationship between these variables and the impulse response graphs show significance response of savings to oil price shocks. The second hypothesis says that oil price shocks have no effect on investment in Nigeria. The null hypothesis in this case is rejected because Granger causality also shows causality from investment to oil shocks. Also, savings is the primary vehicle for investment, thus, an increase in savings also lead to an increase in investment.

The third hypothesis investigates the effect of oil price shocks on the Nigerian economy. The three tests carried out in this study agree on the fact that oil price shocks have no significant effect on the economy. However, oil price shocks affect other macroeconomic variables that in turn influences real output of the economy. Thus, we can conclude that there is an indirect link between oil price shocks and economic performance in Nigeria.

The paper examined the impact of oil price shocks on investment and other macroeconomic variables such as interest rate, exchange rate, savings and real output. The study employed a Vector Autoregressive model that examines the interrelationship between these variables, in order to determine how oil price shocks affect the economy and the appropriate policies to be taken in periods of oil price shocks so that both positive and negative shocks can be managed with the intention of keeping the economy relatively stable over time.

This paper concludes with empirical evidence showing that there is a causal relationship between oil price shocks and investment and that investment reacts to oil price shocks with the impact most felt in the first three years after the shock. Thus, policies should be implemented that encourage investment especially immediately after the shock so that it can
translate into growth in real output. Also, the study reveals that oil price shocks significantly affect savings and savings affects investment, thus policies that would encourage savings especially during periods of oil boom is essential for improved performance of the economy.

The essence of economic analysis is to enhance the decision-making process of policy-makers and to ensure that appropriate policies suitable to the dynamics of the particular economy in question can be implemented. This study has looked into the effect of oil price shocks on domestic investment in Nigeria. Hence, based on the findings from the empirical analysis the following recommendations are suggested:

1. **Timing of Policies**: a look at the impulse response functions and the variance decompositions would reveal the fact that variations or shocks in a variable are mostly explained by own variations and shocks in the first period but begin to respond to other variables more after the first period. Thus, policies should be timed appropriately in order to have the desired effect on the economy and at the right time.

2. **Policies in Reaction to Oil Shocks**: the results show that real output does not react significantly to oil price shocks, but are influenced by other variables that are influenced by these shocks. This means that, it is not oil price shocks itself that influences output, but policies in reaction to these shocks. Thus, government should beware of extreme monetary policy or fiscal policy measures during periods of negative shocks.

3. **Incentives**: Incentives should be provided by the government to enhance savings and investment culture in Nigeria. These incentives include favourable savings and lending rates, reliable financial institutions, protection of infant industries from foreign competitors and so on.

4. **Administration of Funds**: Excess funds from positive shocks should be invested wisely, so that it would help the economy grow. Also, it is important that competent and efficient managers should be placed in charge of the funds so that they are not mismanaged or embezzled as is commonplace in Nigeria.
REFERENCES


Hamilton, J. D. (2011, February 1). Historical Oil Shocks.


Appendix

**Figure 1: Impulse Response functions (Multiple Graphs)**
### Table 3: VAR Estimates

<table>
<thead>
<tr>
<th></th>
<th>GCF</th>
<th>INTR</th>
<th>EXR</th>
<th>RGDP</th>
<th>OILP</th>
<th>SAVINGS</th>
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<td>-0.018044</td>
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Standard errors in ( ) & t-statistics in [ ]
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\]

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(562.327) & (0.12308) & (0.37188) & (719.867) & (0.20193) & (4575.44) \\
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\[
\begin{array}{cccc}
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\[
\begin{array}{cccc}
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R-squared: 0.837779  0.741842  0.964891  0.991255  0.945927  0.993973
Adj. R-squared: 0.765681  0.627106  0.949288  0.987368  0.921894  0.991295
Sum sq. resids: 1.06E+10  506.2447  4621.284  1.73E+10  1362.600  7.00E+11
S.E. equation: 19782.74  4.330104  13.08276  25325.01  7.103989  160964.6
F-statistic: 11.61999  6.465605  61.83704  65.0290  39.36023  371.0905
Akaike AIC: 22.87996  6.026018  13.08276  25325.01  7.103989  160964.6
Schwarz SC: 23.42885  6.574903  8.786311  23.92282  7.565033  27.62160
Mean dependent: 66329.86  18.19350  46.06929  29550.37  31.04025  809992.1
S.D. dependent: 40867.96  7.090967  58.09555  225325.4  25.41913  1725207.
Determinant resid covariance (dof adj.): 6.17E+32
Determinant resid covariance: 5.84E+31
Log likelihood: -1803.436
Akaike information criterion: 94.07182
Schwarz criterion: 97.36514