

# THE EFFECT OF OIL PRICE ON MACROECONOMIC AGGREGATES IN GHANA

BY  
KNUST  
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## DECLARATION

I hereby declare that this thesis is my own work towards the MSc Economics, and that to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree in the University, except where due acknowledgement has been made in the text.

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## DEDICATION

To my precious family and all loved ones

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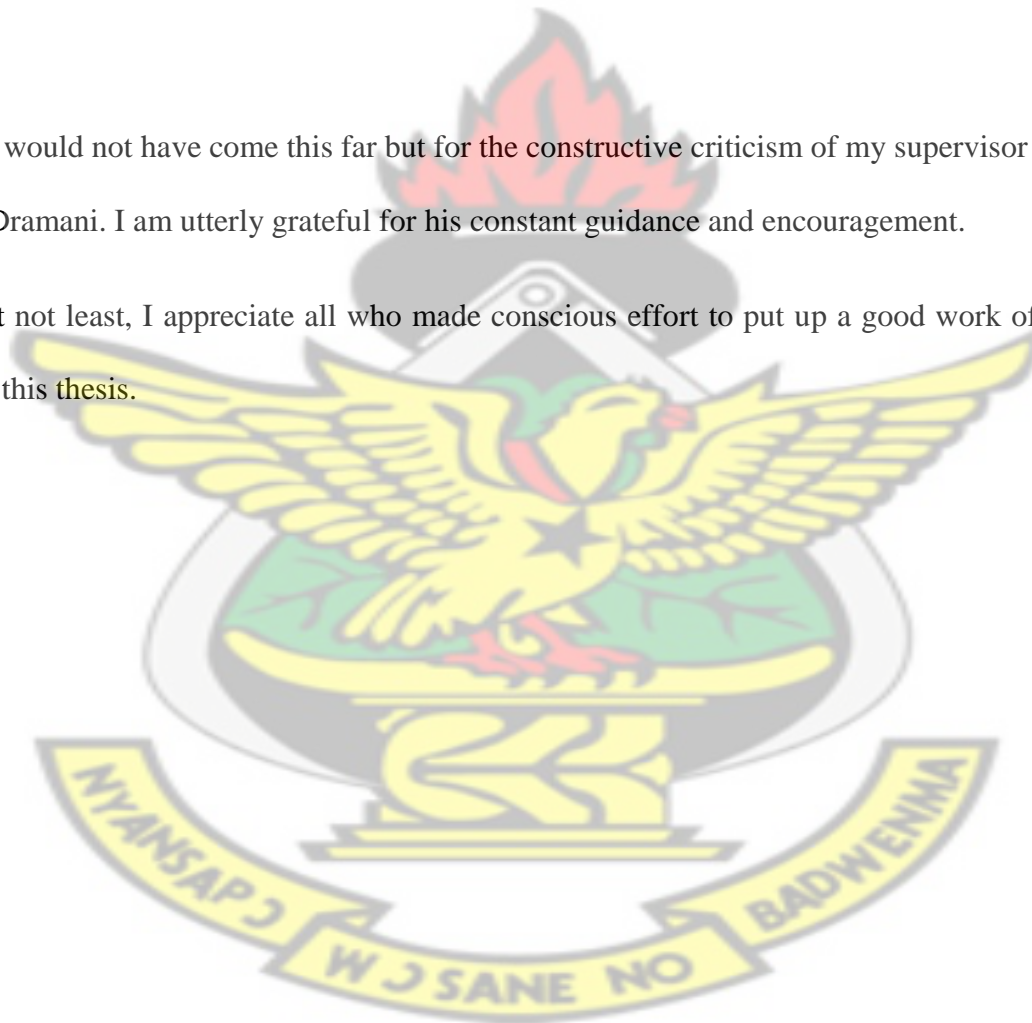
## ACKNOWLEDGEMENT

I would love to express my utmost gratitude to the Sovereign God who has been the anchor in my MSc journey. I am grateful for His grace that abounds in my life and has brought me this far.

I would want to further express my profound gratitude to my mother Mrs. Eva Abaidoo who has contributed enormously to my MSc education. I also acknowledge my supporting Abaidoo brothers, Freda Amaning-Darko, the Nortey-Mensah family and all friends who assisted in diverse ways.

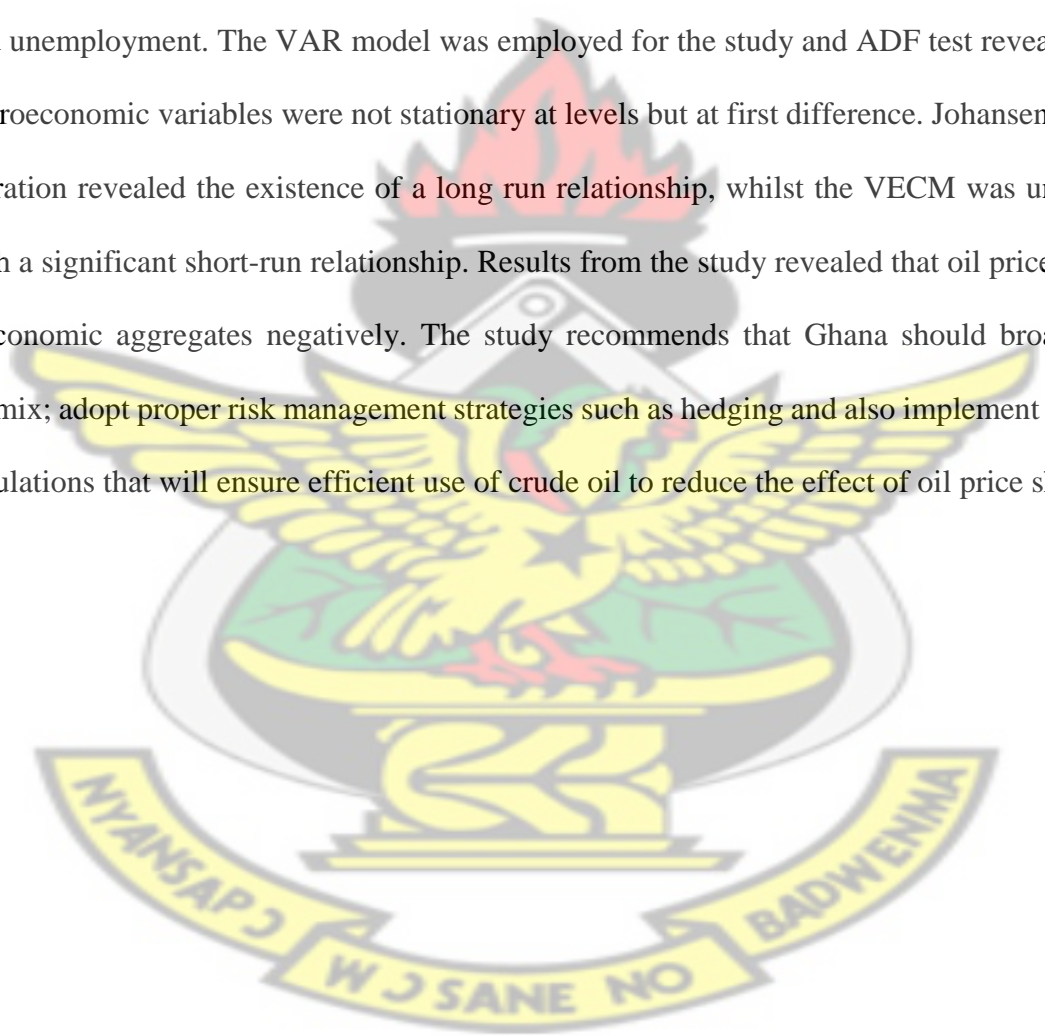
I surely would not have come this far but for the constructive criticism of my supervisor Dr. John Bosco Dramani. I am utterly grateful for his constant guidance and encouragement.

Last but not least, I appreciate all who made conscious effort to put up a good work of which I cited in this thesis.



## ABSTRACT

Oil price is arguably one of the key driving forces of macroeconomic aggregates and has been an area of interest by many in academia and industry in recent times. The study investigated the effects of oil price on macroeconomic aggregates in Ghana by employing annual time series data which spans from 1970 to 2016 from the World Development Indicator (WDI). The study considered macroeconomic variables such as real GDP, real effective exchange rate, real interest rate and unemployment. The VAR model was employed for the study and ADF test revealed that the macroeconomic variables were not stationary at levels but at first difference. Johansen test for cointegration revealed the existence of a long run relationship, whilst the VECM was unable to establish a significant short-run relationship. Results from the study revealed that oil price affects macroeconomic aggregates negatively. The study recommends that Ghana should broaden its energy mix; adopt proper risk management strategies such as hedging and also implement policies and regulations that will ensure efficient use of crude oil to reduce the effect of oil price shocks.



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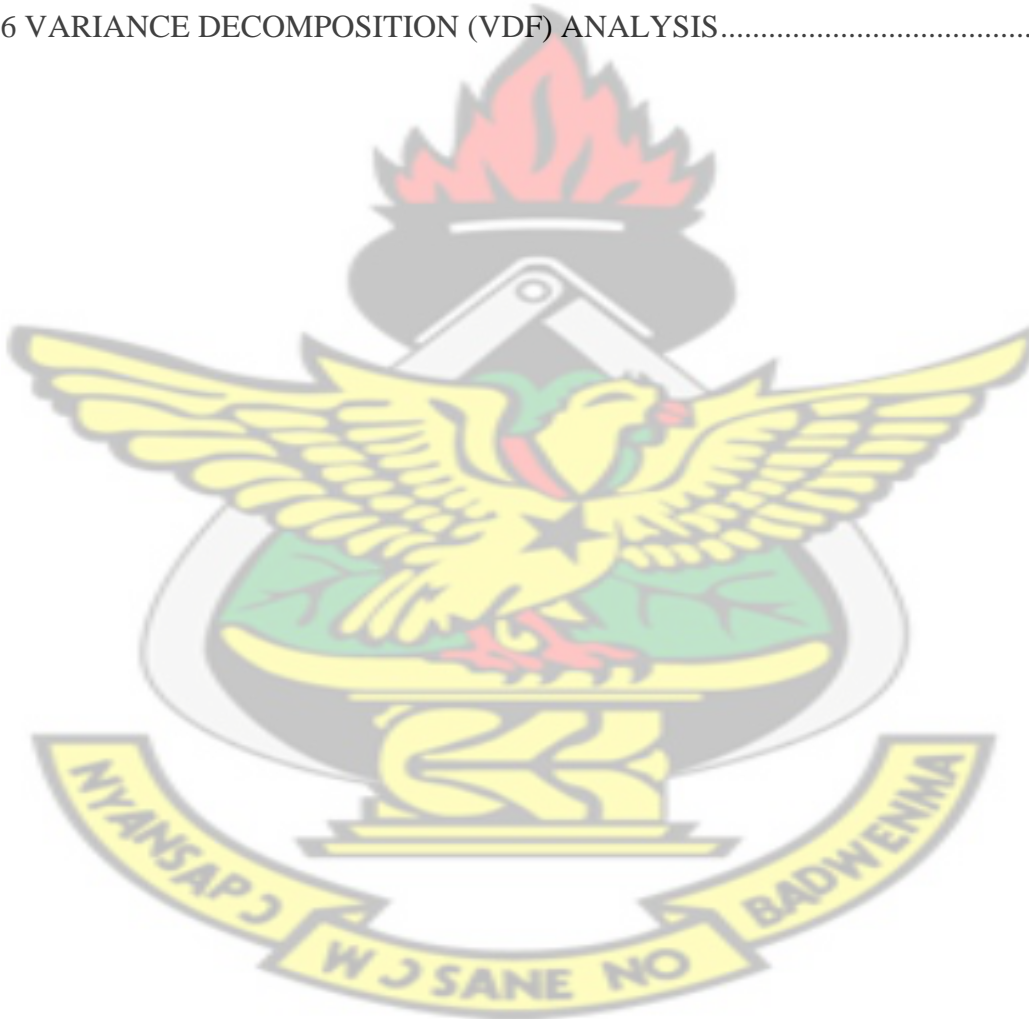
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## ABBREVIATIONS

ADF Augmented Dickey Fuller

GDP Gross Domestic Product

VAR Vector Autoregression

VECM Vector Error Correction Model

IRF Impulse Response Function

VDF Variance Decomposition Function

WDI World Development Indicato



# CHAPTER ONE

## INTRODUCTION

### 1.1 Background

Over the years oil price shock has been considered as a key driving force of fluctuations in the macroeconomy. Oil price shock occurs when there is an abrupt or unpredictable change in oil prices. The phrase gained global popularity between the period of 1973 and 1974 following the Yom Kippur War where OPEC imposed an embargo on western nations which eventually caused the hike in oil prices.

Abandoning of the mutual pact at the latter part of 1973 caused the actual oil price to escalate, the increase was not necessarily a response to geopolitical events in 1973 but rather correction of the market disequilibrium. A classic example that supports this assertion is the Iraq-Iran War which occurred in 1980 and early 2003 where the outbreak of the war did not cause any substantial hike in oil prices (Kilian, 2009).

Brown *et.al* (2010) asserted that the 1973 oil price shock and the subsequent recession, stirred up the interest to undertake studies about the effects oil price have on the economy. Studies undertaken earlier indicated and attempted to throw more light on the asymmetry correlation between prices of oil and large-scale economic activity. An empirical studies that was undertaken subsequently by Brown *et.al* (2010), confirmed the asymmetry correlation between oil prices and aggregate economic activity for some other nations including the United States.

Oil price shock emerges as a result of supply shock or demand shock. From the macroeconomic perspective, oil price shocks are primarily considered as one of the exogenous factors that drive

fluctuations in an economy. A study conducted by Hamilton (2005) postulated that nine out of ten recessions in the United States within the periods of 1945 to 2005 were caused by great real increase in prices of oil. Nonetheless, the abrupt rise in oil prices ahead of recessions, massive reduction in oil prices have not seem to be proceeded by an unusual high economic growth. Owing to this, there has been acknowledgement by many that oil-price shocks are directionally asymmetric. Thus, to say a great positive oil-price shock is relevant unlike negative oil price shock.

A lot of economists regard an oil price shock as a demonstration of a classic supply shock that causes output to attenuate. Increase in prices of energy are evidence of heightening energy scarcity which is considered a fundamental input to production. Decline in inputs required to work causes output and labour productivity to reduce. Sequentially, the reduction in growth of productivity decreases growth of real wage and hence cause a rise in the unemployment rate.

When consumers anticipate a shoot up in oil prices for a short term, or if consumers anticipate the near-term impacts of output to be greater than the long-term effects, they will try to smoothen their consumption by reducing their saving capacity or increasing their borrowing capacity. Such mechanisms push up the interest rate. When output declines and real interest rate climbs up, the demand for real cash equilibrium drops and the price level rises, thus for a given growth rate in the monetary aggregate. The primary transmission of oil prices continues to have direct impact on cost. Thus, a surge in oil prices tends to behave like a tax as it mounts pressure on the real disposable income of households and firms' profit margin and hence diminishing activities within the economy as a result of lower consumption and investment spending. Hence higher prices of oil cause the real GDP to drop, pushes real interest rate up and cause price level to rise, Brown

*et.al* (2010). Further studies by Laser (1987) also revealed that a rise in oil prices leads to a decrease in GDP. Awerbuch (1993), suggested that oil price shocks have a negative correlation with macroeconomic indicators and hence whenever prices of oil increases, there is a decline in economic activities.

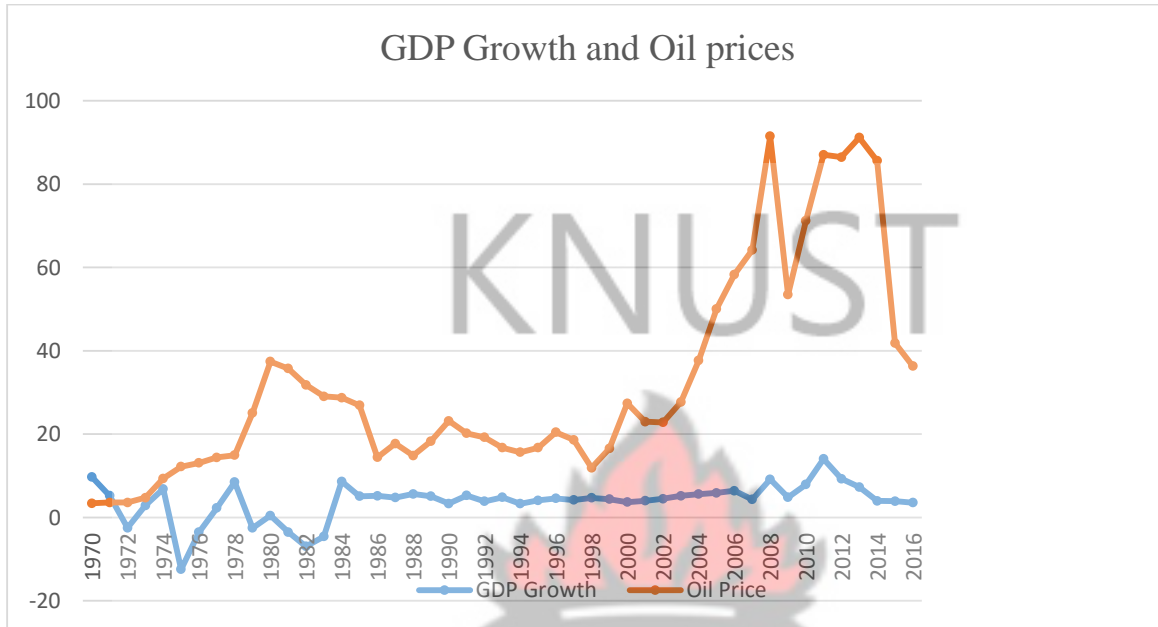
An assumption in the theory of business cycle is that exogenous technological shocks which are often recognized through the Solow residual are the primary source of macroeconomic fluctuations. The nature of technological shocks has not been brought under discussion because it is unobservable and have been critiqued often by some economists on the premise that the results of the intersection of other types of factors are not made clear in the model. Hence indicating distinct sources of fluctuations will allow indistinct sources to decrease in explaining the business cycle.

## **1.2 Problem Statement**

Ghana's macroeconomy has experienced series of expansions and recessions in time past as evident in Figure 1.1. Over the years, Ghana's growth rate has performed abysmally, especially during the era where there was an astronomical increase in oil price. It is worth to note that Ghana recorded an average reduction in per-capita GDP by more than 3% a year during 1973 and 1983 (Fosu & Aryeetey, 2008).

According to Aryeetey and Harrigan (2000), Ghana's economic misfortune was as a result of volatility in prices of oil during 1974 and 1979/81. During this era, prices of crude oil escalated from \$3.60 to \$9.35 per barrel between 1972 and 1974 respectively.

**Fig 1.1 GDP Growth and Oil Prices**



Source: Author's

British Petrochemical publication in the year 2012 suggested that by 1980, the price of crude oil had shoot up to \$36.83 per barrel. Until the period of 2000 and 2008 where an oil shock caused disruption, Ghana's economy was stable. Inflation continued to be on the rise from 10.9% in the year 2000 to a whopping 12.8% in the year in 2007. As if that was not enough, by the year 2008 and 2009, Ghana's inflation rate had escalated to 18.45% and 20.75% respectively (Ghana Statistical Service). Again in 2011, there was an oil price shock which saw a barrel of oil trading at \$87.04. Most economies including Ghana were affected by the shock due to Libya's political unrest which eventually caused disruptions in supply.

Empirical study by Laser (1988) shows that a rise in the real price of oil increases the production cost as cost of oil inputs increases and causes firms to reduce demand for labour, capital and oil.

Firms which use oil for their production activities incur more cost in production as oil prices escalate. In response to the oil price shock on the part of the firm, workers are laid off to enable the firm adjust and hence leads to unemployment.

Oil price shocks tends to increase Ghana government's expenditure as government allocate its resources to subsidize cost of petroleum products rather than allowing an automatic adjustment in price. This is evident in a submission made by Ghana's Finance Minister in 2015 which suggested that the hike in oil prices had a grave shock on the economy and hence government needed to restructure its targeted revenue and cut down its budgeted expenses. To an extent, this takes a big toll on government as it is unable to fulfill its financial obligations. This has raised the concern to undertake the study.

### **1.3 Justification**

There is a prevalent expression of thought that great fluctuations in the real price of oil are injurious to countries that import oil for domestic use. Oil price is perceived by many as one of the indicators that determines the performance of an economy since it affects the daily lives of people directly and indirectly. Oil as a source of energy is considered as an integral input in production and adds up significantly to Ghana's energy mix and in effect have an impact on Ghana's GDP. The study will make known how intense or mild an oil price shock affects Ghana's business cycle and also give a clue to policy makers to know the right economic policy to put in place to mitigate the shocks.

Though some studies have been conducted by Rasche and Tatom (1977), Bernanke (1983) Finn (2000) and more recently Hamilton (2009) in relation to oil price shocks, there has not been yet a single study conducted on the effects oil price shock have on Ghana's business cycle. Empirical

studies conducted by Zhang (2008) concentrated on the precise forecast of asymmetric and nonlinear oil price shock measure which aids a better prediction of the aggregate economic performance in the future.

However, this study differs from other researches that have been undertaken on oil price shocks because it brings to bare the effects oil price shocks have on Ghana's business cycle and the extent to which the shock affects domestic output. Therefore, an assessment of the effect of crude oil price on the macroeconomic aggregates is key to forecasting the growth path of the economy.

#### **1.4 Objectives**

The main objective of the research is to assess the effect of oil price on macroeconomic aggregates in Ghana. Specifically the study seeks to

- i. Investigate the extent to which oil price affect domestic output.
- ii. Evaluate the nexus between oil price and macroeconomic variables in the Ghanaian economy.

#### **1.5 Hypotheses of the study**

H0: Changes in oil price do not influence macroeconomic aggregates in Ghana.

H1: Changes in oil price do influence macroeconomic aggregates in Ghana.

#### **1.6 Organization of the Study**

This research work comprises five chapters. Chapter one of the study throws more light on introduction/ background of the topic, problem statement, objectives of the research, research questions, and justification for the study and the organization of the research work.

Chapter two will review some literature relevant to the topic. The review of the literature are sourced from relevant textbooks, research papers as well as publications of earlier writers in a related area of research. Chapter three gives a detailed description of the econometric methodology and procedures that is used in analyzing the data to address the research problems. Chapter four extensively deals with the analysis and discussions of results obtained from the analyzed data. Chapter five, the last chapter of the research work discusses the research findings, conclusions and recommendations for addressing the problems that will be identified in the research work.



## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

Quite a number of studies have been carried out to ascertain the nexus between oil price shocks and the economic growth, however majority of such studies conducted prioritized the developed economies. This chapter reviews relevant literature on oil price shocks from different countries. The literature is categorized into two strands namely; theoretical and empirical evidence.

#### 2.2 Theoretical Framework

There are quite a number of theories governing business cycles and how they respond to an external shock. This section elaborates on the various theories underpinning business cycle and its response to external shock.

##### 2.2.1 Real Business Cycle (RBC) Theory

The Real Business Cycle (RBC) theory is one of the many theories that seeks to throw more light on how external shocks tends to affect the economy just as oil shocks tend to have a short-run effect on capital and labour which further has a rippling effect on the growth of GDP. Taking into consideration Kim & Loungani's (1992) model which depicts the inclusion of energy as a variable in their RBC model. The cost element considered when oil exporter countries resolve to increase oil prices are made known in tandem with justification of why the effect on growth from rise in prices varies from that of decline in price.

Real Business Cycle, the class of models that emerged is essentially built on rational expectations. These models incorporate explicitly microeconomic behavior of forward looking economic agents in the system. Prices are assumed to be perfectly flexible and the models in this category postulate that only real shocks can propagate business cycle fluctuations in the economy. RBC models are also known to have the ability to incorporate uncertainties (Mendoza, 1991). Finally, the strong theoretical foundation of RBCs improved supply side and allowed direct calculation of welfare.

In spite of the ability of RBC to replicate the real economy, its short run dynamics necessitated some kind of reviews. In effect the assumption of flexible prices left little room for analysis of macroeconomic policies (Rajan, 2004). In addition, inability to recognize nominal sources of shocks restricted the usefulness of the RBC models. In order to respond to these limitations of RBCs, models that can combine explicit microeconomic foundations with nominal factors were developed (Christiano, Eichenbaum and Evans, 2001). This method of approach is non-walrasian in view of the assumptions of imperfect market, sticky prices and monopolistic competition in the spirit of New Keynesian macroeconomics.

### **2.2.2 The Growth Theory**

The standard growth theories concentrate on the primary inputs like Capital, labour & land, without taking into consideration the function of primary energy inputs like oil deposits. Nonetheless, a section of natural scientists and ecological economists are keen at developing theories which considers the function of oil price volatility on the growth of the economy, hence integrating the nexus between energy resources; its tendency to be available and economic growth. The centre-stage of economic growth assumption is that, production is the utmost essential factor

of economic growth, and thus, production which to an extent involves conversion of matter needs some amount of energy. The theory classifies capital, labour and land as the main factors of production; these occurs at the initial stages of the production period and are not exhausted in production directly. Even though energy resources including coal, fuels, oil and gas are classified as intermediate inputs, they are generated at the production stage and are completely exhausted in the process of production. When ascertaining the marginal product of oil as a source of energy necessary in the determination of economic growth, the theory in one breath takes into account the ability to do work, responsiveness to storing, safety, cost incurred in transformation, cleanliness, flexibility of use etc. It also takes into account other characteristics like the type of capital, labour or materials it is used in line with. The theory evaluates that the perfect price to be paid for crude should commensurate its marginal product.

The symmetric/linear relationship of growth theory proposed by Hamilton (1983), Gisser (1985), Goodwin (1985), Hooker (1986) and Laser (1987) hypothesized that oil price volatility causes volatility in GNP. Their theory was premised on the occurrences in the oil market during 1948 and 1972 and the effect it had on oil-exporting countries and importing countries correspondingly. Following Hooker's (2002) thorough empirical research, it revealed that during 1948 and 1972 changes in oil price extensively induced GDP growth. Laser (1987) also affirmed the existence of symmetric relationship between volatility of oil prices and economic growth. Further studies she conducted postulated that a rise in oil prices leads to a decrease in GDP, even though the impact of a fall in oil price on GDP is indistinct due to the diverse impact in different economies.

Most asymmetry-in-effects theory concerning economic growth employed the U.S economy as a case study. The theory postulates that the relationship that exists between a decline in crude oil

price and economic activities in the U.S economy differs extensively and probably zero. Mark *et al.* (1994) conducted similar study in selected African economies and affirmed the asymmetry-in-effect of oil price volatility on economic growth. Ferderer (1996) threw more light on the asymmetric mechanism between the effect of oil price volatility and economic growth by placing emphasis on three potential approaches; thus, counter-inflationary monetary policy, sectorial shocks and uncertainty. He established a substantial connection between rises in oil price and counter-inflationary policy reactions. Balke (1996) confirms Federer's proposal by postulating that monetary policy is not enough to justify the real effects of oil price volatility on real GDP.

The Renaissance growth theory/model was an off-shoot of the symmetric and asymmetry in effect schools. Lee (1998) who was a leading proponent of this school focused her theoretical work on attempting to distinguish between oil price changes and oil price volatility. Lee (1998) defined volatility as the standard deviation in a given period. She submitted that both have negative impacts on economic growth, but in different ways: Volatility has a negative and significant impact on economic growth immediately, while the impact of oil price changes delays until after a year. She concludes by stating that —it is volatility/change in crude oil prices rather than oil price level that has a significant influence on economic growth. There exist other theories on the oil price volatility effect on economic growth in the literature, such as; the Decoupling theory, Income transfer model of growth etc. The theories reviewed are still at their crude stage, this is vivid from the quality of their analysis, ambiguity in conclusions and submissions and a clear absence of an econometric face. This is not unconnected to the background of the proponents of these theories, many of whom are scientists, ecological and environmental economists. The submissions of these

theories however provide analytical foundations on which to compose our empirical investigations.

Theories on crude oil consumption and the growth of an economy are generally grouped into three categories. The first theory suggests that, consumption of energy is a necessity for economic growth, such that energy is a direct input in the process of production and also complements labour and capital (Ebohon, 1996). This theory simply mean increasing consumption of crude oil triggers the growth in an economy. This implies that energy conservation policies have damaging repercussions on the growth of the economy.

The second theory assumes a feedback relationship between the consumption of crude oil and growth of an economy. This theory suggests existence of a bidirectional linkage between the consumption of oil and the growth of an economy. This means an increase in the amount of crude oil consumed induces growth in the economy, likewise growth in the economy will also lead to an increase in oil consumption. The third theory suggests, a neutral relationship between growth in the economy and the amount of oil consumed. As such this theory suggests that, policies initiated to conserve the use of energy will have no significant effect on the economy.

### **2.2.3 Reallocation Theory**

To explain this observation, subsequent theoretical literature has proposed alternate stories of more indirect channels for oil price's output effects that can better explain this asymmetry. One popular theory, reflected in theoretical models by Davis (1987) and Hamilton (1988), involves costs associated with reallocation of specialized labor and capital between sectors. In an economy where labor and capital can instantly transition between economic sectors to accommodate changes in

demand, an oil price change shifting demand between sectors may have little aggregate effect on economic output. However, if there are costs to reallocating labor or capital between sectors (for instance, between an energy-efficient product and its energy-inefficient substitute) or if this reallocation takes time, then a shift in demand associated with a relative oil price change will decrease aggregate output in the short run, until markets can adjust. Importantly, this costly reallocation will be triggered regardless of the sign of an oil shock.

#### **2.2.4 Uncertainty Theory**

A key theory for indirect oil-output effects is the uncertainty oil price. It predicts that an oil price change, regardless of sign, can increase consumers' and investors' uncertainty about future oil price predictions. Bernanke (1983) and Pindyck (1991) used instinctive theories from real option theory to depict that in the event of escalated uncertainty, investors are more likely to postpone irreversible investment decisions and await new information. Pindyck (1991) likens an irreversible investment decision to a call option, in that the ability to still make some irreversible decision holds some value and is "killed", like a call option, when the investor makes their decision. Thus, when there is a high uncertainty about future oil prices, emanating from either a rise or fall in oil prices, investors might adjourn their decision to invest in avenues which future is dependent on prices of energy.

Several prominent studies have tried to quantify the magnitude of this uncertainty effect. Ferderer (1996) found that a variable tracking monthly standard deviations of oil prices had a negative and statistically significant effect on industrial production. Elder and Serletis (2010) used Generalized Autoregressive Conditional Heteroskedasticity In-Mean methods to estimate one-period ahead standard deviations of oil price forecast errors as a proxy for uncertainty at each point in their

sample period. They included this volatility variable alongside variables for positive and negative oil price changes in a structural VAR to measure effects on output. Their study found expected oil price forecast error volatility to have a negative and statistically significant effect on output. The addition of the volatility variable in their VAR system also exacerbated the asymmetry between positive and negative shocks, which is consistent with the above theory of investment postponement, to the extent that forecast error volatilities are a useful proxy for uncertainty. This effect was even substantial enough to assign negative estimates for the response of output growth to negative price shocks, indicating that an oil price decrease would actually stifle output instead of stimulating it (although the sign of that response was not statistically significant).

Kellogg (2010) found sector-specific, micro-empirical evidence for this uncertainty theory, albeit in an industry closely tied to oil prices. Specifically, their study found that on-shore oil drilling companies in Texas do, on average, reduce their drilling activities in the face of higher uncertainty in oil prices, as measured by implied volatility in oil price futures on the New York Mercantile Exchange. Furthermore, the magnitude of this response was similar to that predicted by theoretical models.

### **2.3 Empirical Review**

Hamilton (1983) argued that there is a nexus between oil price fluctuations and the United States of America's macroeconomy. He further postulated that fluctuations in oil prices were the underlying factors to the recession. Thorough studies conducted by (Cunado and Gracia, 2005; Mork, 1989; Mork, Olsen and Mysen, 1994) revealed that oil economies respond asymmetrically to oil price fluctuations. Thus, when there is a rise in prices of oil, macroeconomic activities fall much more than when there is a reduction in prices of oil. Rasche and Tatom (1977) argued that

volatility in oil prices could be used as a key measure of a supply-side shock which diminishes likely economic output. Thus, the scarcity of energy increases as there is an abrupt increment in oil prices.

Raguindin and Reyes (2005) carried on a study to assess the impacts oil price shocks have on the Philippine economy from 1981-2003. During the study, the sudden/impulse response functions for the symmetric transformation revealed that the real GDP of the Philippines attenuates for quite a longer period due to oil price shock. On the contrary, their asymmetric VAR model revealed that a reduction in oil prices have a greater influence on fluctuation of each variable than a rise in oil price. Anashasy *et al.* (2005) carried out a similar study which assessed the effects of oil price volatility on Venezuela's economic performance from 1950-2001. The study employed a general to specific Vector Autoregression and Vector Error Correction Model to analyze the nexus between prices of oil, government revenue, consumption and spending, GDP and investment. Results from the study brought to bear two long-term relationships that are in accordance with the economic and fiscal balance. It further revealed that the relationship established was not only relevant for long-term performance but also short-term fluctuations.

From an oil-importing economy perspective, an exogenous rise in the actual price of imported crude oil leads to what is commonly known as a terms-of-trade shock. This terms-of-trade shocks have been considered to be of concern to the oil-importing economy by virtue of the impacts they have on production related decisions. Owing to this, oil is discussed as an intermediate input in domestic production. The process through which this imported oil is factored in the production function for addition of domestic value has been studied by many but yet little

solution has been proffered in the discipline (Kim and Loungani (1992); Backus and Crucini (2000)).

### **2.3.1 Overview of Ghana's Economic Performance and Impact of High Oil Prices on GDP**

Researchers have argued that oil prices chiefly affect the macroeconomy as an import price, through the terms of trade; as an input price, through the production function either by increasing costs or by increasing uncertainty which lead to deferral of irreversible investment; as a shock to the aggregate price level which reduces real money stock, and as a relative price shock which leads to costly reallocation of resources across sectors. These are further influenced by such country specific factors as price controls, taxes on petroleum products, exchange rate fluctuations and variations in domestic price index. From this one can argue that understanding the relationship between the world oil price and economic activity is important because oil price increases lead to a rise in prices of petroleum products which serve as a key production inputs and as an essential consumer goods. These price increases are considerable enough that they normally become temporary rise in the general rate of inflation. To the extent that increases in the oil price lead to a rise in price level, purchasing power is also reduced through a reduction in the real money stock. The energy intensity which measures the total primary energy consumption per dollar of gross domestic product (using purchasing power parities) stayed at 4381 in 2005.

The economy of Ghana has grown at an average annual rate of about 4.7% over 1990-2007. This growth rate has assumed an upward trend averaging around 6% from 2003-2007 following a growth rate of 3.7% in 2000. This improving macroeconomic performance has translated into an average annual per capita GDP growth of around 2.6% over 2000-2005 compared to 1.8% for sub-

Saharan Africa over the same period. The growth expansion has been driven principally by significant boost in the agriculture sector, leading to an increased contribution to GDP of nearly 38% in 2006, supported by productivity increases and favourable international market cocoa prices.

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## **2.3.2 Impact of High Oil Prices on Inflation**

There is a highflying school of thought that acknowledges that inflation is eventually a monetary phenomenon and that the impact of oil price shocks on the real economy is attributable to the tightening of monetary policy in response to adverse oil price shocks (Bernanke, et al., 1997).

Inflation in Ghana has also decreased over the years from a high of around 71% in 1995 it has to as low as around 10.9% at the end of 2006. Particularly, this decrease in inflation has been achieved in the last six years due to tighter monetary policy following the increasing independence of the Bank of Ghana. The exchange rate seems to be relatively stabilized considerably against the major trading currencies over the years, translating into a substantial reduction in annual depreciation rates much lower than inflation rates. This has raised some concerns regarding the effects of the real appreciation of the exchange rate on the real economy; particularly, the manufacturing sector.

Leduc and Sill (2004) maintain that a monetary policy targeting an overall price stability substantially alleviates the impact of oil price shocks, while easy-inflation policies amplify the negative output response. Recently, in their study on G-7 countries, Cologni and Manera (2008) suggested that unexpected oil price shocks influences inflation which gets transmitted into higher interest rates. In addition to interest rates, monetary aggregates are considered to form important information variables in inflation dynamics (Kapur, 2012). Ou, et al. (2012) analyzed the monetary

policy variables in China's context and showed that as inflation follows a WTI crude oil price shock, interest rates and interbank rates rise immediately, while the growth rate of Money supply (M1) begins to decrease after a lag of 3 months. On the external sector front, Ozlale and Pekkurnaz (2010) found that in the short term, an unexpected increase in oil prices causes the change in the current account ratio to fall in the Turkish economy even after controlling for output gap and exchange rate. Hassan and Zaman (2012) documented a negative and significant relation between oil prices and trade balance both in short run and long run in the context of Pakistan's economy.

### **2.3.3 Impact of Oil Price Shocks on Oil-Exporting Countries**

In this phase of the research, numerous perspectives and papers shall be mentioned and analyzed with regards to the effects of oil price shocks on the growth of the economy of oil-exporting countries. In other words, a standard view on the effects of oil price shocks on the growth of the economy may be supplied through the examples of various oil-exporting countries. In line with the preceding researches and works conducted on the effects of oil price, it may be said that oil price variability has tremendous outcomes related to the economic pastime and economic increase. Reputedly, these consequences and results are noted to have an effect on the oil-exporting and oil-importing countries in diverse ways. Although increase in oil price are widely admitted to have positive consequences on oil-exporting economies, they're anticipated to affect oil-importing economies in a poor manner.

The asymmetric impact of oil price shocks in oil-importing economies was widely discussed and analyzed in preceding studies. However, the concept of an asymmetric impact of oil price shock in oil-exporting economies may be quite extraordinary. Saeed Moshiri and Arezoo Banihashem (2012) in their paper with reference to the uneven results of oil price shocks on economic growth

of oil-exporting economies recommended that in most oil-exporting economies, the proceeds generated from the oil industry are intently linked to the government, causing it to be the most critical influence in economic activities. Conversely, the size of government and its function in economic system ought to be given a critical attention such that a shoot up in oil price in an oil-exporting economy implies that higher oil proceeds ends in implementation of recent initiatives and investments. Nonetheless, when a sudden reduction in oil price, government-oriented initiatives and investments remain uncompleted. Hence, government will be left with no option but to borrow to meet budget deficit caused in such a scenario.

The Dutch disease theory is one of the most famous theories that expounds the impacts of oil price shoot up on the growth of economic output in an oil-exporting economy. Corden and Neary (1982) talked about the theory which suggests that higher oil prices, normally, change the organizations of industries in the oil-exporting country causing it to be extra focused on oil industry and non-traded sectors. Again, it is miles referred to that the higher proceeds generated from oil lead to the appreciation of the local currency which results to the rise of importing consumer goods. The high level of focus placed on importation causes the competitiveness of the local producers to decline with time. Subsequently, according to the Dutch disease theory a rise in oil prices tends to cause more harm to an oil-exporting country.

According to a study conducted by Mendoza and Vera (2010) on the effects of oil price shocks on economic growth in Venezuela, it was established that oil price shocks that was experienced during the era of 1984-2008 captured by the analysis had a positive impact on the Venezuelan economy. Again, it was made known that rise in price of oil were significant and had an impact on the

economy massively than the decline in oil prices. To add to the latter, the asymmetric effect of oil price shocks on economic growth was established.

A contemporary study undertaken by Oyeyemi (2013) suggested that the discovery of oil on the soil of Nigeria has made oil a prevalent component in the economic activities in Nigeria. The equation of revenues generated from oil to the amount of GDP, exports and total revenues of the country positions the economy to be more sensitive to the changes in price of oil. The study affirmed the positive correlation between rise in oil price and economic situation, conversely, revealing that during the era of decline in oil prices there was an interruption in balance of payments and government's finances. It further established that a small shock in global oil prices will have a long-term impact on the economic growth of the country. Another study conducted by Umar and Kilishi (2010) also affirmed that a rise in oil price stimulates the GDP ratio to shoot up and vice versa.

#### **2.3.4 Impact of Oil Price Shocks on Oil-Importing Countries**

In this phase of the research, the effects of oil price shocks will be ascertained from the viewpoint of oil-importing and oil dependent countries. Majority of the research conducted by James D. Hamilton on the effects of oil price shocks on economic activity and macroeconomic variables was based on instances in the United States. In most of his research, he demonstrated that there is a significant correlation between changes in oil prices and economic growth of the US economy. Thus, a crucial negative relationship between the rise in oil prices and recession in the US economy was ascertained (Hamilton, 1983). A different significant aspect of rise in oil price is that, supply interruptions of oil is a key tool that aids in forecasting for a decline in GDP, as such, it can cause

a slowdown in the economy. Nonetheless, Mork (1989) suggested that there is not any existence of a negative relationship in the situation of decreases in oil price.

Hamilton (2000) established that, when analyzing and predicting GDP growth, the nonlinear function of changes in oil price have to be employed. On the contrary, it should be made known that nonlinear functions do not take into consideration endogenous factors that have had a significant effect in altering the prices of oil over time past. Furthermore, the rise in oil prices were noted to be a more significant factor that affect growth of the economy and prediction of GDP than the decline in oil prices.

Kilian (2008a) wrote on the effects of oil price shocks on oil-importing economies and the principal objective was to reassess the literature on the effects of prices of energy on the economy of US. The author further made reference to James D. Hamilton (2005) which elaborated on the correlation between oil and the US macroeconomy. Kilian (2008a) expatiated on why the rise in oil and gasoline prices that occurred in the early moments of 2000s in the US did not cause a significant recession. Kilian opined that the principal cause of the rise in prices was as a result of the high global demand for industrial commodities. In the short-term period, the effects of rise in prices are positive, nonetheless they are lesser than the mean in the long-term period.

Anoruo and Elike (2009) conducted a study on the effects of oil price shock on the economic growth of oil-importing African countries; Keikha *et al* (2012), Jayaraman and Lau (2011) conducted similar studies and had related results which implied that the economic growth of the chosen countries under study were affected by oil price shocks adversely. Papapetrou (2009)

carried out an attention-grabbing study which analyzed the relationship between oil price shocks and economic growth from the period 1982:1 till 2008:8 in Greece. The study revealed that consumption of oil amounted to 64% of total energy that was consumed in Greece in the year 2006. The trend of this relationship and probable asymmetries amongst prices of oil and economic transactions were determined by the aid of a regime-switching model and threshold model. Finally, the outcome of the study revealed that economic transactions in Greece were adversely affected beyond 3% month to month surges in prices of oil and oil volatility rising above 2.4% within one year.

### **2.3.5 Flow Demand Shocks**

The evidence for 1973/74 suggests that a common flow demand shock associated with the global business cycle rather than oil-market specific supply shocks is at least partially responsible for many major oil price increases. Flow demand refers to the demand for oil to be consumed immediately in the process of producing refined products such as gasoline, diesel, heating oil, kerosene, or jet fuel. As the global economy expands, flow demand for oil increases because oil is a necessary ingredient for the modern economy. Hence, it is not surprising that the real price of oil, all else equal, depends on the state of the global economy. Nevertheless, the role of flow demand for the real price of oil was not appreciated for a long time. It was first identified as a major determinant of the real price of oil by Barsky and Kilian (2002). Barsky and Kilian relied on indirect evidence including the striking co-movement in oil and other commodity prices to show that the major oil price fluctuations in the 1970s and early 1980s appear associated in large part with fluctuations in the global business cycle.

Only since Kilian (2009a) have researchers been able to directly quantify the importance of flow demand shocks for the evolution of the real price of oil. This study proposed a structural vector autoregressive (VAR) model of the global market for crude oil since 1973 that allows one to decompose the evolution of the real price of oil into distinct components associated with demand and supply shocks. Kilian (2009a) showed that most large and persistent fluctuations in the real price of oil since the 1970s have been associated with the cumulative effects of oil demand rather than oil supply shocks, complementing the results in Kilian (2008a,b) on the role of exogenous oil supply shocks. The methodological approach introduced in Kilian (2009a) has been refined in recent years, but the substance of the findings has remained intact. For example, Kilian and Hicks (2013) show the pattern of flow demand shocks during 2003-08 to be consistent with pattern of forecast errors made by professional real GDP forecasters. Kilian and Murphy (2012) examine the robustness of Kilian's (2009) findings to alternative identifying assumptions based on the signs of responses to shocks. Baumeister and Peersman (2013a) in addition allow for time-varying parameters in a similar VAR model. Kilian and Murphy (2013) refine earlier structural oil market models by allowing for an explicit role for speculation in oil markets, again confirming the substance of the earlier results.

In short, these and other studies have provided overwhelming evidence that oil demand shocks collectively explain most major oil price fluctuations since 1973 with a central role played by flow demand shocks. Only for the 1990 episode is there evidence of flow supply shocks having played a non-negligible role (Kilian and Murphy 2013). Whereas the idea that flow demand shocks can explain major oil price fluctuations was met with great skepticism when it was first proposed by Barsky and Kilian (2002), this view has become the conventional view today.

### 2.3.6 Causes and Consequences of Exogenous Oil Price Shocks

Reflecting the preoccupation of many economists with exogenous OPEC supply shocks in oil markets, much of the early literature on the transmission of oil price shocks focused on models with exogenous oil prices. Often the real price of oil is modeled as an exogenous autoregressive-moving average (ARMA) process (e.g., Atkeson and Kehoe 1999, Leduc and Sill 2004). Indirectly it is recognized in these models that demand is not a factor that alters the real price of oil and as such oil price shocks are alike and influenced by supply shocks. As argued previously, the conventional outlook has been knocked over in the modern oil market literature.

However, we maintain the abridging assumption of an exogenous real price of oil due to its simplification of the exposition of the rudimentary mechanisms of the transmission of oil price shocks. We abstract from other changes in the economy often associated with an oil price shock influenced by flow demand, as though in entirety oil price shocks were by exogenous flow supply shocks.

The implications of an oil price shock on an economy depend to a large extent on the importance of oil as factor of production (LeBlanc & Chinn, 2004) and the state of the macroeconomy.

Crude oil is a very important factor of production which has led the government to subsidize petroleum product prices to an estimated annual average of 2.3 percent of GDP until 2005. This is reflected in the table as the consumption of oil has increased from about 27 thousand bbl per/day in 1995 to 47 thousand bbl/day in 2005. Out of this about 39 thousand bbl were imported per day

which accounted for up to over 21% of total imports for the fiscal year, implying that unexpected increases in world oil prices can adversely affect the terms of trade and the real economy.

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## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 Introduction

This chapter throws more emphasis on the suitable approach that is adopted to aid achieve the objectives of the study. It will also make known why the specific model was selected, type and source of data.

#### 3.2 Specification of Economic Model

The model for the study is specified based on reviewed literature and critical evaluation of theoretical framework. In view of the fact that the main objective of the study is to examine the effects of oil price shocks on Ghana's business cycle, the model employs values of real GDP and oil prices.

The Vector Autoregression (VAR) model that was developed by Sims (1980) and has been widely used by (Hamilton, 1983; Mork, 1989; Jimenez- Rodriguez; 2008, Zhang, 2011) in successful studies in examining the impact of oil price volatility on the large-scale economy is adopted for this study as it is not a complicated model to use in analyzing multivariate time series (Luetkepohl, 2011). Brooks (2008) suggests that the VAR model is a systems regression model which fairly merges univariate time series models and simultaneous equation models in such a manner that recent values of variables contained within the model hinge on the past values of their own values and past values of other variables included in the model. The VAR model is considered to be a preferable method for examining the long-run nexus due to its ability to approximate well the

unknown model of true economic structure by considering non-static interactions amidst the system into account. The variables handled in the VAR model are considered to be endogenous, without any inflicted structural relationships or limits. The VAR model of order  $p$  takes the form

$$y_t = c + \sum_{i=1}^p \varphi_i y_{t-i} + \varepsilon_i \dots \dots \dots (3.1)$$

where,  $y_t = (y_{1t}, \dots, y_{nt})$  is a  $(n \times 1)$  vector of endogenous variables,  $y_{t-i}$  is the corresponding lag terms of order  $i$ .  $c = (c_1, \dots, c_n)$  is the  $(n \times 1)$  intercept vector of the VAR model,  $\varphi_i$  is the  $i^{th}$   $(n \times n)$  matrix of autoregressive coefficients for  $i = 1, 2, \dots, p$ , and  $\varepsilon_i = (\varepsilon_{1t}, \dots, \varepsilon_{nt})$  is the  $(n \times 1)$  generalization of a white noise process.

The model is further specified to consider the macroeconomic variables the study employs. Thus,

$$LGDP = \beta_0 + \beta_1 OP + \beta_2 LREEX + \beta_3 LINT + \beta_4 LUNEMP \dots \dots \dots (3.2)$$

The variables are logged so as to ensure that the variables have a common unit of measurement and also help reduce heteroskedasticity which is likely to manifest in the model.

### 3.3 Data and Sources

In order to achieve the main objective which is to examine the relationship between oil price and business cycle, secondary data was employed. The study uses annual multivariate time series data that spans from 1970-2016 so as to capture the period of the first oil price shock that occurred in 1973/1974. Data used for the study was sourced from World Development Indicators of the World Bank and. The study made use of real GDP, oil prices (OP), real interest rate (INT), real effective exchange rate (REEX), unemployment (UNEMP).

Real GDP is used as a proxy for aggregate economic activities so as to produce a precise correlation between the variables, independent from price variations.

Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs (WDI, 2016).

Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator (WDI, 2016).

Unemployment refers to the share of the labor force that is without work but available for and seeking employment (WDI, 2016).

Oil prices (OP) which is employed in the study as the main independent variable is the international price of crude oil in a particular year and sold in \$/bbl.

### 3.4 Measuring Oil Price Shocks

Mork (1989), Lee *et al.* (1985) and Hamilton (1986) postulated that there is an asymmetry relationship between oil price and economic growth. However, a distinct asymmetry model of oil price shocks was employed by these authors. The study follows the path as used in a lot of literature which included a model for both symmetry and asymmetry relationship. The symmetry model for the oil price shocks is given as;

$$dOil_t = \ln Oil_t - \ln Oil_{t-1} \dots\dots\dots(3.3)$$

On the contrary, the asymmetry model for the oil price shocks is given as

$$ROILP_t^+ = \max (0, (roil_{pt} - roil_{pt-1})) \dots\dots\dots (3.4)$$

Thus when there is a rise in real oil prices, or,

$$ROILP_t^- = \max (0, (roil_{pt} - roil_{pt-1})) \dots \dots \dots (3.5)$$

Thus when there is a fall in real oil prices.

where  $roil_{pt}$  is the log of oil at period t,  $ROILP_t^+$  is the rise in real oil price and  $ROILP_t^-$  is the fall.

### 3.5 Stationarity Tests

When running a time series analysis, it is key to examine the stationarity of all variables that is considered for the study. This is because non-stationary series sets the tone for statistically spurious relationships, thus, precise economic deductions cannot be derived from the data since it comprises means and variances that are invariable over time. For example, when an oil shock persists it will be immeasurable for a non-stationary series. Hence it is important to ensure the VAR model constructed is devoid of unit roots. Running a stationarity test gives a clue of the right estimator to employ and helps to determine the order at which the variables are integrated.

The Augmented Dickey-Fuller (ADF) test was employed so as to analyze whether there is the presence of unit roots in the data, thus testing the null hypothesis. The ADF displays various results subject to the assumption that the time series have a time-trend and or an intercept. If there exists in the data a long-term rise or fall, the model should contain a time-trend which can be determined by studying the data's graph. Furthermore, there is the need to incorporate an intercept if the mean of the series is not closer to zero (Verbeek, 2008).

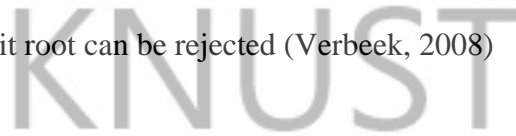
Taking into account a model with two lags, thus AR (2), the unit root test in the Augmented Dickey-Fuller is modelled as;

$$\Delta y_t = \lambda + \delta t + \Phi y_{t-1} + \Phi \Delta y_{t-1} + \Phi \Delta y_{t-2} + \varepsilon_t \dots \dots \dots (3.6)$$

Where  $y_t$  is the dependent variable,  $\lambda$  is the intercept,  $t$  is the time trend,  $\Delta$  is considered to be the differencing operator and  $\varepsilon_t$  is the white noise. The unit root test is undertaken under the null hypothesis  $H_0: \Phi = 0$  ( $y_t$  has a unit root)

$$H_1: \Phi < 0 \text{ (} y_t \text{ has no unit root)}$$

This implies the existence of a unit root can be rejected (Verbeek, 2008)



### 3.6 Cointegration Test

When running a multivariate time series data, it is essential to run a cointegration test to check whether there is a statistically significant long-run relationship between the variables used in the model or not. The theory of cointegration is in principle a statistical illustration of a condition in which the variables in the hypothesized relationship ought not to digress from each other in the long run, or in the short-run, if the variables ought to digress from each other, the digression should be constrained and declining stochastically as time approaches (Banerjee et al., 1993).

According to Johansen (1988), cointegration and VAR method can be employed to demonstrate the long-run and short-run relationships between non-stationary variables. Hence the study adopts the Johansen cointegration test to determine the long-run relationship amongst the variables. The long-run relationships are often postulated by economic theory in which the theory assumes that the presence of a steady relationship that connects the variables in use. The VAR model used in running the cointegration test considers a set of variables  $y$  and of order  $q$  which is expressed as;

$$y_t = \lambda + \Pi y_{t-1} + \sum_{i=1}^{q-1} \Delta y_{t-i} + \varepsilon_t \dots \dots \dots (3.7)$$

where,

$$\Pi = \sum_{i=1}^{q-1} \Pi_{i-1} \text{ and } \Gamma = - \sum_{j=i+1}^p \Pi_j$$

If the coefficient matrix  $\Pi$  has a reduced rank,  $r < n$ , it implies that there exist a  $n \times r$  matrices  $\alpha$  and  $\beta$  which have rank such that,  $\Pi = \alpha\beta'$  and  $\beta'$  is stationary. Where  $r$  represents the number of cointegrating relationship, the entries of matrix  $\alpha$  are the adjustment parameters in the Vector Error Correction Model (VECM) and  $\beta$  is a cointegration vector.

### 3.7 Vector Error Correction Model (VECM)

When constructing a Vector Error Correction Model (VECM) it is necessary to first of all consider the lag selection as the lag selection can have an effect on the outcome of the data analyzed and then proceed with the Johansen Cointegration test. The VECM which is a component of the VAR model helps in establishing a long-run relationship amongst the variables employed by the study.

### 3.8 Cyclical Co-movement Analysis (CCA)

The Cyclical Co-movement Analysis (CCA) includes assessing the dynamic relationship that exist amongst the sequence in the business cycle to measure the extent of co-movement. The main purpose of running a CCA is to evaluate how and to what extent the cycle of crude oil prices is in lead, harmony or is lagging the cycles of the macroeconomic variables employed by the study. The Hodrick and Prescott (1980) filter (HP) was used to measure the extent of co-movement in the study.

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Introduction

This chapter presents the results obtained from the study and discusses into detail the various components of the results. The results of stationarity test carried out on the variables employed by the study is presented first and followed by that of cointegration. The results of long-run and short-run relationships are captured in this chapter.

#### 4.2 Stationarity Test

The stationarity test was carried out on the time series data obtained to ensure stability of all variables used so as to prevent a spurious outcome. This was achieved by using the Augmented Dickey Fuller. For stability of the variables, absolute values of the test statistics should be greater than that of the critical value at 5% significance level. However, at levels, the test statistics of variables employed were less than that of critical value at 5% significance level hence the first difference was taken on all variables and were stable. In stationarity test, variables that are stable at levels are described to be integrated of order zero, thus  $I(0)$ . On the contrary, when variables are only stable after being differenced, they are described as being integrated at order (1).

**Table 4.1.1 ADF UNIT ROOT TEST AT LEVELS**

Variables	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
LRGDP	2.055	-4.187	-3.516	-3.190
LOP	-2.717	-4.187	-3.516	-3.190
LREEX	-3.361	-4.187	-3.516	-3.190
LINT	-3.513	-4.187	-3.516	-3.190
LUNEMP	-2.587	-4.187	-3.516	-3.190

Source: Author's

**Table 4.1.2 ADF UNIT ROOT TEST AT DIFFERENCING**

Variables	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
LRGDP	-4.156	-4.196	-3.520	-3.192
LOP	-7.027	-4.196	-3.520	-3.192
LREEX	-6.136	-4.196	-3.520	-3.192
LINT	-9.988	-4.196	-3.520	-3.192
LUNEMP	-10.564	-4.196	-3.520	-3.192

Source: Author's

### 4.3 Selection of Lag Length

The lag length was selected based on information criteria by Likelihood ratio (LR), Final prediction Error (FPE), Akaike information criterion (AIC), Hannan-Quinn information criterion HQIC and Schwarz information criterion (SC). Out of forty-three observations, LR suggested that

four lags be chosen, FPE suggested one lag be chosen, AIC suggested three lags be chosen, HQIC suggested one lag be chosen and SC also suggested one lag be chosen respectively. However, three lags were chosen as 5 of the criteria did not choose at least one from lag two. Again three lags were chosen to avoid the potential of spurious results as the number of lags chosen are likely to affect the results obtained.

**Table 4.2 LAG SELECTION CRITERIA**

Lag	LOG L	LR	FPE	AIC	HQIC	SBIC
0	-1867.23	-	4.5e+31	87.0804	87.1559	87.2852
1	-1643.72	447.01	4.5e+27*	77.8475	78.3007*	79.0763*
2	-1618.23	50.984	4.6e+27	77.8246	78.6554	80.0773
3	-1591.5	53.468	4.8e+27	77.744*	78.9523	81.0206
4	-1566.94	49.102*	6.4e+27	77.7649	79.3508	82.0655

Values with \* indicates the lags chosen by the five lag selection criteria

Source: Author's

#### 4.4 Cointegration

One precondition which sets the tone for the Johansen cointegration test is that, all variables should be non-stationary at levels and integrated at same order but not at difference. The variables however were not stable at levels but rather at difference which necessitated running of the cointegration test. The Johansen cointegration test was used to test if there exist a long-run relationship amongst the variables employed in the study. Values from the trace statistic and maximum statistics suggested that there is one cointegration model in the system. This implies there is a long-run relationship amongst the variables and hence implies that we reject the null hypothesis that there is no long run relationship amongst the variables.

**Table 4.3.1 JOHANSEN'S TEST FOR COINTEGRATION (TRACE TEST)**

Maximum Rank	Trace Statistic	1% Critical Value	5% Critical Value
0	86.2235	76.07	68.52
1	30.1406**	54.46	47.21
2	8.6219	35.65	29.68
3	1.7250	20.04	15.41
4	0.0000	3.76	6.65

Value with \*\* indicates it was significant at both 1% and 5%

Source: Author's

**Table 4.3.2 JOHANSEN'S TEST FOR COINTEGRATION (MAXIMUM TEST)**

Maximum Rank	Max Statistic	1% Critical Value	5% Critical Value
0	56.0829	38.77	33.46
1	21.5187	32.24	27.07
2	6.8968	25.52	20.97
3	1.7250	14.07	18.63
4	0.0000	3.76	6.65

Source: Author's

#### 4.5 Short-Run Relationships

The Vector Error Correction Model (VECM) was used to run the short-run relationship test since a significant relationship was established by the test for long run. The results of the test revealed

that lag 1 and lag 2 of real GDP are jointly zero which is the null hypothesis that real GDP has no short-run relationship running against itself. The decision hence implies that we fail to reject the null hypothesis as it is insignificant at 5%.

The results of the test revealed that lag 1 and lag 2 of oil price are jointly zero which is in line with the null hypothesis that real GDP has no short-run relationship running against oil price. The decision hence implies that we fail to reject the null hypothesis as it is insignificant at 5%.

Again, results of the test revealed that lag 1 and lag 2 of running real effective exchange rate are jointly zero which is in line with the null hypothesis that real GDP has no short-run relationship running against real effective exchange rate. The decision hence implies that we fail to reject the null hypothesis as it is insignificant at 5%.

Also, results of the test revealed that lag 1 and lag 2 of running real interest rate are jointly zero which is in line with the null hypothesis that real GDP has no short-run relationship running against real interest rate. The decision hence implies that we fail to reject the null hypothesis as it is insignificant at 5%.

Finally, results of the test revealed that lag 1 and lag 2 of running unemployment are jointly zero which is in line with the null hypothesis that real GDP has no short-run relationship running against unemployment. The decision hence implies that we fail to reject the null hypothesis as it is insignificant at 5%.

#### 4.4. VECM Short-run Relationship Analysis

Variables	Coefficient	Std. Err.	P-Value
GDP	0.0024196	0.0033991	0.477
OP	2.88e-11	4.17e-11	0.49
REEX	-9.49e-09	2.97e-09	0.46
INT	-2.54e-10	4.22e-11	0.48
UNEMP	3.94e-13	9.40e-12	0.967

Source: Author's

#### 4.6 Cyclical Co-movement Analysis

To determine the cyclical co-movement, a cross correlation of the variables were computed. The results shows how the various variables used move with each other. Real effective exchange rate have a positive correlation coefficient with Real GDP at a rate of 23.88% which implies that real effective exchange rate is procyclical to output. Real interest rate also have a positive correlation coefficient with Real GDP and co-move at a rate of 76.89% but co-move with real effective exchange rate at a rate of 66.56%. Oil price have a positive coefficient correlation with real GDP which implies that it is procyclical to output and move at a rate of 60.01%, but exhibits a negative coefficient correlation with real effective exchange which implies that oil price is counter-cyclical to real effective exchange rate at a rate of -1.49%, while it exhibits a positive coefficient correlation with interest rate at a rate of 32.56%. This implies that an increase or decrease in oil price will cause an increase or decrease in output and hence cause an expansion or contraction in the business cycle. Unemployment have a positive coefficient correlation with GDP at rate of 46.81%, real

effective exchange rate at a rate of 36.31%, real interest rate at a rate of 71.06% and oil price at a rate of 5.41%.

**Table 4.5 CROSS -CORRELATION OF VARIABLES**

Variables	GDP	REEX	INT	OP	UNEMP
GDP	1.0000	-	-	-	-
REEX	0.2388	1.0000	-	-	-
INT	0.7689	0.6656	1.0000	-	-
OP	0.6001	-0.0149	0.3256	1.0000	-
UNEMP	0.4681	0.3631	0.7106	0.0541	1.0000

Source: Author's

#### 4.7 Variance Decomposition

The variance decomposition analysis is carried out to analyze and appreciate the percentage of the changes in the dependent variable as a result of its own shocks or innovation or as a result of shocks or innovation to other variables under study (Brooks, 2008). Our attention is in the percentage of the predicted variance in other variables is accounted for by the shock.

From table 4.7, it can be deduced that the shocks or innovations in real GDP is largely accounted by the past values of itself by 93.891% and by the past or current values of oil price, real effective exchange rate, real interest rate and unemployment by 0.127%, 0.009%, 5.069% and 0.904% respectively.

The innovations or shocks in oil price is largely accounted by the past values of itself by 71.307% and by the past or current values of real GDP, real effective exchange rate, real interest rate and unemployment by 27.371%, 0.458, 0.486 and 0.377% respectively.

The innovations in real effective exchange rate is largely accounted by the past values of itself by 65.941% and by the past or current values of real GDP, oil price real interest rate and unemployment by 14.635%, 4.108%, 4.294 and 11.020% respectively.

The innovations in the real interest rate is accounted largely by the past values of itself by 76.451% and by past or current values of real GDP, oil price, real effective exchange rate and unemployment by 4.949%, 0.889%, 0.960% and 16.751% respectively.

The shocks in unemployment is largely accounted by past values of itself by 72.528% and by real GDP, oil price, real effective exchange rate and real interest rate by 9.055%, 6.039%, 4.649% and 7.727% respectively.

**Table 4.6 VARIANCE DECOMPOSITION (VDF) ANALYSIS**

Dependent Variable	PERIOD	GDP	OP	REEX	INT	UNEMP
GDP	10	93.89106	0.127015	0.008686	5.069689	0.903553
OP	10	27.37094	71.30767	0.458007	0.485600	0.377787
REEX	10	14.63540	4.108496	65.94081	4.294914	11.02038
INT	10	4.948820	0.888938	0.960266	76.45115	16.75083
UNEMP	10	9.054564	6.039279	4.649117	7.728603	72.52844

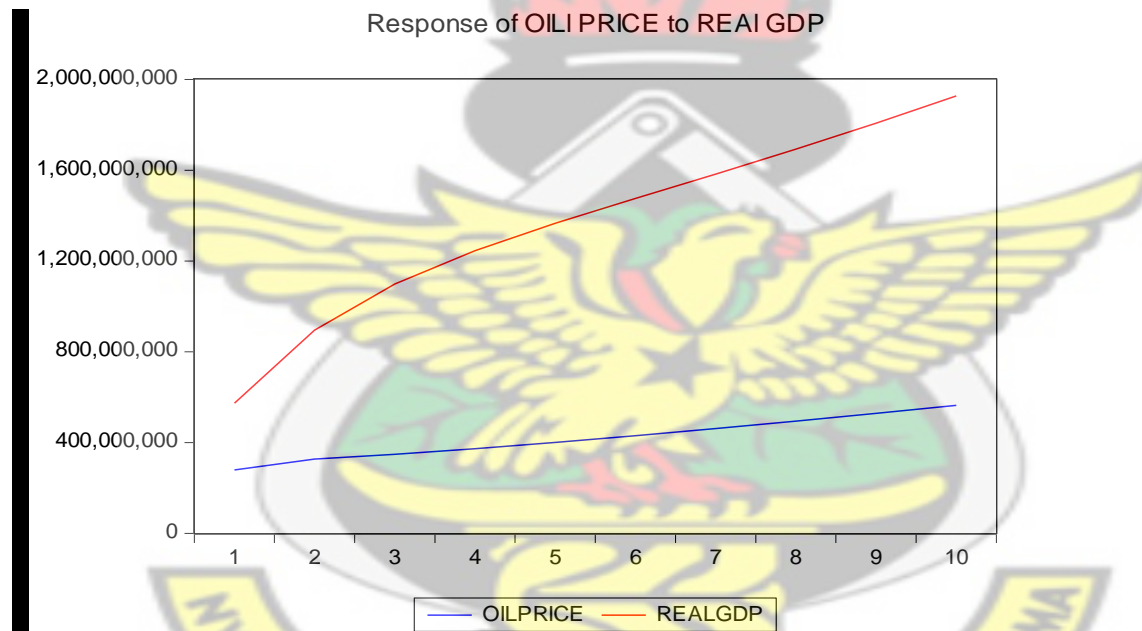
Source: Author's

#### 4.8 Results of Impulse Response Function

The impulse response function helps to explain the responsiveness of a variable to a standard deviation shock or innovation in a variable within the Vector Autoregression system. Thus, we estimate the effects on the VAR system if a unit shock is applied to a particular macroeconomic variable.

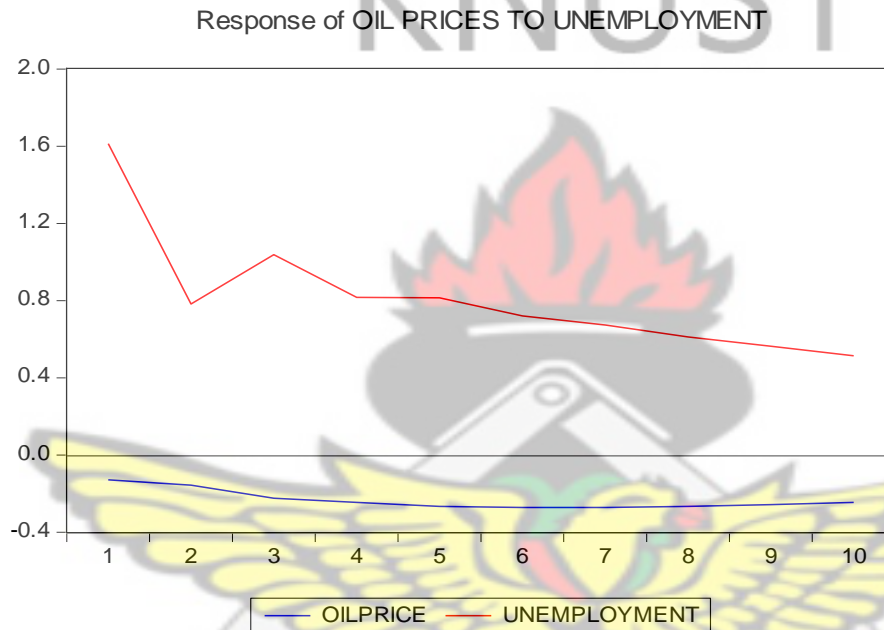
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**Figure 4.1 Impulse Response Function of Real GDP to Oil Price**



The impulse response function in Figure 4.1 indicates that, a one unit positive oil price shock causes an increase in real GDP.

**Figure 4.2 Impulse Response Function of Unemployment to Oil Price**



The impulse response function from Figure 4.2 indicates that a one unit oil price shock has a permanent negative effect on unemployment. Thus, as oil price falls, unemployment becomes negative. A rise in oil price however, does not necessarily cause an increase in unemployment. This implies that, oil price fluctuations causes a downward trend of unemployment although such a trend is permanently negative.

# CHAPTER FIVE

## CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Introduction

This chapter summarizes the entire study conducted and brings to bare the findings made by the study, conclusion and recommendation which is relevant to inform policy makers on what decision to take.

### 5.2 Summary

The stationarity test carried by the study employed the Augmented Dickey Fuller (ADF) test to test for the stability of the variables employed by the study. The results revealed that, all variables employed were not stable at levels but rather at first differencing. The inability of the variables to be stationary at levels necessitated the introduction of the Johansen's cointegration test. The Johansen's test analyzed if there exist a long-run causality amongst variables or not. The results revealed that there exist one cointegration model in the equation but then no significant long-run causality was established amongst all variables employed by the study.

Results from the cyclical co-movement analysis revealed that oil price have a positive coefficient correlation with real GDP, real interest rate and unemployment and hence makes oil procyclical to

these variables. On the contrary, oil price had a negative coefficient correlation with real effective exchange rate hence it is counter-cyclical to real effective exchange rate.

Results obtained from the impulse response function indicates that, a positive oil price shock causes an increase in real GDP, while an oil price shock has a permanent negative effect on unemployment. Thus, as oil price falls, unemployment becomes negative. A rise in oil price however, does not necessarily cause an increase in unemployment. This implies that, oil price fluctuations causes a downward trend of unemployment although such a trend is permanently negative.

### **5.3 Conclusions**

The main objective of the study was to analyze the effects oil price pose on macroeconomic aggregates in Ghana. This was achieved by using annual time series data from 1970-2016 which was extracted from the World Bank's World Development Indicator (WDI). All variables employed by the study were not stationary at levels but were stationary after first differencing using the Augmented Dickey Fuller test.

The Johansen cointegration test was employed to examine if there exist a long run relationship among the variables. The Johansen cointegration test results revealed the existence of one cointegration model in the system which implied there was a significant long run relationship amongst the variables in the long run. The existence of at least one cointegration model in the system necessitated the estimation of the VECM. In the long run, it was established that oil price

do have a significant effect on macroeconomic aggregates in Ghana. In the short run the results of the study revealed no significant relationship.

In summary, an increase in oil prices cause a great effect on macroeconomic aggregates in Ghana as it is established that oil price shocks have a negative relationship with growth in output.

#### 5.4 Recommendations

Ghana should consider broadening its energy mix by exploring the other sources of energy available to avoid being effected by oil price shocks. Renewable energy can be considered as it is environmental friendly and have a high energy security.

Proper attention should be given to risk management strategies such as hedging of oil resources to prevent the economy from being hit by an oil shock. Physical oil reserves in Ghana should be equipped with sophisticated machines and equipment so the reserves would have the capacity to store and process oil for use in the event of scarcity which often leads to shocks in oil prices.

Policy makers should consider implementing policies and regulations that will ensure efficient use of crude oil especially in the production sector of the economy, government agencies and institutions.

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