UNIVERSITY OF CAPE COAST

DIFFERENTIAL IMPACT OF OIL PRICE SHOCKS ON EXTERNAL BALANCE, STOCK MARKET, INFLATION AND OUTPUT IN GHANA

BY

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Thesis Submitted to The Department of Economics of the Faculty of Social Sciences, College of Humanities and Legal Studies, University of Cape Coast, In Partial Fulfilment of the Requirements for the Award of Doctor of Philosophy Degree in Economics

February 2018

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

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Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

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ABSTRACT

Crude oil is an essential commodity for the growth and development of Ghana's economy. Studies that examine the effect of oil price fluctuations on Ghana's economy have mainly focused on analysing the effect of changes in the price on output and inflation. Oil prices are however driven by supply and demand factors. This implies that impact of oil price fluctuations on an economy may be different depending on its source (demand or supply). This study examines the differential impact of origin of oil price shocks on external balance, stock market activity, inflation and output in Ghana. Using an SVAR model, oil price shocks is decomposed into oil supply shocks, aggregate demand shocks and oil market specific demand shocks. Their impacts on external balance, stock market activity, inflation and output were analysed using a combination of ARDL, Markov Switching models, impulse response and variance decomposition analysis. The results of the study revealed oil price shocks tend to have differential impact on external balance, stock market activity, inflation and output in Ghana. Specifically, oil demand shock was found to have positive effect on external balance whilst the effect of oil market specific shock was found to have negative effect on external balance. The effect of oil supply shock on external balance was mixed. In terms of stock market activity, oil demand shock was found to positively affect stock market activity whilst the effect of oil market specific demand shock was mixed. The effects of oil demand shock on output was positive whilst its effect on inflation was mixed. On the other hand, the effect of oil market specific demand shocks was inflationary and output depressing. The study therefore recommends that policy initiatives to minimise the effect of oil price hikes should take into account the source of the price shock.

KEYWORDS

Economic Activity

External Balance

Inflation

Monetary Policy

Oil Price Shocks

Stock Market Activities

ACKNOWLEDGEMENTS

I wish to express my deepest gratitude to my principal supervisor, Dr. Camara K. Obeng for his eruditeness, commitment and encouragement. My Co-supervisor, Dr. William G. Brafu-Insaidoo, whose careful supervision and instructions helped me in completing this work on time.

I am also grateful to my mentor, Prof. Samuel K. Annim and my external advisors Dr. Hove Seedwel and to Dr. Christian R. Ahortor for their support, constructive criticism, patience, due diligence and comments that helped structured this thesis.

My Senior colleagues in the Department of Economics, University of Cape Coast, especially Dr. Emmanuel Ekow Asmah; Head of Department, Dr. Ferdinand Ahiakpor, Dr. James Atta Peprah, deserve a special gratitude for encouraging me to work hard on my thesis.

The administrative staff of the Department of Economics, UCC also deserve special commendations for their support. I am indebted to all of them especially Mrs Stela Oduma Nyarko.

Finally, I would like to acknowledge the support from my dad, Mr. James Jerry Cantah, my mom, Mrs Charlotte Cantah and my wife Mrs Gifty Boatemah Obeng-Cantah.

DEDICATION

To my son Ato-Kwamena Bradford Cantah

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LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
BP	British Petroleum
BOG	Bank of Ghana
BW	Bandwidth
CPI	Consumer Price Index
CEPA	Centre for Policy Analysis
ECM	Error Correction Model
ECT	Error Correction Term
ERP	Economic Recovery Programme
GDP	Gross Domestic Product
GEC	Ghana Energy Commission
GEM	Global Economic Monitor
GSE	Ghana Stock Exchange
GSS	Ghana Statistical Service
IMF	International Monetary Fund
HIPC	Highly Indebted Poor Country
LCPI	Log of Consumer Price Index
LPG	Liquefied Petroleum Gas
LOP	Log of Crude oil price

MPC	Monetary Policy Committee
MPR	Monetary Policy Rate
NPA	National Petroleum Authority
PP	Phillips-Perron
PPI	Producer Price Index
OECD	Organisation of Economic Co-operation and Development
OPEC	Organisation of Oil Exporting Countries
OLS	Ordinary Least Square
SAP	Structural Adjustment Programme
SBC	Schwartz-Bayesian Criterion
SIC	Schwarz Information Criterion
TFP	Total Factor Productivity
SVAR	Structural Vector Auto Regressive
VAR	Vector Auto Regressive
VECM	Vector Error Correction
WDI	World Development Indicators

CHAPTER ONE

INTRODUCTION

Background to the study

The role of crude oil in the growth and development process of an economy cannot be overemphasised. The importance of crude oil as an essential input of production has been soaring since 1859 after an oil discovery at Pennsylvania, USA. Crude oil serves as an input of production in almost every sector of an economy (Agricultural, Industrial and Services) with little or no substitutes. Thus, most economies that tend to depend on crude oil as their main source of energy, whether an importer or exporter, are usually vulnerable to fluctuations in the price of the commodity. Following the first oil price shocks of the 1970s, for example, major economies such as the United States and the United Kingdom witnessed declines in economic growth, increased in unemployment rate and a rise in the general prices of goods and services. In fact, it was during this period that these economies experienced what became known as stagflation. The effect of the oil price shocks of the 1970s provided some form of catalyst for economic research to be focused on the effect of oil price hikes on economic activities. After the seminal work of Hamilton (1983), a number of research works on the effect of oil price shocks on macroeconomic activity have been conducted.

One clear view in both theoretical and empirical literature is that oil price shocks tend to have adverse effects on economic activity. The effect of an oil price shock on economic activities is transmitted through demand and supply channels. As a basic input of production, oil price shocks could lead to an increase in the cost of production. High cost of production compels profit maximising producers to reduce their production and employment levels. This in tend reduces the availability of goods and services (supply) and hence economic activities tends to decline. Thus, productive capacity may decline as economic activities become sluggish due to high cost of production. In addition, oil price shocks may increase uncertainty in investment leading to the postponement of irreversible investments which could have adverse effects on output.

Irreversible investments in the economy could also be affected through the effect of oil price shocks on stock price. Stock markets are known to have informational efficiency; hence, stock prices are fairly expected to reflect all current and available information including oil price shocks. Theoretically, oil price shocks affect stock market prices via their effects on expected earnings (Huang, Masulis, & Stoll, 1996). Thus, depending on the level of informational efficiency of the stock market and the number of firms on the stock market that depend on crude oil as an input of production, an oil shock could adversely affect investments that go into the stock market as well as output levels within the economy.

On the demand side, Jiménez-Rodríguez and Sanchez (2005) argued that oil price shocks indirectly affect the consumption of goods and services through its effect on disposable income. Thus, an oil price shock causes disposable income to fall which also compels consumers to postpone their consumption. This situation has the potential to cause economic activities to be sluggish. In addition, oil price shocks could increase uncertainty about the future outlook of the economy, and this could induce consumers to save as a precautionary measure, hence, it will adversely affect economic activities. Hamilton (2005) emphasised the indirect effect arising when patterns of consumption expenditure change. Changes in the pattern of expenditure will disrupt sectoral allocation of resources and result in reductions in consumption as well as increase in unemployment in the presence of friction in both labour and capital markets.

Das, Bose and Bhanumurthy (2014) also identified trade as the third channel by which oil price shocks could affect an economy. They noted that once crude oil is a key part of the import basket an increase in the price of crude oil could have significant effect on the trade balance of the economy. Kilian, Rebucci and Spatafora (2009) noted that a common premise in policy discourses is that oil price shocks tend to have large and usually harmful effects on external balance. This according to them compels countries to borrow from abroad to offset the adverse terms of trade shocks.

It is clear from the discussions above that oil price shocks can have adverse effects on the progress of an economy from all angles. It is important, however, to note that changes in oil price just like the price of any other commodity is affected by demand and supply conditions in the market. As such, changes in the price of oil may be a reflection of demand and supply conditions in the oil market. Thus, analysing the effect of oil price shocks on economic activities as if economic activity only responds to exogenous changes in the price of crude oil may be misleading (Kilian, 2009a).

An oil price shock which is as a result of high demand for oil, implies that there is expansion in world economic activity and with crude oil being an essential input of production, demand for the commodity goes up. This tends to put an upward pressure on the price of the commodity. Hence, the effect of such price increase may not necessarily result in reduction in economic activity as theoretically postulated by a number of expositions above (see Kilian, 2009a). On the other hand, when the price shock is as a result of shortage in the supply of the commodity, it implies that there is a reduction in the production of crude oil. Since oil is an essential input of production, reduction in its availability and price has the potential to have an adverse effect on economic performance. This implies that depending on the source of an oil price shock, it may not have the same effect on economic activity. LeBlanc and Chinn (2004) have however noted that the effect of oil price shocks on economic activity at any point in time depends on the importance of crude oil in the production and consumption process of an economy.

The importance of crude oil to the Ghanaian economy cannot be overemphasised. It has over the years become one of the most important input of production in the Ghanaian economy. In fact, the consumption of crude oil and its related products in Ghana has increased from 750 thousand tonnes a day in 1972 to over 4000 thousand tonnes per day by the end of 2014 (IEA, 2016). Crude oil is relatively the largest source of energy in Ghana. It provides up to 45 percent of the country's energy needs with the remaining 55 percent provided by Biomass (40%), Hydro (8%) and Natural gas (7%) respectively. In addition, crude oil and its related products accounts for close to 50 percent of electricity generation in Ghana (Energy Commission of Ghana, 2016).

In terms of the real sector of the Ghanaian economy, crude oil provides close to 100 percent of the total energy in the Agricultural and Transportation sectors of the Ghanaian economy. Also crude oil provides up to 38.4 and 4.1 percent of the total energy requirement of the industrial and commercial sectors of the Ghanaian economy (Energy Commission of Ghana, 2016). Crude oil is, thus, an essential input of production and has the ability to affect demand and supply sides of the Ghanaian economy.

Despite the recent discovery of crude oil in the country and the key role of oil in the Ghanaian economy, Ghana largely depends on imported crude oil to meet domestic demand for the commodity. In 2009, for example, import of crude oil and its related products accounted for over 18 percent of merchandise imports. This increased to 20.5 percent in 2011 and steadily to over 25 percent by the end of 2014 (Bank of Ghana, 2014, 2015a). Thus, increases in the price of crude oil could lead to the deterioration of Ghana's external balance position.

Under a reasonable assumption of inelastic demand for crude oil (Hamilton, 2008), high oil prices would more likely contribute to worsen trade deficit position of the Ghanaian economy. This could also lead to the deterioration of the exchange rate and lead to higher domestic prices and ultimately affect the growth of the economy. For example, the annual report of the Bank of Ghana (2012) indicated that higher crude oil prices resulted in a 47 percent increase in oil imports in 2011. This, according to the Bank, was the major contributor to the trade deficit in 2011, which increased from US$2,962 million in 2010 to US$3,052.3 million at the end of 2011. With the continuous rise in the price of the of the economy do not always move in the same direction. Figure 1 shows that between 2009 and 2011 oil price and the value of oil imports in Ghana moved in the same direction. However, between 2012 and 2014 as oil price declined, the value of oil imports was still on the increase. The increase in the value of oil import could be attributed to a number of reasons. First, it could be as result of the fact that the economy is growing, hence, energy needs of the country increased. Secondly, it could be as a result of the energy crises, which may have compelled policy makers to resort to the use of oil in emergency power plants.

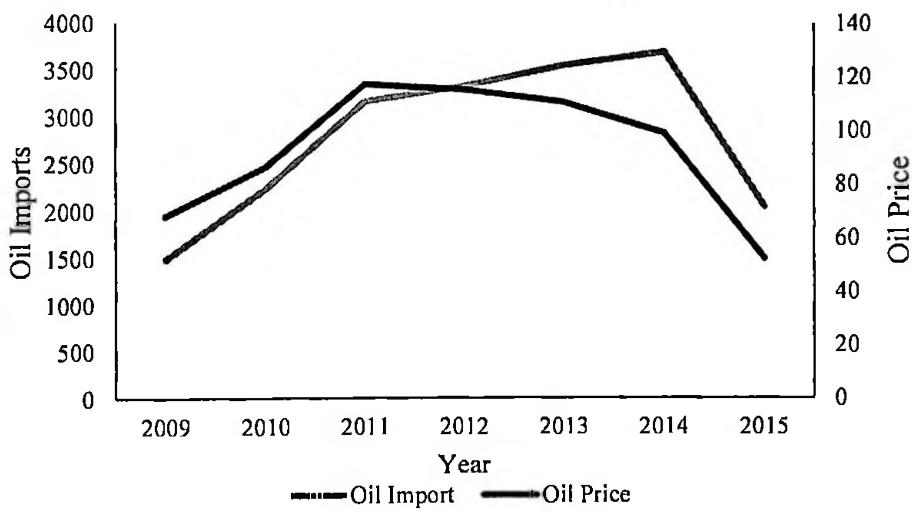

Figure 1: Oil Price and Oil Imports
Source: Bank of Ghana/BP Statistics Review 2016

An examination of Figure 2, which shows the movements in average oil price and Ghana's Trade balance seem to suggest that crude oil price hikes has not always resulted in trade deficits as suggested by a number of Bank of Ghana's Annual reports. For example, rising oil price in 1998-1999, 2001-2002 and 2006-2008 seem to be associated more with improvement in the trade balance of the economy rather deficits. This seem to suggest that not all oil price hikes lead trade deficits and this calls for further examination.

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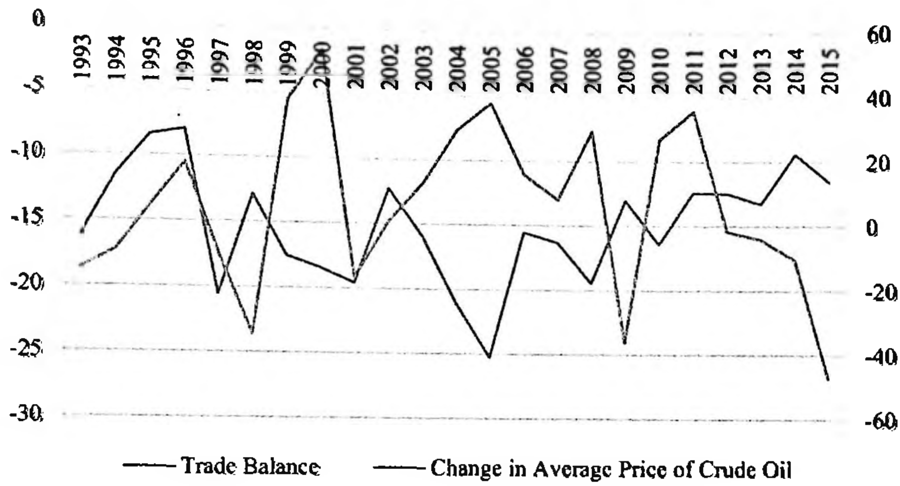

Figure 2: Trade Balance and Average change in Oil Price
Source: World Bank/BP Statistics Review 2016

A twist in Ghana's situation when it comes to the importance of crude oil to the Ghanaian economy is the fact that Ghana is also an exporter of the commodity. Since the country began commercial production of crude oil in 2010, it has grown to become one of the most important export commodities in the Ghanaian economy. The contribution of crude oil to merchandise exports increased from 21.73 percent in 2011 to about 28.2 percent by the end of 2014 (Bank of Ghana, 2015a), making crude oil the second largest export commodity in Ghana after gold. Hence, as an exporter of the commodity, higher price implies more revenue to the economy and improved trade balance.

On one hand, high oil price could contribute to increase in the value of the local currency, which could adversely affect the export of other commodities within the economy and rather encourage importation of goods and services, making the economy prone to external shocks. On the other hand, lower oil prices would tend to have significant negative effect on export earnings and affect revenue generation within the economy. The consistent declines in the price of crude oil in 2015 for example, compelled the Ministry of Finance to revise its projected revenue from oil exports, as captured in the 2015 budget statement, by 64.4 percent (Terkper, 2015). Such unexpected reductions in revenue tend to have adverse effect on export earnings, trade balance, fiscal policies and the growth of the economy as a whole.

Clearly, Ghana presents an interesting case study on the effects of oil price shocks on economic activity given its status as an importer and exporter of crude oil. Reduction in the price of the commodity could affect government spending and this has the potential to cause economic activity to be sluggish.

Apart from the potential effect of changes in the price of crude oil on trade balance, change in the price of the commodity has the potential to affect the growth of the Ghanaian economy. In fact, some economists in time past have attributed poor macroeconomic performance of the Ghanaian economy to hikes in the price of oil. For example, Fosu and Aryeetey (2008) attributed the decline in economic activity in Ghana between 1973 to 1983 partly to the oil price shocks of the 1970s. During this period, per-capita income of Ghana declined by an average of 3 percent per annum, together with some other factors. Inflation rate during this period also rose to an all-time high of 123 percent by the end of 1983. Similarly, following oil price hikes in 2000, economic growth fell from 4.4 percent in 1999 to about 3.7 percent in 2000. Inflation rate during the same period rose to over 40 percent and domestic currency also depreciated by about 80 percent between January 2000 and December 2000.

After a series of stabilisation programmes between 2001 and 2004, the country returned to a stable growth path. This was however disrupted again in 2008 following increases in the prices of food and crude oil in the world market. The price of crude oil reached an all-time high of US$147 per barrel in July 2008. Efforts by the government to subsidise the price of oil related products contributed to a fiscal deficit of over 20 percent of GDP. Inflation also accelerated from 10.9 percent in 2006 to 20.75 percent by the end of 2009. Economic growth during the period also declined from 8.4 percent in 2008 to 4.7 percent at the end of 2009. The domestic currency also saw about 50 percent depreciation against the US dollar between 2008 and the first half of 2009 (Mhango, 2010). The macroeconomic instability and sluggish growth in the Ghanaian economy that usually follow an oil price shock have the potential to increase unemployment and lead to the postponement of irreversible investments, which could further reduce the growth rate of the economy.

The effect of oil price shocks on Ghana's economy (in terms of its impact on growth and general price levels) presents some form of challenge to monetary policy makers. This challenge was clearly indicated by the Bank of Ghana (2004). It noted that the difficulty of an oil price surge for central banks is often problematic from a stabilization policy viewpoint, in the sense that higher oil prices not only push up inflation (thus calling for a rise in interest rates), but also dampen growth (necessitating rates to be lower than otherwise). Thus changes in the price and availability of crude oil has the potential to affect the effectiveness of monetary policy.

An analysis of economic growth rate and percentage change in oil price indicates that economic growth and oil price largely moved in opposite directions (see Figure 3) between 1984 and 2006. Thus oil price increases were usually followed by sluggish economic growth rate. Beyond 2006 however, the movement between crude oil price and economic growth seem to have changed. That is, oil price and economic growth rate began to move in the same direction.

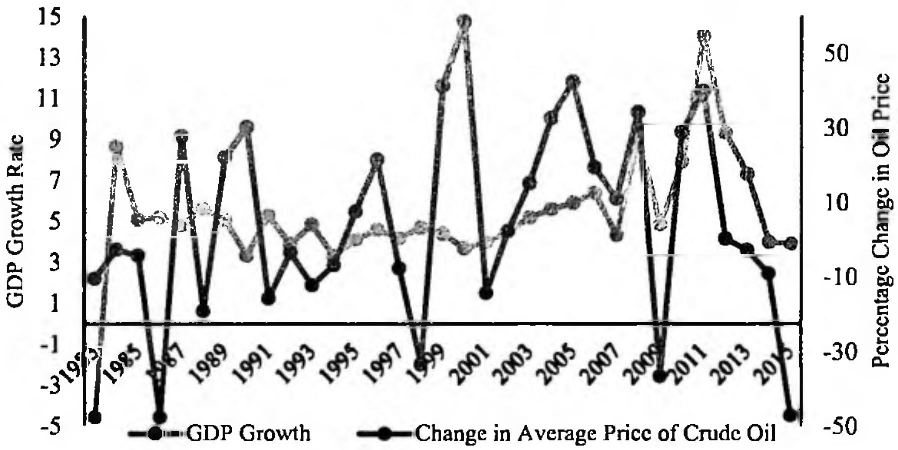

Figure 3: Oil Price and Economic Growth
Source: Bank of Ghana/BP Statistics Review 2016

The change in the direction of the movement between oil price and economic growth rate in Ghana implies the existing views that oil price hikes are usually followed by sluggish performance of the Ghanaian economy may not be the situation that exists now. Seeming change in relationship between oil price hikes and economic growth may be due to the discovery of oil in 2007, which has boosted investment in the oil subsector or probably due to the fact that forces of price increase are not the same as those in the 1990s (Kilian, 2009a). Thus, there is the need for a detailed examination of the way and extent to which the sources of the oil price increase affect the growth of the Ghanaian economy.

Oil price shocks also have the potential of affecting activities in the stock market. This is because oil firms such as Tullow, Ghana Oil Company, Total Ghana Limited, together hold close to 50 percent of the total market capitalisation of the Ghana Stock Exchange as at 2016 (Ghana Stock Exchange, 2016). Thus, changes in the world price of the commodity have the potential to affect the profitability of these firms, which could also affect their stock prices and as such affect activities on the stock market as a whole. In addition, a number of firms listed on the Ghana Stock Exchange (including Anglo Gold Ashanti) basically use crude oil as an input in their production process. Hence, changes in the price of the commodity could also affect these firms in terms of their profitability, stock prices and the stock market in general. It is important to note that the stock market plays a crucial role in the Ghanaian economy by facilitating the transfers of investment funds from investors to firms which are key for the growth of the economy. Investors may, however be very apprehensive to invest their money when they foresee a possible loss of value in the future. Thus, oil price fluctuations could affect the investments that go to the stock market.

Given that the stock market possesses informational efficiency, it has the ability to propagate the impact of oil price shocks on the Ghanaian economy much faster. The impact of oil price shocks on the stock market has the potential to cause reduction in output due to low investments and increased unemployment. Together with the impact of an oil price shock on domestic price levels, trade balance and exchange rate, such shocks could result in stagflation.

Since oil price shocks have the potential to affect trade balance position, stock market activities and the macroeconomy as a whole, it is important to analyse the impact of oil price shocks on the Ghanaian economy in a holistic manner. It is therefore key to examine the possible effects of crude oil price shocks on stock market activities (since that could react immediately to activities on the oil market), trade balance position and macroeconomic stability as a whole. A clear understanding of its effect, is key to identifying the appropriate policy responses that could work to minimise its negative impact on the Ghanaian economy.

Statement of the Problem

The ensuing discussions suggest that crude oil is an essential element of the Ghanaian economy and as a result changes in its prices and availability could have adverse effect on the growth and development of Ghana. In fact, studies such as Cantah and Asmah (2015); Jumah and Pastuszyn (2007); Tweneboah and Adam (2008) and Nchor, Klepáč, and Adamec (2016) have all found evidence to suggest that fluctuations in the price of crude oil tend to have negative impact on the growth of the Ghanaian economy. A critical examination of Figure 2, however, reveals that oil price hikes over the years has always not been associated with declines in the growth rate of Ghana's economy. There were some years (2006-2015) where oil price increases were associated with high growth in the Ghanaian economy.

The existing studies on the Ghanaian economy basically evaluated the response of macroeconomic aggregates (mainly economic growth and inflation) to exogenous changes in the price of crude oil. Inherent in their analysis is a thought experiment where the price of crude oil is varied while holding all other variables constant. Kilian (2009a) has argued that this thought experiment is not well defined for two reasons. First, bi-causality between macroeconomic aggregates and oil prices implies that cause and effect are no longer properly defined when relating variations in the price of crude oil to macroeconomic outcomes (Barsky & Kilian, 2004). Secondly, just like any other commodity in the world market, the price of crude oil is driven by clear-cut demand and supply shocks. Kilian (2009a) notes that these shocks tend to have different dynamic effects on the real price of crude oil and hence on Ghana's economy. Thus with the ceteris paribus assumption, even when controlling for reverse causality becomes invalid due to the importance of the origin of the oil price shock. This implies that previous studies that have examined the implications of oil price shocks for the Ghanaian economy may be invalid or even lead to wrong policy recommendations due to the inherent assumptions made.

Although, several reports of the Bank of Ghana (see for example, Bank of Ghana, 2009, 2012) have alluded to the adverse effect of oil price hikes on Ghana's trade balance, empirical research on the effect of oil price shocks on external balance in Ghana is yet to be identified. In addition, the various reports of the Bank of Ghana seem to suggest oil price hikes usually tend to have adverse effect on Ghana's external balance. However, per the theoretical arguments of Kilian (2009a) and Kilian *et al.* (2009) this may always not be the case when the supply and demand conditions in the oil market are taken into account.

Also, given that stock markets possess informational efficiency and also the fact that oil related firms listed on the Ghana Stock Exchange together hold more than 50 percent of the total market capitalisation, the effect of oil price shocks on Ghana's economy may be propagated much faster through the stock market. Kilian and Park (2009) intimated that fluctuations in the price of crude oil are often considered as a key factor for understanding the movement in stock prices. Interestingly, studies that have examined the effect of oil price shocks on stock market activities largely focused on developed economies (see for example, Kilian & Park, 2009; Le & Chang, 2015; Li, Cheng, & Yang, 2016), the only identified study on sub Saharan Africa is on Nigeria (Effiong 2014) an oil exporting economy. Thus, the dynamics of the effect of oil price shocks on stock market activities in Ghana (a net oil importing economy) is not likely to be the same as that of an oil exporting economy. More-so, these identified studies focused on the linear relationship between oil price shocks and stock market activities. However Basher, Haug, and Sadorsky (2016) maintains the relationship between financial variables (including stock market variables) and oil prices are more likely to be non-linear rather than a linear one.

This study, therefore, examines the effect of oil price shocks on inflation, output, external balance and stock market activities in Ghana, with specific focus on the origin of the oil price shock. Given that oil is an essential source of energy for the Ghanaian economy, it is interesting, from the policy point of view, to investigate and to quantify the impact of oil price shocks on key macroeconomic variables in the country.

Purpose of the Study

The purpose of the study is to examine the impacts of oil price shocks on key macroeconomic variables in Ghana. Specifically, the present study seeks to:

1. Quantify the differential impact of different sources of oil price shocks on external balance;
2. Examine the impact of oil price shocks on stock market activity in Ghana;
3. Analyse the extent to which differences in sources of oil price shocks affect inflation and output in Ghana.
4. Examine the extent to which oil price shocks affects the effectiveness of monetary policy Ghana.

Hypotheses

Given the objectives of the study, the main hypothesis the study seeks to test is that oil price shocks do not affect the Ghanaian economy. Specific hypotheses to be tested in this study include the following:

1. H_0: Oil price shocks have no differential impact on the external balance

   H_A: Oil price shocks have differential impact on the external balance
2. H_0: Stock market activity in Ghana is not affected by oil price shocks

   H_A: Stock market activity in Ghana is affected by oil price shocks
3. H_0: The source of an oil price shock does not matter for changes in inflation and output in Ghana

   H_A: The source of an oil price shock matter for changes in inflation and output in Ghana

4. H_0: Oil price shocks do not affect the effectiveness of monetary policy in Ghana

   H_A: Oil price shocks do affect the effectiveness of monetary policy in Ghana

Contribution to the Literature

This thesis makes some contribution to the literature on oil price shocks and economic activities especially for developing countries and Ghana in particular. The contributions made by the present study to the literature is in three folds; oil price shocks and external balance, oil price shocks and Stock market activities, and oil price shocks and inflation and output.

In relation to oil price shocks and external balance, the present study extends the existing literature by considering the effect of oil price shock on external balance taking into account the source of the price shock and how differences in the source of the price shocks affects external balance (trade balance and capital account balance) for a net oil importing developing country.

The study compares how the effect of oil price increases on external balance differs from the effect of various sources of oil price shocks on the external balance. It is also important to state that unlike the existing studies, the main focus of the present study is on the Ghanaian economy, which presents an interesting case study. Ghana is relatively a new exporter of crude oil and also an importer of the commodity. An increase in the price is expected to boost its external balance as an exporter, however, as an importer of the commodity, an increase in price is likely to have an adverse effect on external balance. Thus, it would be quite interesting to examine how oil price fluctuations affect the external balance position of the Ghanaian economy. The study also goes further to examine whether the short run effects of oil price shocks are different from the long run effects in relation to the external balance.

In relation to oil price shocks and stock market activities, the present study attempts to analyse the differential impact of oil price shocks due to differences in the source of the shock on stock market activities in Ghana. This study, unlike existing studies on oil price and stock market activities, examines both the linear and non-linear effects of oil price shocks on stock market activities in Ghana. This would help to capture the true relationship that may exist between oil price shocks and stock market activities, given that movements in financial variables are usually not linear in nature (Basher *et al.*, 2016). Hence the use of a linear model may not capture the true effect of oil price shocks on external balance.

Finally, on the impact of oil price shocks on macroeconomic activities, the present study mainly extends existing empirical literature on the Ghanaian economy given the peculiar nature of the economy. Unlike existing studies on the Ghanaian economy, this study attempts to identify how differences in the source of an oil price shocks impacts differently on inflation and output. The present study goes a step further to analyse how these shocks affect the effectiveness of monetary policy in the Ghanaian economy.

Significance of the Study

This thesis contributes to the literature on oil price shocks and economic activities in Ghana. Existing studies have ignored the role of demand and supply conditions in the effect of oil price shocks on economic activities. This study extends the literature by examining the differential impact of oil price shocks on inflation, output, external balance and stock market activities in Ghana.

In addition, since crude oil is a key source of energy for the Ghanaian economy, changes in its price and availability could have adverse effect on the growth and development of the country. Hence, understanding how different sources of oil price shocks affects inflation, output, external balance and stock market activities in Ghana would help policy makers on the most effective way to minimise the adverse effect of oil price shocks on Ghana's economy. The study would also provide investors on the stock market with key information about how movement in oil prices affects stock prices which could assist them in making optimum investment decisions. The study would also serve as a reference material for students.

Scope of the Study

The study examines the impact of oil price shocks on Ghana's economy with specific focus on external balance, stock market activities, and selected macroeconomic variables (exchange rate, inflation and growth). The study also goes further to examine the impact of oil price shocks on the effectiveness of monetary policy in Ghana. It employs a combination of monthly and quarterly time series data sets. Monthly time series data sets spans from January 2002 to December 2015 to examine the impact of oil price shocks on stock market activities as well as the impact of oil price shocks on inflation and output in Ghana. Quarterly series spans from the first quarter of 1983 to the last quarter of

2015 was also employed to examine the effect of oil price shocks on external balance in Ghana. The study employs both linear and nonlinear time series estimation techniques to achieve its stated objectives.

Organisation of the study

The thesis is organised into eight chapters. The next chapter that follows the current chapter, Chapter Two, provides an overview of the Ghanaian economy with specific focus on growth, trends in inflation and monetary policy. The Chapter also examines the external balance situation of the country, activities in the stock market and Ghana's linkages to the oil market over the years. A critical examination of related theoretical and empirical literature related to the work is presented in chapter three. The main focus of the review would be to highlight the key relationship between the oil market and macroeconomic variables, the external balance and stock market activities. Chapter four presents the methodological issues with specific focus on Structural Vector Autoregressive (SVAR) model, the Autoregressive Distributed Lag (ARDL) model, and the Markov regime switching model. In Chapter Five, the study presents the very first empirical chapter on Oil price shocks and external balance. Chapter six, empirical results on stock market activities and oil price shocks is presented. Empirical results on oil price shocks and inflation and output are presented in the chapter science. This Chapter also considers the impact of oil price shocks on the effectiveness of monetary policy in Ghana. The final Chapter presents the summary, conclusions and recommendations of the study as well as the limitations and suggestions for future studies.

CHAPTER TWO

OVERVIEW OF THE GHANAIAN ECONOMY

Introduction

This chapter provides an overview of the developments in Ghana's macroeconomy since 1983. The reason why the study chose 1983 as the starting point for the analysis of the economy is the fact that 1983 marked the beginning of a new era in the economic history of the country. It was during this period that the country switched from a controlled economy towards a more liberalised one. More-so, the scope of the present study spans from 1983 to 2015, hence there is the need to put developments in the economy during this period into perspective.

The review of Ghana's macroeconomy begins with developments in Ghana's external sector and its linkage to fluctuations in crude oil price. This is followed by developments in Ghana's stock market over the years and its linkages to the world oil market. In addition, the study examines macroeconomic activities over the period under consideration as well as the role of monetary policy over the same period of time.

Ghana's External Balance Situation Since 1983

Analysis of Ghana's external balance position would focus on trade balance, current account and capital account position of the country. This is in line with the objective of the study which looks at the differential impact of oil price shocks on the external balance position of Ghana. More importantly, since these three variables are at the core when it comes to external balance, it is important to understand trends in the external sector over the years to aid the understanding of the possible impact of oil price shocks on the external sector of the economy.

To achieve this, the trends in external balance is analysed in three different blocks: the decade of the economic recovery programme (1983-1993); the era of democratisation and liberalisation (1994-2004); Era of oil discovery and production (2005-2016).

The decade of the economic recovery programme (1983-1993)

As a result of the persistent problems associated with Ghana's Balance of Payments, one of the main objectives of the Economic Recovery Programme (ERP) was targeted at achieving a viable Balance of Payment (BOP) position in the medium to long term (Fosu, 2001). This was expected to be achieved through expansion in exports and increased Foreign Direct Investments as well as some policy reforms including exchange rate reforms.

Contrary to expected improvements, the country's BOP positions following the implementation of the ERP and later the Structural Adjustment Programme (SAP), both the current account and trade balances of the economy continued to show persistent deficits in both trade and current account balance (see Figure 4).

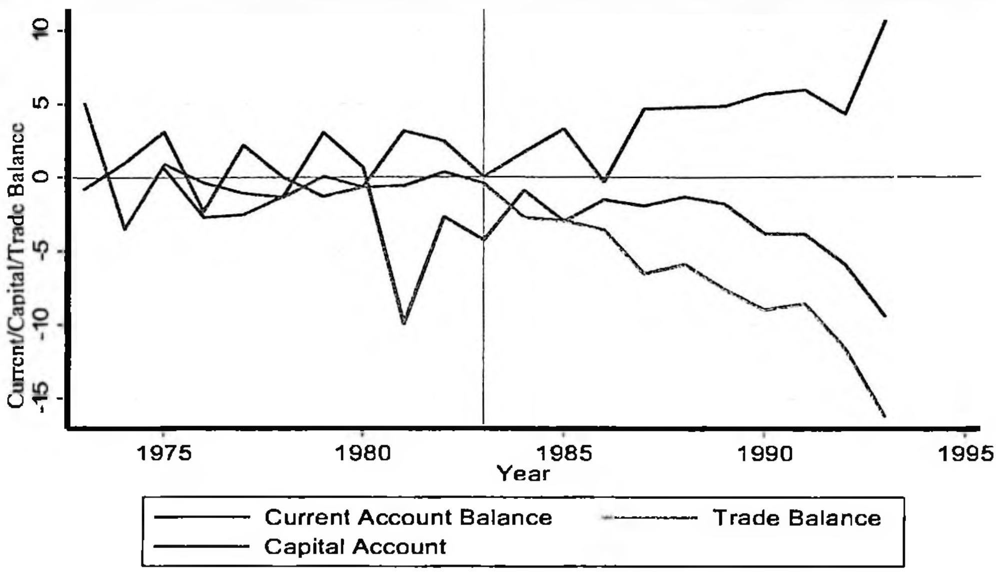

Figure 4: Trade & Current Account Balance (1973-1993)
Source: Author's construct based on data from WDI (2016)

Indeed, the Ghanaian economy experienced some periods of Trade and Current Account surpluses prior to the implementation of the ERP. This was mainly as a result of quantitative restrictions on imports and the transfer of dividends, profits and salaries to achieve trade balance surpluses, and contain current account deficit respectively (Harrigan & Oduro, 2000).

The deficits in the trade balance according to Aryeetey and Harrigan (2000) was partly due to the liberalisation of Ghana's economy, which led to the release of pent-up demand, positive growth of income and the large inflows of capital. Though there were significant declines in the anti-export bias of trade and payments regime, the resulting increase in exports over the period could not offset the boom in imports that came following the liberalisation.

For example, whilst exports as percentage of GDP rose from 5.6 percent in 1983 to about 20.3 percent at the end of 1993, imports into the country increased from 6.0 percent to about 36.4 percent during the same period. Between 1983 and 1986 importation of goods and services into the economy increased by 11.7 percent per annum (CEPA, 1996). In terms of estimated import price index, imports rose by 57 percent in real terms, though average import prices declined by some 6.4 percent.

Just as the trade balance, the current account balance of the Ghanaian economy continued to be in the deficits after the implementation of the ERP which was largely due to the deficit in the trade balance position. This was because improvements in net transfers (which increased consistently from US$ -1.8 million in 1983 to US$261.2 million by 1993) and other official transfers, the current account continued to remain in a deficit position. It is important to, however, mention that the increase in official and private transfers contributed largely to the declines in the current account deficit to GDP ratio between 1986 and 1991 (see Figure 4). Due to expansionary fiscal policy and increased aggregate demand fuelled by increases in the money supply, the current account to GDP ratio deteriorated from 5.9 percent in 1992 to 9.4 percent by the end of 1993 (Harrigan & Oduro, 2000).

The capital account, unlike the trade and current account balance recorded large surpluses in all years except 1986, during the period of the reform. This was as result of the high levels of long-term capital inflows in the form of loans in support of the recovery programme. It is worth-mentioning that the deterioration in the trade and current account during the period was partly due to huge inflows into the country's capital account which also contributed to the appreciation of the domestic currency. The appreciation of the domestic currency had a negative impact on attempts to diversify the country's exports (Younger, 1992).

Generally, the decade of the ERP was characterised by persistent trade and current account deficits mainly as result of boom in the importation of goods and services which was ushered in by huge capital inflows, income growth and import needs associated with the rehabilitation of production units in sectors where exports have a high import intensity (e.g. mining sector).

The contribution of crude oil in the trade and current account balance was very minimal during the period. This was as a result of the decline in the price of crude oil after the oil price shock of the 1970s. Between 1983 and 1986 the price of oil declined by 51 percent (i.e. from US$29.55 in 1983 to US$14.43 by 1986). CEPA (1996) maintained that the average decline in import prices by 6.4 percent was largely due to the reduction in the import price of crude oil. The decade of the ERP was associated with declines in the share of oil imports. The share of crude oil import declined from over 32 percent in 1983 to about 9 percent by the end of 1993. Non-oil imports accounted for over 88 percent of total imports (CEPA, 1996).

In all, the decade of economic reforms was characterised by liberalisation of the external sector of the Ghanaian economy. This was expected to lead to improved BOP position through export diversification and removal of quantitative restrictions on imports. However, since there was a very weak productive base in the country, the liberalisation of trade in the country resulted in persistent trade deficit. During this period, the share crude oil imports in the total import was on the decrease mainly because of the fallen crude oil prices in Ghana

The era of democratisation and liberalisation (1994-2004)

The era of democratisation and liberalisation immediately followed the period of economic reforms. During this period, the country enjoyed political stability following the inception of democratic rule. The economy experienced sustained growth with economic growth rate averaging 4.4 percent per annum (CEPA, 2009). However, the Ghanaian economy struggled to achieve stability in exchange rate and general price levels. The domestic currency depreciated by an average of 29.3 percent per annum against the US dollar whereas inflation rate in the country averaged 27.1 percent per annum (Mhango, 2010).

The depreciation of the domestic currency, during the period under review seemed to have contributed largely to some improvements in the external balance position of Ghana's economy. By 1994, the Ghanaian economy experienced some levels of reversals in the deteriorating external position of the country after the implementation of the economic reforms. The improvements in the external sector was led by improvements in the trade account, which previously contributed significantly to the deterioration of the external position of the country.

Apart from the role played by the exchange rate, Ghana's economy enjoyed relatively favourable terms of trade, declines in general importation of goods and services, and increased export volumes in 1994. The world price of Ghana's major export commodities (Gold, Cocoa, and Timber) at the time, went up in the world market. An increase in the world price of gold by some 6 percent also contributed to the increase in the volume of gold exports by 11.42 percent (CEPA, 1996). This resulted in 19 percentage increase in the value of gold exports from Ghana. Despite a reduction in the export of cocoa beans by 11 percent, the value of cocoa exports increased by 14 percent due to an increase in the world price of the commodity by about 28 percent. Total exports in Ghana increased by some 15 percent in 1994, whilst total imports also declined by 9 percent. This situation resulted in some improvements in the country's trade balance (see Figure 5).

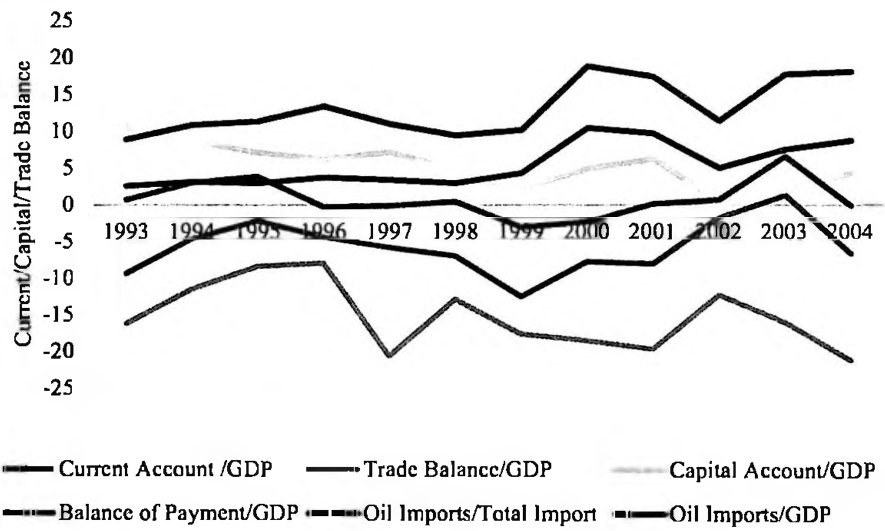

Figure 5: External Balance and Oil imports (1993-2004)
Source: Author's computations (2017)

The improvements recorded in the trade balance culminated into improvements in the current account position of the country as well as the overall balance of payment position. The Capital Account, however, decreased from 10.6 percent of GDP in 1993 to about 8.8 percent of GDP. This was mainly as a result of the reduction in the inflow of aid after the ERP and SAP were at their closing stages. The favourable developments that occurred in the trade and current account positions of the Ghanaian economy continued in 1995. Trade deficit improved from 11.5 percent of GDP to a deficit of about 8.4 percent of GDP (CEPA, 1998). The current account also improved from a deficit of about 4.7 percent of GDP in 1994 to a deficit of 2.2 percent of GDP by the end of 1995. This was largely due to increase in both the value and volume of exports. The value of exports increased by 18.5 percent, whilst export volumes also increased by 8.7 percent. Favourable terms of trade also continued to be on the side of the country as average world market prices for Ghana's export commodities increased by 4.8 percent in 1995 (CEPA, 1998). The capital account continued its downward spiral in 1994.

The series of improvements recorded in the Country's trade and current account positions seem to have peaked in 1996. This was immediately followed by deterioration of the nation's external balance position. Trade and Current account balance deteriorated from a deficit of 7.9 and 4.4 in 1996 to a deficit of 20.6 percent and 5.9 percent respectively in 1997 (Harrigan & Oduro, 2000). This contributed to the deterioration of the overall balance of payment position of the economy. The bad performance of the external sector was mainly due unfavourable terms of trade. The year (1997) saw a continuous decline in the world price of gold and other major exports in the country which resulted in a decline in the gross receipts for both traditional and non-traditional exports by 7.3 percent (CEPA, 1998).

From 1998 to 2000, the Ghanaian economy experienced continuous deterioration of its external balance position from all angles. The current account experienced an average deficit of 9.1 percent per annum, with trade deficit also averaging about 16.3 percent per annum. Though capital account increased between 1998 and 2000, the capital account balance though positive, reduced from an average of 7.3 percent of GDP between 1994 and 1997 to an average of 4.0 percent between 1998 and 2000. The overall balance of payment position of the economy was worsened by an average of 1.7 percent of GDP per annum (CEPA, 2002).

A number of factors have been attributed to the poor performance of the external sector between 1998 and 2000. The reduction in the capital account to GDP ratio for example was partly due to external payment crisis that the country faced in 1999 and extended into 2000. CEPA, (2000) noted that this crisis together with unstainable macroeconomic fundamentals during the period contributed to the creation of unfavourable conditions for autonomous private capital inflows.

Deficits recorded in the trade and current account balance was largely due to poor export performance. The period was associated with huge drops in the prices of gold and cocoa in the world market. This resulted in the reduction of the country's export value. On the other hand, Ghana's imports during this period was on the increase. For example, imports of goods and services increased by 10.4 percent between 1998 and 1999. The increase in imports was partly caused by high demand for crude oil coupled with high price of the commodity in the world market.

Ghana's demand for crude oil between 1998 and 2000 grew by an average of 12.6 percent with the country recording its highest growth in demand in 2000 (demand for crude oil grew by 19.4 percent). Oil prices, on the other hand, increased by 41.3 percent and 58.6 percent in 1999 and 2000 respectively. This situation largely contributed to the increase in the share of crude oil imports in total imports of the country (see Figure 2). In fact, the share of crude oil in total import increased from 9.4 percent in 1998 to 10.2 and 18.8 percent in 1999 and 2000 respectively. Similarly, oil imports as a percentage of GDP also increased from 2.95 percent in 1998 to about 4.3 and 10.4 percent in 1999 and 2000 (see Figure 5). Thus, crude oil seemed to have played a key role in the deterioration of Ghana's external balance position.

The overall BOP position of the country slightly improved in 2001 as the country recorded a BOP surplus of about 0.16 percent of GDP. This was largely due to improvements that occurred in the capital account as it improved from 4.9 percent of GDP in 2000 to about 6.3 percent of GDP the following year (CEPA, 2006). The improvements in the capital account was predominantly due to improvements in external assistance to the country which increased capital inflows. However, the current account and trade balance worsened by 0.3 and 1.13 percent respectively in 2001. The deficit recorded during the period was mainly due to declines in the volume of exports. General imports of goods and services declined by a little over 2 percent and this was partly due to reduction in oil import bill which fell by a little under one percent.

The economy was unable to sustain the gains made in the balance of payment position as it recorded a deficit of about US$10.5 million. This can be alluded to the worsening of the trade account (Bank of Ghana, 2005). The trade balance position recorded a deficit of over 20 percent and the Bank of Ghana partly attributed this to growth in the country's demand for crude oil and increase in the world price of the commodity. Crude oil import bill went up by 38 percent in 2004 (Bank of Ghana, 2005)

The inability of the Ghanaian economy to achieve a stability in its external balance position, especially in trade and current account balance, continued to be a major problem in the country up to 2004. During this period crude oil became an essential part of Ghana's economy and as such the continuous importation of the commodity over the period seem to have contributed significantly to the persistent deficits recorded in both the trade and current account balance.

Era of oil discovery and production (2005-2016)

This era covers the period Ghana discovered oil in commercial quantities. The country discovered what is now known as the Jubilee field in 2007 and later the Tweneboa, Enyenra Ntomme (TEN) Fields. These discoveries were expected to bring some form of reliefs to the Ghanaian economy in terms of helping to improve its external balance position. This is because Ghana's crude oil imports during the last decade of the twentieth century increased consistently (see Figure

6) and was increasingly becoming a major factor that could affect the external balance position of Ghana's economy.

However, the discovery and the subsequent production of oil in commercial quantities seem not to have had any effect on the country's importation of crude oil. The average crude oil imports as a share of total imports since the discovery of oil in Ghana is almost twice of the total oil imports between 1994 and 2004. That is, oil imports as a share of total imports increased from an average of 13.6 percent of total imports between 1994 and 2004 to an average of 20.5 percent of total imports since the discovery of crude oil. In fact, crude oil import bills have been identified by various editions of the Bank of Ghana Annual report on the Ghanaian economy as a major contributing factor to Ghana's external imbalances experienced between 2007 and 2015(Bank of Ghana, 2015a; CEPA, 2012).

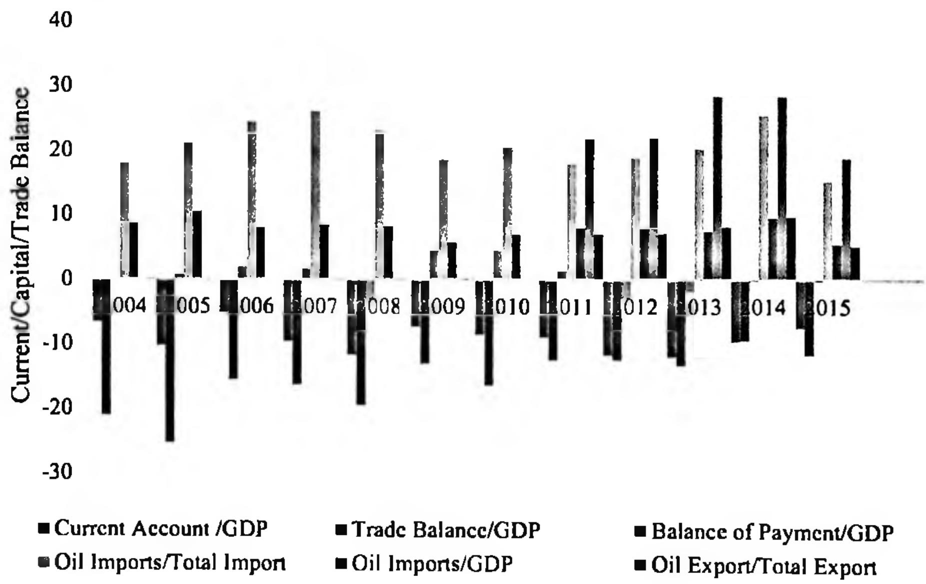

Figure 6: External Balance Position and Crude Oil Imports & Exports
Source: Author's computations (2017)

For example, despite the strong performance of Ghana's exports in 2008 which resulted in a 25.8 percentage growth in total export earnings of the country, Ghana's economy still recorded a trade deficit of about 19.5 percent of GDP. This was mainly due to a rise in total import by 27.3 percent (Bank of Ghana, 2009). The situation is best described by the 2008 edition of the Bank of Ghana Annual Report which indicated that the strong export performance of the economy was due to increases in the world price of Ghana's main export commodities. However, this performance was offset by high imports which resulted from increased pace of economic activities and high crude oil prices (Bank of Ghana, 2009). This was the year the oil price rose to US$147 per barrel, the highest price in history. Since the beginning of the twenty first century, crude oil imports have had strong influence on the external balance situation of Ghana's economy. The movements in oil price seem to have strong impact on trade and current account balance of the Ghanaian economy. Such deficits are usually financed via the depletion of international reserves.

Interestingly, oil exports since 2010 is becoming one of Ghana's key foreign exchange earners. The value of oil exports as percentage of GDP has increased from 7 percent in 2011 to over 9 percent by the end of 2014 (GSS, 2015). This figure however, declined in 2015 to about 5 percent due to huge drops in the world price of the commodity during this same period. In terms of the share of oil exports in total exports, it has increased from 21.7 percent in 2011 to over 28 percent in 2014 (Bank of Ghana, 2015a). Buttressing this, between 2011 and 2014, crude oil export was the second largest export earner for Ghana after gold.

It was only over taken by cocoa in 2015 due to the declines in the world price of crude oil. The decline in crude oil exports is seen as a major contributing factor for the increase in Ghana's trade deficit from 9.4 percent of GDP in 2014 to 11.5 percent of GDP (World Bank, 2016a). This was clearly stated in the 2015 Bank of Ghana Annual report when it indicated, "Exports also underperformed as a result of the slump in commodity prices on the international market, especially oil and gold".

Ghana's economy therefore presents an interesting case when it comes to the link between external balance and movements in the prices of crude oil. As an importer of the commodity, changes in the price of crude oil have the potential to lead to the deterioration of trade and current account balance both as an export and an import commodity.

Changes in the price of crude oil could also potentially affect Ghana's external balance in two major ways. First increases in the world price of the commodity could compel the country to borrow from abroad to offset the adverse terms-of-trade shocks that may occur as result of high oil prices (Kilian *et al.*, 2009). Secondly, given the fact that crude oil is an essential input of production, changes in its price and availability have the potential to affect the movement of Foreign Direct Investments which could have direct impact on the capital account of the external balance.

Given the recent development in the literature on the view that the impact of oil price shocks may depend on their source (i.e. whether, supply or demand) (Kilian, 2009a; Kilian et al., 2009), and the history of Ghana's external balance position (which has been in deficits in most years), it would be interesting from both a policy and a theoretical perspective to examine and to quantify the impact of oil price shocks on external balance position of Ghana as an importer and exporter of crude oil.

Overview of Ghana's Stock Market

July 1989 saw the birth of Ghana's first capital market, the Ghana Stock Exchange (Henceforth GSE). The GSE was established as a private company guaranteed under the Companies Code 1963 and given recognition as an authorised Stock Exchange under the Stock Exchange Act of 1971 (Act 384) by October 1990. On the 12th November, 1990, the Council of Exchange was inaugurated and trading activity on the stock exchange began on the floor of the exchange that very day. The status of the Ghana Stock Exchange was changed to a public company limited by guarantee in April 1994.

Since it commenced operation in 1990, the Ghana Stock Exchange has increased in size and performance though the performance experienced has been associated with some level of fluctuations. According to the annual report of GSE, the exchange turnover of stocks increased by over 6,879% between 1991 and 1997. That is, it increased from 1.8 million shares in 1991 to 125.63 million shares by the end of 1997. It is therefore not surprising that the Ghana Stock Exchange continues to be one of the best performing stock markets in Africa. As a matter of fact, the Ghana Stock Exchange emerged as the sixth best performing emerging market after it posed a remarkable return of 114% in 1993. Again in 1994, a research Group in the United States of America, Birinyi Associates, voted the Ghana Stock Exchange as the best performing stock market amongst all emerging markets with gains of about 124%. In 2001, the value of traded stocks increased from $6.96 million in 2000 to $12.5 million; however, it reduced to $10 million in 2002 and quadrupled a year after to $43.99 million. This figure almost doubled by the end of 2004 when it increased from $43.99 million to $72.88 million. The Ghana Stock Exchange was adjudged the best stock market in the world in terms of performance after posting a yield of 154% at the end of trading in 2003. Between 2005 and 2012 the Ghana Stock Exchange was consistently ranked among the top ten performing stock markets on the African Continent. The resilience of the Ghana stock change was put to test during the 2008 global financial crisis. The Ghana Stock Exchange compared to its peers in Sub-Saharan Africa performed creditably well that its index recorded a return of about 58.06% and was followed by Malawi and Tanzania with returns of 26.69% and 3.54% respectively. In fact, the value of traded shares on the Ghana Stock Exchange increased from $51.6 million in 2006 to about $286.8 million by the close of 2008. The extraordinary performance of the Ghana Stock Exchange was attributed to good macroeconomic performance during the period, and a subsequent increased investor and economic activity. Indeed, around this time, a number of new initial public offers were also offered with the divestiture of shares of existing state-owned enterprises on the exchange.

Though GSE in the midst of the 2008 financial crisis performed very well, the performance of the stock market took a nose dive by the close of 2009 when trade value on the stock market dropped from its 2008 figure to about $51.8

million by the end of 2009. Lin, Wesseh, and Appiah (2014) maintain that the poor performance of GSE in 2009 was partly due to the migration of the stock market from paper certification to electronic book entry securities under a new automated trading system. The process, they noted, required time since investors needed to be convinced to accept it. Also, the poor performance in 2009 was partly due to hikes in local interest rates which made money market instruments relatively attractive than activities on the stock market. More-so, the effect of the 2008 oil price hikes was severely felt in the Ghanaian economy after 2008.

The value of traded stocks however regained its momentum in 2010 when it rose to $101.8 million. The value of traded stocks more than doubled a year after when it reached $254.1 million in 2011. During this period, the volume of shares inched up by 27% while value of traded shares in 2011 represented 149% over the volume and values achieved in 2010 respectively. Market capitalisation also increased by 136.59% mainly due to the listing of Tullow Oil PLC.

Oil Prices and the Stock market

Ghana has since independence been a net-importer of crude oil and this trend has continued even after the discovery of oil in commercial quantities in 2007 and the subsequent production of the commodity in 2010. Literature on energy consumption and the growth of economic activity suggest that increases in energy consumption significantly leads to the growth of the Ghanaian economy (Akinlo, 2008). Indeed, energy consumption in Ghana has since 2006 increased from 5,176.9 Kilotonne of Oil Equivalent (KTOE) to about 7,016.4 KTOE by the end of 2014 (Energy Commission of Ghana, 2016). During this period, the growth of the Ghanaian economy averaged 5 percent per annum. A key component of energy consumption in Ghana over the years has been the continuous increase in the consumption of petroleum products, which are mainly extracted from crude oil. Between 2005 and 2014, consumption of petroleum products in Ghana has increased by 80% and it has overtaken biomass as the major source of energy for the Ghanaian economy. Petroleum provides more than 50 percent of the total energy needs of the Ghanaian economy.

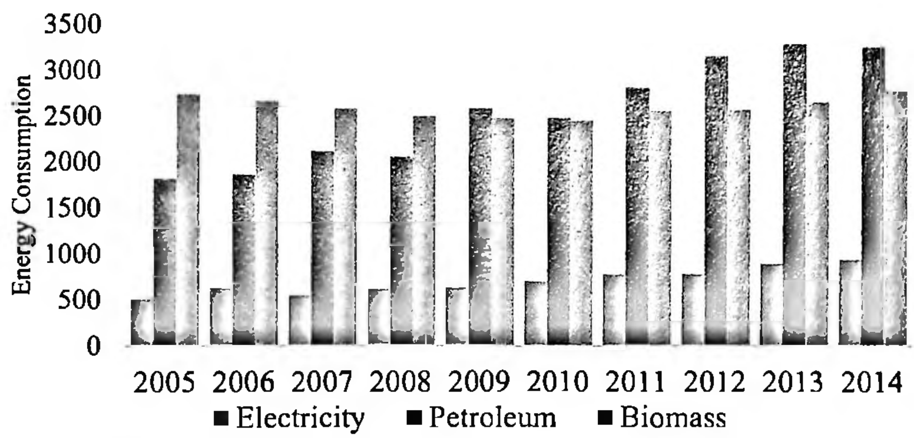

Figure 7: Energy Consumption in Ghana
Source: Ghana Energy Commission (2015)

In terms of sectoral consumption of energy, the 2015 edition of the National Energy Statistics-published by the Ghana energy commission, indicated that oil and its related products provided up to 4.1, 38.4, 99.8 and 100 percent of the energy needs of the Commercial/Service, industrial, agricultural and transport sectors respectively in 2015. If the consumption of biomass, which is mainly used by small scale firms which are not listed on the GSE, is eliminated from the energy mix, then oil and its related products provide up to 6.5 and 52.3 percent of the total energy needs of the commercial/service and industrial sectors respectively. Thus, the role of oil as key source of energy in Ghana's productive process cannot be overemphasised.

In terms of listed companies on the GSE, Tullow Ghana, Anglo Gold Ashanti and other manufacturing companies together hold over 70 percent of the total market capitalisation of the Ghana Stock Exchange. These firms are also the major players in Ghana's industrial sector and their activities are heavily dependent on the availability of petroleum products. Hence, changes in the price of crude oil could have serious implications for these firms, the GSE and the Ghanaian economy as a whole. A careful examination of Figure 8 reveals that growth in the price of crude oil and All Share Index (ASI) has, since the first quarter of 2002, moved in opposite directions.

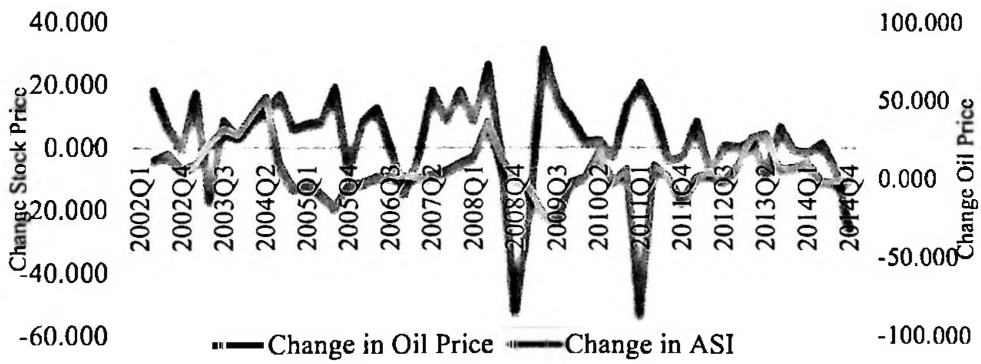

Figure 8: Change in Oil Price and All Share Index
Source: GSE & World Bank GEM (2017)

Periods of high oil prices are usually followed by periods of low stock market activity with some few periods where they both move in the same direction. For example, from the first quarter of 2008 to the first quarter of 2009, oil price and ASI moved in same direction. This is probably because during the global financial crisis of 2008, the US dollar depreciated at a very fast rate and investors turned to the use of gold as their store of value. As a result, the price of gold increased and this greatly influenced the stock returns on the shares of Anglo Gold Ashanti (AGA) and Golden Star Resources. It is important to note that during this period, AGA was the firm with the largest share of the total market capitalisation of the entire stock market. The strong performance of the GSE despite the high oil price hikes also reflected in the economy as it experienced a growth rate of 9.1 percent in 2008. The fact that high growth in the price of crude oil is followed by reductions in the performance of the stock market implies there is the need to empirically investigate the extent to which oil price shocks account for this phenomena. It would be interesting to also examine whether the source of an oil price shock plays a key role in the relationship between oil price shocks and stock market activities.

Macroeconomic Stability and Oil Price

Following a decade (1973-1983) of poor macroeconomic performance, Ghana adopted the Bretton Woods sponsored Economic Recovery Programme and later the Structural Adjustment Programme (SAP). The basic aim of the programme was to halt the downward trend in economic growth, which reduce by an average of 3 percent per annum, and achieve stability in key macroeconomic variables such as inflation and exchange rate. The economy responded positively to the changes brought by the ERP and SAP as it recovered from a negative growth rate of 5 percent in 1983 to an impressive positive growth rate of about 8 percent a year later (E Aryeetey & Kanbur, 2008). Economic growth rate after the reform programme averaged 5.7 percent between 1984 and 1989. During this period, inflation rate reduced from 123 percent in 1983 to about 25 percent by the end of 1989. The domestic currency which depreciated by 221 percent in 1983, depreciated by about 33 percent against the US dollar in 1989. It is important to note that the price of crude oil during this period, which was a major input of production in the economy was on the decline in the world market. A barrel of oil which sold for US$29.55 in 1983 reduced consistently to US$14.92 by the 1988 before increasing to US$18.44 by 1989. Thus, the low price a major input of production (crude oil) together with other factors related to the economic reforms probably contributed to the strong performance of the Ghanaian economy between 1984 and 1989.

Though the economy continued to experience positive growth rates, the growth experience was not as high as what the country experienced immediately after the economic reforms. GDP growth which averaged 5.7 percent between 1984 and 1989 declined to an average of 4.27 percent between 1990 and 1999. The poor performance relative to what was experienced in the first five years after economic reforms was predominantly due to the erratic performance in the agricultural sector. The agricultural sector during this period was the largest contributor to GDP and hence poor growth in the agric sector affected the growth of the economy as a whole (CEPA, 1996). Macroeconomic stability witnessed relative improvements between 1990 and 1999. Inflation rate declined from average of 28.5 percent between 1984 and 1989 to about 27.6 percent between

1990 and 1999. During the same period, the average rate of depreciation declined from 93.3 percent to about 26.35.

The decline in the average international price of crude oil between 1990 and 1999 (with oil prices declining from an average of $20.39 between 1984 and 1989 to about US$18.33 for the period 1990-1999) probably did not contribute to propel the growth of the economy as the growth rate of the economy continued to decline. Thus, the decline in the economic growth rate of the country could be attributed largely to erratic growth experienced in the agricultural sector. A careful examination of Figure 3 however indicates that periods where oil prices experienced positive growth rates in its price levels were usually associated with slowed economic growth between 1990 and 1999.

The beginning of the twenty first century came with some macroeconomic challenges which also affected the growth of the economy. Economic growth rate reduced from 4.40 percent in 1999 to 3.7 percent in 2000. This was partly due to decline in the prices of the country's major exports (Cocoa, Gold and Timber) at the time. The price of Cocoa, for example, declined by 20 percent in 2000. On the other hand, the price of the crude oil increased from US$17.97 in 1999 to US$28.83 representing 58.6 percent (BP, 2012). This contributed to the high inflation rate experienced in 2000. Inflation rate increased from 12.6 percent in 1999 to 40 percent in the year 2000. The domestic currency during the same period also depreciated by 104 percent during the same period.

Following the implementation of a number of stabilisation programmes which began in 2001, the economy returned to the path of growth and relative macroeconomic stability. Between 2001 and 2007, the economic growth rate of the country averaged 5.12 percent per annum. This was almost one percent higher than the growth experienced by the Ghanaian economy in the 1990s though it was still below the growth rates enjoyed by the economy immediately after the economic reforms. The domestic currency achieved relative stability against the US dollar with average depreciation of 9.5 percent between 2001 and 2007. In fact, the economy in some years (e.g. 2005) experienced depreciation of less than one percent. Inflation rate during the period reduced consistently from 40 percent in 2000 to about 10.7 percent by the end of 2007. The average inflation rate during the period was about 15.1 percent. The economy showed strong resilience in the face of rising crude oil prices. After a decline in the world price of crude oil by 14.2 percent in 2001, the price of the commodity rose consistently after 2001. It increased by 2.3 percent 2002 till peaked at 42 percent in 2006. It is important to however state that during this period, increases in the price of crude oil still seem to result in some declines in the economic growth rate of the country.

The average growth rate of the economy inched up by 2.4 percent per annum between 2008 and 2015. That is, it increased from an average of 5.1 percent between 2001 and 2007 to an average of 7.56 percent. These were largely due to the discovery and the beginning of commercial production of crude oil in 2010. In fact, the 14.05 growth rate experienced in 2011 was largely due to the inclusion of crude oil in the country's output mix. The period between 2007 and 2015 also marked the era of relatively low levels of inflation rate since the implementation of ERP and SAP. Average rate of inflation which was about 13.6

percent was the lowest that has been recorded since the implementation of the ERP and SAP. The domestic currency, however, performed poor relative to its performs between 2001 and 2007. The domestic currency depreciated by an average rate of 11.9 percent between 2008 and 2015. This figure represented an increase in the average depreciation rate of the domestic currency by 3.4 percent when compared to the average depreciation of the cedi against the US dollar in the period 2001 to 2007.

An interesting feature that can be observed from Figure 3 is that the era between 2008 to 2015 seem to be associated with different relationship between movements in the global price of crude oil and the growth of the economy. Since 2008, the growth in the price of crude oil seem to be associated with increased growth of the Ghanaian economy. Similarly, reductions in the growth of the price of crude oil seem to be followed by reductions in the growth rate of the economy. This relationship can still be observed from Figure 3, despite the fact that Ghana is still classified as a net importer of crude oil, indicating that oil price hikes should possibly lead to reduction in the growth rate of the economy. The change in the relationship could be as a result of change in monetary policy in response to the effect of oil price shocks on domestic prices or possibly due the changing relationship between oil price and economic activities as observed by (Hamilton, 2005; Kilian, 2009a). Whatever the cause of the change in the possible relationship between oil price and economic growth in Ghana, it would be interesting to analyse what has changed over the period since the country Started commercial production of crude oil.

Monetary Policy between 1990 and 2015

The implementation of monetary policy is usually aimed at achieving stability in the growth of output and general price level. The implementation of monetary policies in Ghana have been very dynamic over the years and consistent with international trends in order to ensure its relevance to national development. Basically monetary policy involves the control of the supply and the cost of money in line with the expected level of economic activity. These policies may be implemented with the common objectives of achieving price stability, balance of payments equilibrium and output growth. Hence, monetary policy is said to be effective when it is able to achieve its stated set of objectives.

Quartey and Afful-Mensah (2014) argued that for monetary policy to be effective and globally acceptable, it must be dynamic and respond to changing times. It is therefore not surprising that the implementation of monetary policies the world over has evolved over time to maintain its relevance and effectiveness. However, the dynamism in the implementation of monetary policies was not seen in most African economies until the late 1980s and early 1990s after the implementation of a number of structural adjustment programmes and economic recovery programmes. Central Banks during this period gradually shifted from direct control measures to indirect monetary policies.

In the case of Ghana, reforms in monetary policy were done as part of general reforms in the financial sector. These reforms have evolved from the implementation of the Financial Sector Adjustment Programme (FINSAP), which saw the deregulation of the financial sector including monetary policy, to Financial Sector Strategic Plans I and II (FSSP), which includes among other things the gradual liberalisation of the financial sector in Ghana and a change in monetary policy from direct controls to indirect control measures such as monetary targeting and inflation targeting.

Changes in monetary policies in the country over the years were done with the prime goal of making monetary policy more effective in battling inflation and unemployment. For example, the inability of the direct monetary controls, which was the main monetary policy tools employed, prior to the implementation of the Structural Adjustment Programme resulted in the change in monetary policy from direct controls to the adoption of monetary targeting (an indirect control measure) (Bawumia, 2010; Quartey & Afful-Mensah, 2014).

The adoption of indirect monetary policy rule was in line with the ERP/SAP, which sought to liberalise the Ghanaian economy. The liberalisation process involved progressive implementation of de-regulatory measures which eventually led to the institutionalisation of a market based monetary management system in 1992 (Bank of Ghana, 2015b). The new system of monetary policy mainly employed indirect and market based instruments in the implementation of monetary policy in Ghana.

The adoption of market based instruments as a tool of monetary policy was consistent with the classic theory of financial repression developed by McKinnon (1973) and Shaw (1973) in which they advocated for a liberalised financial system free of interest rate controls to enhance savings mobilisation and economic growth. Hence, market based instrument was seen as the best tool for monetary policy to achieve its objective of maintaining a stable inflation rate whilst encouraging growth of the economy.

The use of indirect monetary policy was based on the use of market instruments to control the supply of money in the economy to achieve price stability and sustain growth of the economy. The use of market based instrument for indirect monetary policy control required that the entire financial sector of the Ghanaian economy be reformed. This resulted in the Financial Sector Adjustment Programme (FINSAP), which was operational for the period 1986 to 2000. The end product of the reform was the liberalisation of the exchange rate and interest rates in the country.

Following the liberalisation of the financial sector in Ghana, the Bank of Ghana adopted monetary targeting as its monetary policy framework. By this framework the central bank viewed inflation as purely a monetary phenomenon, hence to control inflation, the Bank had to control the growth of money in the economy (Bawumia, 2010). Given that the Bank had no direct control over the supply of money, it employed some indirect control measures such as open market operations, reserve requirements rediscount facilities and repurchase agreements.

The implementation of the indirect monetary policy measures achieved some relative successes during the early years of its implementation. Between 1984 and 1991 for example, macroeconomic stability was restored with inflation rate declining from 123 percent in 1983 to about 10 percent by the end of 1991. In relation to the foreign exchange market, the depreciation of the Ghana Cedi against the US dollar reduced from 40 percent to about 12 percent by 1991.

The macroeconomic stability achieved within the first five years after the implementation of FINSAP was not sustained as the gains from the reform began to erode after 1992. Inflation rate, which had reduced drastically began to rise again. Though it was less than the 1983 figure, average inflation rate recorded between 1992 and 2000 was three times the inflation rate recorded in 1991. The depreciation of the domestic currency against the US dollar, which had fallen to about 12 percent in 1991 rose again to over 51 percent (Bawumia, 2010). By the start of the twenty first century, it had become clear that the monetary policy framework based on monetary targeting had become virtually ineffective in achieving macroeconomic stability and enhancing economic growth. Inflation rate, interest rate and exchange rate depreciation in the economy during the period remained high and these things were highly inimical to the growth of the economy.

Bawumia (2010) identified fiscal dominance as the major cause of the ineffectiveness of monetary policy over the period. He argued that budget deficit that was incurred during the period was mainly financed via the use of monetary financing. This situation largely contributed to the ineffectiveness of monetary policy over the period. For example, money supply which grew by 53 percent in 1992 was mainly due to the use of monetary financing of deficits. Similarly, fiscal expansion that took place in the country in the run-up to the 2000 elections according to Bawumia (2010) tipped the economy into a cycle of inflation and currency depreciation. The domestic currency during the period lost about 50 percent of its value against the US dollar with inflation rising to about 40 percent by the end of the period.

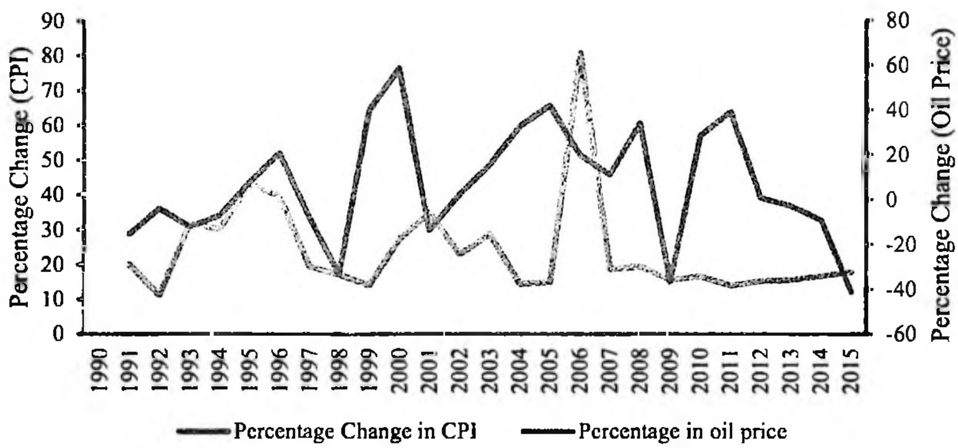

Figure 9: Trend in CPI and Crude Oil Price.
Source: WDI and BP statistical Bulletin (2016)

It is key to note that periods for which monetary policy is ineffective seem to be associated with periods of high growth in the price of crude oil. The growth of consumer price index in Ghana has over the years closely tracked movements in the price of crude oil. Thus, the monetary policy framework of monetary targeting may have failed to be effective partly because of the behaviour of oil prices over the period. In fact, various editions of the Bank of Ghana Quarterly bulleting have noted that periods of high inflation are usually associated with increased growth in the price of crude oil. This trend continued even after the country adopted inflation targeting as its monetary policy framework.

This trend however seemed to have changed in 2007 when increases in the price of crude was not followed by increases in the rate of inflation in the economy. This is probably due to argument in the oil price literature, which suggest that increase in the price of crude between 2007 and 2009 was mainly due to high demand for the commodity as a result of high economic growth rates experienced by the so called BRICS nations during the period. Thus, there is the need to analyse the effect of oil price shocks on the effectiveness of monetary policy in Ghana, taking into account the source of the shock.

Overview of Ghana's Financial Sector

Ghana's financial sector has seen remarkable improvements since independence. From a sector that was mainly characterised by just three commercial banks (Standard Chartered Bank, Barclays Bank and Ghana Commercial Bank) to sector comprising 38 licensed/representative commercial banks, 133 Rural and Community Banks, a host of semi-formal and informal financial institutions and foreign exchange bureaus (Bank of Ghana, 2016). Also, Ghana currently has about 90 financial institutions that engage in insurance activities.

Despite the seeming expansion of Ghana's financial sector, the impact of changes in monetary policy rate in Ghana seem to have raised concerns over the effectiveness of monetary policy in the country. This is because there seem to be some form of asymmetric linkage between movement in the policy rate and lending rate in the country. For example, when the Bank of Ghana increased the policy rate in 2008 and 2009, deposit and lending rates rose sharply in response to the changes in the policy regime (Kovanen, 2011). However, when the BoG reduced the policy rate, lending rates continued to remain quite high in Ghana's economy. The non-responsiveness of financial sector to changes in the policy rate in recent times has been attributed to a number of reasons. Kovanen (2011) identified increasing amount of non-performing loans in the banking sector and lack of confidence in the sustainability of the low rate of inflation experienced between 2010 and 2012. Thus, the nature of Ghana's Financial sector makes it relatively difficult for changes in monetary policy rate to be felt in the economy.

Summary

This chapter provided an overview of the Ghanaian economy since 1983. The overview showed that economy has since the implementation of the economic recovery programme and the inception of democracy experienced sustained economic growth with intermittent macroeconomic instability which sometimes tends to slowdown the growth rate of the country. Though a number of reasons have been assigned by various policymakers and research to the intermittent macroeconomic instability and poor economic growth over the period, oil price hikes is widely accepted as one of the important cause of macroeconomic instability.

A critical examination of the movements in crude oil price since 1983 and key macroeconomic variables such as Trade Balance, Inflation and economic growth rate seem to suggest that is may always not be the case that oil price hikes leads to adverse effects on these variables. This is due to the fact that, an examination of the movements between oil price and these macroeconomic variables seem to indicate that there are periods where oil price and macroeconomic variables such as trade balance and economic growth move in the same direction instead of opposite direction whilst oil price and inflation sometimes move in opposite directions instead of moving in the same direction. This means that increases in the price of crude oil sometimes tend to have positive effect on macroeconomic variables.

Hence, the attribution of macroeconomic instability to increases in price of crude oil could be misleading and could have adverse implications for the implementation of macroeconomic policies to minimise the adverse effect of such price hikes. Also the country may not be able to derive any benefits from oil price hikes (if any) since it has over the years focused just on the adverse effect of the price hikes without examining the possible positive effect. As result of this, the next chapter attempts to examine existing theoretical and empirical literature on the relationship between oil price shocks and macroeconomic variables, verify the possibility of dual effect (either positive or negative or both) oil price hikes on an economy.

CHAPTER THREE

REVIEW OF RELATED LITERATURE REVIEW

Introduction

This chapter examines existing theoretical and empirical literature that relates oil price shocks to economic activities. The chapter consists of two major sections. The first section examines the theoretical literature that links oil price shocks to economic activities while the second section comprises the review of existing empirical works.

Theoretical review

To situate the argument within a theoretical context, this section provides an account of the theoretical developments in the area of oil price shocks and economic activities. Therefore, the study examines theoretical literature on the link between; oil price shocks and external balance; oil price shocks and stock market activities and then finally, oil price shocks and macroeconomic variables such as growth, inflation and exchange rate.

Oil price shocks and external balance

The effect of oil price shocks on external balance of an economy mainly works through two main channels. These are the trade channel and the financial channel. Kilian *et al.* (2009) argued that oil price shocks affect the external balance of an economy through the trade channel by working through changes in the prices and quantities of imported and exported goods. They also indicated that oil price shocks affect the external balance position via the financial channels through changes in external portfolio positions and asset prices. They, maintained that all other things being equal, oil price hikes tend to increase inflationary pressure on the importing country and this also reduces the real income levels in net oil importing economies as terms of trade worsens. The inflationary pressure in the domestic economy that usually follows the oil price hikes could compel monetary authorities of the oil importing economy to raise interest rates in an attempt to curb the inflationary pressure from the oil price hikes. The high interest rates coupled with the reduction in the real income may compel households and firms to curtail their investments and consumption expenditure plans which could also have an adverse effect on the growth of the oil importing economy. The reduction of growth could also affect the economy's demand for imported commodities by the net oil importer.

Similarly, Rebucci and Spatafora (2006) argued that oil price hikes lead to the deterioration of the trade balance of oil importing economies, resulting in a higher current account. They noted that the oil price hikes contribute to the decrease in the disposable income and corporate profitability which in turn reduce domestic demand. They opined that the reduction in domestic demand of oil importing economy along with depreciation of the exchange rate acts to restore equilibrium in the current account overtime. Both Kilian *et al.* (2009 and Rebucci and Spatafora (2006) maintained that this would however depend on the policy response to the price shocks, which could either cushion the economy or amplify the negative effect. Rebucci and Spatafora (2006), for example, argued that the speed with which equilibrium is restored after an oil price shock and the output cost of adjustment depend mainly on the expected persistence of the shock, structural flexibility of the economy and central bank credibility. They further expressed the view that the speed and output costs of adjustment are also affected by the speed with which the price shock is allowed to be transmitted into domestic fuel prices. All these contribute to determine the degree to which oil price hikes increase inflationary pressures in the economy, which in turn calls for the tightening of monetary policy that could have adverse effect on the growth of an economy.

In the case of net oil exporting economies, the effect of an oil price shock on their external balance comes in two folds; a direct effect and an indirect effect. In relation to the direct effect, oil price hikes tend to have positive impact on the external balance of the economy as it results in increased surpluses in the trade balance due to higher export revenues (Le & Chang, 2013). Rebucci and Spatafora (2006) argue that increased trade surplus is usually offset by stronger economic growth rates and appreciation of the real exchange rate overtime. Thus, oil price hikes may contribute to increase income levels in net oil exporting economies coupled with appreciation of the real exchange rate contribute to increase imports which then ends up offsetting the benefits from the price hikes.

In relation to the indirect effect of an oil price shock, Le and Chang (2013) note that an exogenous rise in the price of crude oil constitutes a negative supply shock to an oil importing economy which slows down economic activities in oil importing economies resulting in reduction in oil export and other exports from oil exporters. This is worsened by the fact that the real exchange rate of the oil exporting country appreciates making their exports relatively expensive to the oil importing economies that experience depreciation in their real exchange rate relative to the oil exporting country. Thus, the net effect of an oil price shock on the external balance of an oil exporting country depends on the size of higher oil export revenues relative to the rising price of the exporting country's imports.

Le and Chang (2013)'s arguments seem to corroborate general concern that large unexpected fluctuations in the world price of crude oil do not only have adverse effect on net oil importing economies, but also presents challenges for policy makers of net oil exporting countries. To the net oil exporting country, revenue from crude oil poses fiscal challenges that are as a result of the fact that it is an exhaustible resource, very volatile in nature and originates from abroad. More so, oil price shocks may increase uncertainty, particularly for those counties perceived to be high risk economies (developing countries).

Backus and Crucini (2000) maintain that for an oil importing economy, an exogenous hike in the price of crude oil is indicative of a negative term-of-trade shock via their effects on production decisions in the country. Crude oil is considered as an intermediate input of production and as such an increase in its price results in a direct increase in the cost of production, and this may lead to a reduction in the real GDP of the oil importing economy. Thus the domestic economy would produce less and hence would have very little to export. However, the economy may not necessarily consume less in terms of imported products. As a result, the impact of an exogenous increase in the price of crude oil on traded balance is always expected to be negative (Le & Chang, 2013).

The effect of a permanent increase in the price of crude oil on total trade balance and non-oil trade balance depends on the difference in the wealth effect between net oil importing and net oil exporting economies (Bodenstein, Erceg, & Guerrieri, 2011). If the deterioration in oil trade balance experienced by a net oil importer tend to be highly persistent, the only way to meet its intertemporal trade balance condition is to ameliorate its non-oil trade balance by a sufficient amount. This may necessitate some initial deteriorating of its non-oil terms of trade (or real exchange rate)

In relation to the financial channel, Kilian *et al.* (2009) argued that the response of the financial channel could either reduce or aggravate the effect of oil price increase on a net oil importing economy's external balances. An increase in the price of oil could result in a decrease in asset prices and dividends in oil importing economies and this would have an adverse effect on asset owners. On the other the hand, the price increase could contribute to increase asset prices in oil exporting economies which would affect asset owners in both oil exporting and importing economies.

Oil price shocks and stock market activities

Economic theory suggests that any asset price at any point in time is determined by its expected discounted cash flows (Fisher, 1930; Williams, 1938). The implication of this is that any other factor that could change the expected discounted cash flows could have significant effect on asset prices. Therefore, since oil is a major input of production for a number of firms, changes in the price of crude oil would lead to increase in the cost of production of these firms. This tends to restrain profits and to a large extent cause decrease in shareholders' value. As a result of this, Filis, Degiannakis, and Floros (2011) argued that an upsurge in the price of crude oil should be followed by stock price decreases.

Effiong (2014) intimated that the impact of oil price shocks on stock market activities is transmitted through supply and demand channels. With regards to the supply channel, Effiong argued that an increase in the price of oil, which is a major source of energy, and an input in the production process leads to increase in the cost of production, causing reduction in production levels and profitability of firms. Low profitability of firms contributes to the reduction in the value of the firm as reflected in the stock market price. On the demand side, high oil prices are transferred to the consumer in the form of higher prices of goods and services provided by a firm. This tends to reduce the real balances, consumption and the final demand of the consumer. This impacts negatively on the profitability of the firm and hence its stock price. The question that has generated a number of argument in the literature has been whether the effect of an oil price shock should be the same for both oil exporting and oil importing economies.

A number of economists have argued that the impact of oil price shock on the stock market is an indirect one that is transmitted through macroeconomic indicators. Bjørnland (2009) and Jiménez-Rodríguez and Sanchez (2005) maintain that an oil price hike is expected to positively affect economic activity in oil exporting countries which tends to contribute to increased income. Thus the increased income is expected to contribute increased expenditure and investments. This they argued generates greater productivity and reduces unemployment rates. The stock market usually responds positively such economic conditions. The problem with their argument is that they ignore the role of the exchange rate and the possibility of the Dutch Disease which could erode the gains from high oil prices by making domestic firms less competitive hence, adversely affecting their profitability and for that matter their stock prices. Also, in the situation where the increased in expenditure is the inform of increased imports, then it would rather contribute to reduce domestic employment and demand for final goods and service produced by domestic firms.

The effect of an oil price shock may also be transmitted to the stock market through the discount rate. This is because expected inflation and expected interest rates are essential components of the discount rate which may both be affected by expected oil price hikes. Huang *et al.* (1996) argue that oil price increases tend to adversely affect the balance of payments position of oil importing economies which causes depreciation of the domestic currency and puts an upward pressure on the expected inflation rate. The heightened expectations for inflation tend to have positive impact on the discount rate and as such lowers the stock prices.

Sadorsky (1999) maintain that the negative response of stock market activity to crude oil price hikes can be explained from the microeconomic perspective. That is from the microeconomic perspective, firms that employ oil as a direct or indirect factor of production would be adversely affected in terms of their earnings in times of oil price hikes. Hence if such firms are unable to pass the increasing cost of production to their clients, then profits and dividends, which are the main factors that affect the stock price of the firm fall and such the stock price of the firm also fall. Since crude oil is an essential source for a number of firms, it implies the stock market would be generally affected by oil price increases.

Oil price shocks, macroeconomic activities and monetary policy

Theoretical contributions on the effect of crude oil price shocks on the macroeconomy have evolved over the years with each providing its own unique understanding of how oil price shocks affect an economy. As a result, findings from theoretical expositions in the literature do not provide a consistent picture on whether oil prices should or should not substantially affect the macroeconomy. Whilst one strand of the literature emphasises the importance oil price shocks in substantially affecting the macroeconomy, the other argues that oil price shocks does not substantially affect the macroeconomy. Another area considered in the literature has examined the role of monetary policy in the relationship between oil price shocks and the macroeconomy.

Theoretical works that evolved following the oil price shocks of the 1970s believed that changes in the price of crude oil tend to have substantial effects on the macroeconomy due to its importance as an essential input of production. For example, Rasche and Tatom (1977) and Brown and Yucel (1999) argued that an increase in the price of crude oil signifies the scarcity of an essential input of production (energy). Accordingly, even if all resources in the economy are fully employed and efficiently used, the ability of the economy to produce a given output would be limited due to the scarcity of an essential input of production (crude oil). Hence, output produced in the economy falls as cost of production increase. The drop in production and the high cost of production caused by high oil prices causes unemployment and inflation to rise in the economy.

Bernanke (1983), in his capital equipment hypothesis, demonstrated that oil price shocks reduce value added by firms. This was based on the argument that firms will postpone their investment decisions in an attempt to identify whether an oil price increase is permanent or transitory. Thus, firms would find it more desirable to postpone irreversible investment decision if they are uncertain about the future price of crude oil. Hence, uncertainty created by high oil prices could lead low investment which could translate into lower outputs.

Related to the capital equipment hypothesis is the theoretical work of Finn (2000). Finn (2000) also integrated energy as an essential input for capital utilisation in a model for perfectly competitive markets. Finn argued that oil price shocks resulted in sharp and simultaneous declines in energy use and capital utilisation. With both capital and energy as essential inputs in the production process, such declines lead to the reduction in output and marginal productivity of labour. Thus high oil price tends to reduce the productivity which may induce investors to lay off workers leading to high unemployment, low outputs and high price levels.

The second strand of theoretical literature is based on the argument that oil price shocks do not substantially affect the macroeconomy. A number of these works that evolved after the reduction in oil prices in the early and mid-1980s were not followed by substantial increases in economic growth, employment and reduction in inflation. These works concentrated much on the asymmetric relationship between the oil price and economic activity.

Lilien (1982), using the dispersion hypothesis, argued that a change in oil price alters the equilibrium allocation of resources across various sectors of the economy. He noted that an increase (reduction) in the price of crude oil would result in the contraction (expansion) of output in oil intensive sectors of the economy. Moreover, the rise (reduction) in oil price would generate growth (contraction) in the output of energy-efficient sectors relative to energy-intensive sectors. However, because reallocation progresses only gradually due to the high adjustment cost associated with such reallocation, oil price shocks that entail readjustment between energy-efficient and energy-intensive sectors will result in a loss in output in the short run. Jiménez-Rodríguez and Sanchez (2005), posited that while the loss in output will exacerbate the economic contraction caused by oil price hikes, it will constrain the economic expansion when oil prices declines. This gives rise to an asymmetric relationship between oil price hikes and economic activity.

Kliesen (2008) opined that the short-term price elasticity of demand for crude oil is low due to the fact that consumers and producers are unable to change their consumption and production patterns instantaneously after an oil price change. As a result, the effect of high oil prices on economic activity might be small at its initial stages. The negative demand shock for energy-intensive goods and services might cause considerable reallocation of resources, especially labour, which if costly could have substantial impact on the overall performance of the economy. However, reductions in the oil prices do not lead to growth because the effect of positive demand shocks from the reducing energy prices is reduced by the need to adjust the capital stock.

Also, Edelstein and Kilian (2009) identified four complementary mechanisms by which energy price fluctuations may directly affect consumption and investment expenditure. First, higher energy prices reduce discretionary income, as consumers have less money at their disposal to spend after paying their energy bills. This discretionary income effect will be bigger than the less elastic the demand for energy (cetris paribus). Also, energy price shocks prices may create uncertainty about the future path of the price of energy, causing consumers to postpone purchases of consumer durables. Third, consumption may reduce in response to energy price shocks, as consumers increase their precautionary savings. And finally, consumption of durables that are complementary in their operation requires energy that will tend to decline even more, as households and firms delay or forego purchases of energy-using durable. Das *et al.* (2014) argued that the contractionary effects could be reinforced by rising interest rates due to the rise in prices and by investors being extra cautious because of concerns about heightened uncertainty.

Kilian (2009) in an attempt to explain why the effects of oil price shocks in the twentieth century seem to be different from oil price shocks of the twenty first century, argued that the source of the oil price shock is an important element in understanding the effect of an oil price shock on the macroeconomy. Thus, the underlying cause of the price increase or decrease is an important element to identify the impact of an oil price shock.

One of the central questions that has been asked several times in the evolution of the literature on crude oil prices and the macroeconomy has been the extent to which monetary policy, as opposed to oil price shocks, contributed to poor macroeconomic performance in the past. This question has generated a number of explanations among economists with no consistent answer on the role of monetary policy in the relationship between oil price and the macroeconomy.

Bohi (1990) and Bernanke, Gertler and Watson (1997) argued that contractionary monetary policy in response to an oil price shock explains much of the decline in aggregate economic activity after an oil price shock. Bernanke *et al.* (1997) implicitly assumed that oil price shocks are exogenous and its inherently adverse aggregate supply shocks are both recessionary and inflationary. Their argument was premised on the fact that the recessionary impact of oil price shocks in the absence of a monetary policy response is relatively weak, but with relatively higher potential for inflation. Kilian (2009b) noted that without a strong case being made for the existence of a wage-price spiral, oil price shocks may not cause sustained inflation and for this reason the argument by Bernanke *et al.*, (1997) is weak. In addition, a careful examination of recent literature suggests that oil price shocks do not take place in isolation (Kilian 2009a). Thus the premise of analysis by Bernanke *et al.* (1997) is violated.

The fact that oil price shocks do not take place in isolation implies that any analysis based on an exogenous oil price shock could lead to inappropriate policy responses. Kilian (2008b, 2009a) noted that policy-makers should not just respond to the changes that occur in the price of crude oil since that is merely a symptom rather than the cause. He rather advocated that policy makers respond directly to the underlying demand and supply shocks that drive the price of the commodity along with other macroeconomic variables. Furthermore Bodenstein, Guerrieri, and Kilian (2012) argued that monetary policy response to oil price shocks should differ depending on the source of the observed oil price fluctuations. Thus, the source or underlying cause of an oil price shock is an important element in prescribing policy responses to the shock.

An examination of the theoretical literature indicates a general consensus about the adverse effect of oil price shocks on macroeconomic variables, however what remains to be answered has been how monetary policy can effectively be used as a tool to mitigate the adverse effect of the oil price shocks. A number of empirical works have attempted to examine the effects of oil price shocks on economic activities with varying findings while others have focused also on the response of monetary policy to oil price shocks over the years.

Review of Empirical Literature

Since the seminal work of Hamilton (1983), a number of empirical studies on the effect of oil price shocks on economic activities have emerged over the years. Most of these have largely focused on developed economies with very few studies focusing on developing countries. This section reviews various empirical literature on the link between oil price shocks and economic activities, with specific focus on three main issues: oil price shocks and external balance; oil price shocks and stock market activities and oil price shocks and macroeconomic activities. Undertaking the reviews on the above stated sub themes, the study first examined empirical works in developed economies, followed by literature from developing economies and then specific attention is given to related literature on the Ghanaian economy.

Oil and external balance

A number of studies have been conducted on the effect of oil price shocks on key macroeconomic variables after the first oil price shock of 1970 with its associated recession. These studies have mainly focused on the short-run relationship between oil price fluctuations and the macroeconomy with the prime objective of identifying appropriate policy response to deal with such fluctuations.

Developments in the crude oil market in recent past, especially increasing volatility of oil prices, have heightened concerns of academics and policy makers on the potential impact of oil price shocks on key macroeconomic variables open economies, namely trade balance and the capital account balance (external balance). As part of the key indicators of macroeconomic fragility, the external balance position of an open economy serves as another channel through which oil price shocks affect the economy as a whole.

Notwithstanding, the burgeoning body of literature investigating the effect of oil price shocks on the macroeconomy, there exist only limited amount of literature on the effect of oil price shocks on an economy's external balance. Those that have attempted largely focused on developed economies. Agmon and Laffer (1978) can be seen as the pioneers, when it comes to oil price shocks and external balance. They examined how trade balance and balance of payment adjusted after oil price hikes for oil importing developed economies. Their study was based on the monetary approach to balance of payments. The results of their study indicated that increases in the price of crude oil were immediately followed by the deterioration of the trade balance. Trade balance, improved again with adjustments exclusively in non-oil trade. Their source of adjustment was not clearly indicated. Agmon and Laffer (1978)'s study was the first real attempt to examine the effect of oil price hikes on the external balance, although their focus was mainly on developed economies; more so structural changes that has occurred in the world since 1978 requires re-examination of the relationship.

Kilian *et al.* (2009) estimated the effects of demand and supply shocks in the crude oil markets on external balance of oil importers and exporters using a Structural Vector Autoregressive Model. They revealed that the effect of oil demand and supply shocks on trade and current account balance depends on both the source of the shock (whether demand or supply shock) and the response of non-oil trade balance. Their study also found that oil demand shock, oil specific demand shock and oil supply shocks together accounted for about 89 percent of the fluctuations in the current account for oil exporting countries. The corresponding shares of major oil importing though large, was lower than that of the oil exporting countries.

Employing a structural VAR model, Özlale and Pekkurnaz (2010) investigated the impact of oil prices on the current account balances of the Turkish economy. Controlling for other factors such as output gap and exchange rate misalignment, their study identified the net effect of oil price on current account balance. Results from their structural impulse response function showed that the response of current account balance to oil price shocks increased steadily up to the first three months before it started to decrease.

Chuku, Akpan, Sam and Effiong (2011) analysed the impact of oil price shock on the current account balance of Nigeria, a major oil exporter. Chuku *et al.* (2011) applied a Structural VAR model to a quarterly series from the first quarter of 1970 to the last quarter of 2008. The results of their study indicated that oil price shock in the short run had a significant effect on the current account balance of Nigeria. Specifically, the study indicated that oil price shock increased the current account within a year and half, and then declined steadily after until the 30th quarter. Mucuk, Gerçeker, and Ay (2013) also investigated the causal relationship between international oil prices and current account deficit for the Turkish economy using the Johansen's approach to cointegration. The study found oil price hikes contributed to increase current account deficit in the Turkish economy.

Using a panel data made up of 27 oil exporting countries Allegret, Couharde, Coulibaly, and Mignon (2014) investigated the relationship between oil price hikes and current account balance of these countries given the role of financial development. Their study employed panel smooth transitional regression models over the period 1980-2010. They found evidence to prove that there exists a non-linear relationship between variations in the price of oil and current account balance. However, they argued that this depended on the level of financial development in the economy. Specifically, the study showed that oil price hikes exerted positive impact on current account balance in economies with lower levels of financial deepening though the impact diminished with economies with higher levels of financial deepening.

Schubert (2014) examined the effects of oil price shocks on internal and external economic performance of a small open economy with specific focus on Organisation for Economic Cooperation and Development (OECD) countries such France, Germany and Italy. Employing a Dynamic Stochastic General Equilibrium (DSGE) model, the study focused on the effects of permanent increase in the price of oil on the external performance of these countries. Schubert (2014)'s findings indicated that the current account exhibited the properties of the J-curve after an oil price increase. Thus, after an increase in the price of crude oil, the current account first deteriorates for a while and improves after some time.

Huntington (2015) explored the empirical relationship between oil trade and an economy's current account for 91 countries including Ghana. His pooled data from 91 countries over the period 1984-2009 employing a fixed effect panel estimation. The result of the study indicated that reduction in oil import dependence may initially reduce general trade deficit. He found that oil net exporters tend to be significant in explaining current account surpluses, but did not find any significant influence of oil importing economies in explaining current account deficit. Though this study, to some extent, focused on the Ghanaian economy, the fact that study was a cross country study makes it difficult to identify Ghana's peculiar situation in terms of how oil price shock affect the current account.

Bayrakar, Egri, and Yildiz (2016), examined the impact of oil prices on current account deficit and growth of Brazil, Indonesia, South Africa, India and Turkey. Bayrakar *et al.* (2016) employed panel data set from 1980 to 2014 and used pooled least squares in estimating the relationship between oil price and the various variable. Results from their study indicated that oil price increases had significant effect on growth and current account deficits. Specifically, they found a negative relationship between current account deficits and oil price increases and a positive relationship between oil price hikes and GDP. Their results seem quite interesting given the fact that all the countries within their sample seem to consume more oil than they produce.

Focusing on major oil exporters and major oil importers, Rafiq, Sgro, and Apergis (2016) examined the effect of oil price shocks on three measures of external balance; total trade balance, oil trade balance and non-oil trade balance. They employed three second generation heterogenous linear panel model and a nonlinear panel estimation technique that allowed for cross sectional dependence. Results from their study indicated that oil price increases tend to improve real oil trade balance. However, this was at the expense of non-oil trade balance. For oil importing economies, their results showed that declines in oil prices tends to have negative impact on both oil and non -oil trade balances. They suggested that oil price declines are also beneficial to oil exporters due to the quantity effect.

Oil price shock and stock market activities

As indicated in the background and theoretical review of this work, one of the fastest means by which oil price shocks are transmitted into an economy is via the stock market. That is, after the first point of call (the external balance position), signals from the effect of the shock on the external balance would most likely be picked up by the stock market before it is transmitted to the rest of the economy. Hence an analysis of the effect of oil price shock on an economy would be incomplete without analysing how such shock affect stock market activities.

A number of studies have therefore examined the effect of oil price shocks on stock market activities over the years. However, existing empirical works have demonstrated different results and there seem to be no consensus in the empirical literature on the subject of oil price shocks and stock market activities. As matter of fact the results seem to be mixed and most of these studies are largely focused on developed countries.

Empirical work by Jones and Kaul (1996) showed the existence of a negative relationship between stock market of advanced economies (USA, Canada, UK and Japan) and oil price shocks. Their study basically employed the standard cash flows and dividend valuation model in the examination of the reaction of stock market to oil price shocks. The study found that the post war effect of oil price shocks on stock prices were an indirect one for the US and Canadian economies. That oil price shocks affected the stock prices of these economies via its impact on real cash flows. On the contrary, the effects of oil price shocks on the UK and Japanese stock prices was direct.

Applying a Vector Autoregressive model to examine the correlation between daily returns of oil futures contracts and stock returns between October 9, 1979 and March 16, 1990, Huang *et al.* (1996) found no evidence of significant relationship between oil future returns and broad-based market indices such as the Standard and Poor's (S & P) 500. However, they showed some evidence to suggest that future oil returns do affect some individual oil company stock returns.

Sadorsky (1999) employs a VAR model to examine the effect of both oil price and oil price volatility shock on US stock market activities. His study showed that both oil price and oil price volatility had a negative and statistically significant effect on stock returns and after 1986 both oil price and oil price volatility shocks explained larger proportions of stock return forecast error variance. Sadorsky (1999) indicated that the there was evidence to suggest oil price dynamics changed after 1986.

Faff and Brailsford (1999) investigated the sensitivity of Australian industrial equity returns to an oil price factor between 1983 and 1996 using an augmented market model to establish the sensitivity. Results of their study indicated the effect of oil prices on the stock market depended on the industry. That Faff and Brailsford (1999) established that oil prices had on stock prices with negative sensitivities in the transportation, packing and papermaking industry whilst within the same period, it had positive sensitivities on the oil and gas industry.

Using a multivariate VAR, Papapetrou (2001) examined the dynamic links among oil prices, real stock prices, interest rates, real economic activity and employment in Greece. Papapetrou found evidence to suggest that oil price fluctuations had significant effect on economic activity and employment in Greece. He also found evidence to suggest that oil prices were important in explaining movement in stock prices.

Zarour (2006), employing a VAR model, analysed the effect of sharp increases in the price of crude oil on the stock returns of five Gulf Cooperation Council (GCC) members (Bahrain, Kuwait, Oman, Saudi Arabia, and United Arab Emirates). The study employed daily data set between May 2001 and May 2005. Their results indicated that the response of the selected markets to oil price shocks increased positively and became faster during episodes if oil price increases.

Park and Ratti (2008) also analysed link between oil price shocks and stock prices for the United States economy and thirteen other European countries. employing a monthly series from January 1986 to December 2005, Park and Ratti (2008) found that the effect of an oil price shock on the stock market depended on whether the country was an oil exporting or importing economy. Thus, for an oil exporting economy like Norway, their study showed that oil price increases had significant positive impact on stock market prices. On the other hand, for oil importing European economies, the study revealed that higher oil price volatility resulted in significant depression of stock prices. For the US economy, they found that oil price shocks contributed immensely to variability in stock prices than that interest rate.

Cong *et al.* (2008), examined the interactive relationship between oil price shocks and stock market activity in China, employing a multivariate VAR. They did not find any evidence to suggest that oil price shocks significantly impacted on indices of stock market returns in China except for manufacturing index and other oil companies.

Using a cointegrated Vector Error Correction Model (VECM) Miller and Ratti (2009) investigated the existence of a long-run relationship between world oil price and international stock market activity between January 1971 and March 2008. Their study allowed for endogenously identified breaks in the cointegrating and error correction matrices, and found the existence of a long-run relationship between the price of crude oil and the international stock market between January 1971 and September 1999. The study, however, found that the expected negative long run relationship of oil price and the international stock market seemed to have disintegrated after September 1999. This, to them, gave credence to the argument of a changing relationship between oil prices and real stock prices.

Bjørnland (2009) analysed the effects of oil price shocks on the Norwegian stock returns, highlighting the transmission channels of crude oil prices for the macroeconomic behaviour. The study employed a Structural VAR to capture the interaction between different macroeconomic variable, stock return and oil prices. His findings indicated that stock returns increased by 2.5% following a 10% rise in the price of crude oil before it gradually died out. This was so because Norway is an oil exporting economy and as such made Bjørnland (2009) results consistent with the argument by Park and Ratti (2008).

Narayan and Narayan (2010) modelled the impact of oil prices on Vietnam's stock prices using daily data from 2000 to 2008. Their model also included exchange rate as a determinant of stock prices. Narayan and Narayan (2010) found a cointegrating relationship between crude oil price, exchange rate and stock prices. They also showed evidence that oil prices increase impacted positively on Vietnam's stock prices.

Fayyad and Daly (2011) investigated the empirical relationship between oil price and stock market returns for countries in the Gulf Cooperation Council (GCC), UK and the US economies. The study employed daily data from September 2005 to February 2010 by applying a VAR analysis. The study found that the predictive power of oil price for stock market activity increased after an increase in the price of oil. Their results further indicated that the response of the stock market in the GCC increased during the global financial crisis. Fayyad and Daly (2011) also found that countries such as the UK, Qatar and the United Arab

Emirates (UAE) exhibited greater responsiveness to oil price shocks than the other markets studied.

Employing the Bootstrap Panel Cointegration techniques and Seemingly Unrelated Regression (SUR), Arouri and Rault (2012) looked at the long-run relationship between oil prices and stock markets in the GCC for the period June 2005 to October 2008. Their results found evidence of a cointegrating relationship between oil prices and stock market activities in the GCC. Results of the SUR also indicated that increases in the price of crude oil impacted positively on stock prices in all the member states of the GCC except in Saudi Arabia. Their result confirms assertions made by Park and Ratti (2008).

Kilian (2009) criticised the conventional method in the oil price-literature, which treats oil prices as exogenous with respect to the world economy. Other studies (such as Barsky & Kilian, 2004; Hamilton, 2008; Kilian, 2008) with similar view as Kilian (2009) maintain that economic shocks that drive macroeconomic aggregate (including stock prices) could equally drive crude oil prices, making it difficult to separate reverse causality. Consequently, aggregate oil price shocks must be decomposed into structural factors to reflect the endogenous nature of such shocks. Thus, oil price shocks should be measured in terms of its origin. Employing a recursive structure, Kilian (2009) identified three oil shocks: an oil supply shocks; global oil demand shocks and oil-market specific demand shocks. Apergis and Miller (2009) have argued that the decomposition of crude oil price shocks does not only eliminate the deficit of previous studies, which considered oil prices exogenously with regard to other variables that

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determine economic activities but also the deficiency associated with those studies in terms of documenting the relative importance of such differentiated shocks for the course of asset prices. Following the criticism of Kilian (2009), a number of studies have attempted to, incorporate role of the origin of oil price shocks in their analysis of the impact of oil price shocks on stock market activity.

One such study is the study by Kilian and Park (2009). They examined the response of aggregate US real stock returns and oil price shocks. Employing modelling technique based on what was proposed by Kilian (2009), they found that US stock returns reacted differently depending on whether a rise in the price of oil was driven by supply or demand shocks in the crude oil market. They found evidence to suggest that a positive shock to global demand for industrial commodities resulted in both higher real oil prices and higher stock prices. On the other hand, they noted that oil-market specific demand shocks caused by precautionary demand for crude oil depressed stock prices but did not find any significant impact of oil supply shocks on stock returns.

Employing a modified version of Kilian's approach, Apergis and Miller (2009) examined how explicit structural shocks that characterised the endogenous nature of oil price changes affected stock market returns in Australia, Japan, Italy, France, United Kingdom, Canada and the United States in separate estimations. Their results, contrary to the one obtained by Kilian and Park (2009), indicated international stock returns do not respond in a large way to oil market shocks in general. Thus, the significant effect that existed proved to be very small in magnitude.

Basher *et al.* (2012) employed a structural VAR to model the dynamic relationship between crude oil price, exchange rate, interest rates, global economic activity oil supply and stock prices of emerging markets. Their results indicated a bidirectional relationship between oil price shocks and stock market activities in emerging markets. Thus, an increase in oil price shocks resulted in the reduction of stock prices of emerging markets. On the other hand, increases in the stock prices of emerging markets contributed to increases in the price of crude oil.

Wang *et al.* (2013) also analysed the impact of oil price shocks on stock market activities for oil importing and exporting countries based on a structural VAR estimation. Their findings suggested that, the response of the stock market, in magnitude, duration, and direction, was highly dependent on whether an economy is a net-importer or a net exporter of crude oil and also on whether the price shock was driven by aggregate demand or supply shocks. Their study also revealed that the contribution of each type of crude oil price shock was dependent on the significance of crude oil in the national economy.

Effiong (2014) investigated the impact of oil price shocks on the Nigerian stock market given credence to the origin of the shock. Employing a structural VAR specification proposed by Kilian and Park (2009), the study analysed data spanning January 1995 to December 2011. The results of the study indicated that oil supply shocks, though had negative impact on the stock market, was insignificant. The study however revealed a positive significant impact of aggregate demand and oil-market specific shocks on the Nigerian stock market.

Effiong (2014) noted that oil price shocks cumulatively accounted for about 47% of the variations in stock prices in the long-run.

Le and Chang (2015) examined how oil price fluctuations influenced the performance of stock markets of Japan, Singapore and Malaysia. The study employed the causality approach developed by Toda and Yamamoto (1995) to explore the causality between oil price and stock prices in these countries, taken into account their long-term and short-term impacts. Using monthly data from January 1997 to July 2013, the study captured the different characteristics of oil importing, exporting and refining in the three Asian economies stated above. Their results indicated that the manner in which stock market reacts to oil price increases varied between different markets and periods.

Narayan and Gupta (2015) also contributed to the debate on the role of oil prices fluctuations in predicting stock returns. The study employed monthly series spanning 150 years (October 1859 to December 2013) and applied a predictive regression model for the US economy. The study made room for salient features of the data (a persistent and endogenous oil price and model heteroscedasticity). The study showed that oil prices predicted US stock returns. The study also revealed evidence to suggest that positive and negative oil price changes were both significant predictors of US stock returns, however negative oil price changes was found to be more important.

Angelidis, Degiannakis, and Filis (2015) investigated the ability of oil price returns, oil price shocks and oil price volatility to provide predictive information on the state (high/low risk environment) of the US stock market return and volatility. The study further disaggregated oil price shocks according to their origin to assess whether they contained incremental forecasting power to oil price return. Their results suggested that oil price returns and volatility possessed the power to forecast the state of the US stock market.

Diaz, Molero and de Gracia (2016) examined the relationship between oil price volatility and stock returns in the G7 (US, UK, Japan, Italy Germany, Canada and France), employing monthly data from 1970 to 2014. The study considered alternative specifications for oil prices (world, nominal and real prices) in order to measure oil price volatility. In a multivariate VAR model, the study found that stock markets in the stated countries responded negatively to oil price volatility.

Li *et al.* (2016), using a structural VAR model, decomposed oil price shocks into four components; oil supply shocks, global demand shocks, domestic demand shocks and oil market specific shocks, to analyse the impact of these shocks on stock returns of China's listed companies in the oil industrial chain using data from 2009 to 2014. Their results suggested that listed companies benefited from increase in the price of oil, however, the impacts of supply and oil market specific shocks were the most significant of the them all. The study also found that there was a gradual increase in the aggregate contributions of oil price shocks to changes in stock return.

With reference to studies in Ghana that specifically examined the link between crude oil prices and stock market activities are very limited. Adjasi (2009) analysed the impact of macroeconomic uncertainty on stock-price volatility in Ghana using data from January 1991 to January 2007. The main finding of the study indicated that higher volatility in oil prices reduced volatility of stock prices. Kuwornu and Owusu-Nantwi (2011), using a Full Information Maximum Likelihood estimation also examined the relationship between macroeconomic variables (including oil price) and the stock market for the period January 1992 to December 2008. Whereas findings of the study suggested most macroeconomic variables significantly affected stock returns in Ghana, it also showed that crude oil prices did not appear to have any significant effect on stock market returns in Ghana.

Oil price shocks, macroeconomic performance: the role of monetary policy

Since the first oil price shock of 1973, a number of researchers have examined the relationship between oil price shocks and macroeconomic performance for a number of economies. Different analytical techniques have yielded different results, which were sometimes sharply different from one another. In fact, the empirical literature on oil price shocks and macroeconomic performance have evolved since the first oil price shock.

The first set of empirical literature that evolved after the 1973/74 oil price shock believed that high oil price could be a permanent characteristic of a changed natural resource regime. Hence, a recurring theme in the literature at the time was all about how the economy as a whole responded to a sudden, permanent price shock. The key question was how would the economy adjust under such conditions? This assumption underlies Rasche and Tatom (1977) use of potential GNP concept to analyse the oil price shock problem for the US economy. This was extended by the work of Bruno and Sachs (1982) which was on how the economy adjusted to supply shocks. Later works by Eastwood (1992) and Hickman, Huntington, and Sweeney (1987) still assumed a permanent oil price shock.

One of the longest running themes in the empirical literature since the first oil price shock of 1973 has been one of attribution. That is, the extent to which recession in an economy could be attributed to oil price shocks, policies of the government or some other events. Estimates from the work of Rasche and Tatom (1977) attributed about 7 percent of the long run reduction in US GNP to the oil price shocks of 1973/74.

Hamilton (1983), analysed the contribution of oil price shocks on US business cycle since the second World War and revealed that the link between oil price movement and output was not one of historical coincidence for the period 1948 to 1972. The study attributed slowdown in the growth of the US economy to oil price hikes three to four quarters after the price increase had occurred. Hence the study concluded that oil price increases was significant in explaining US recession. Mory (1993), using GNP and oil price also arrived at the same conclusion as Hamilton (1983).

In the wake of the declines in the price of crude oil in the mid to the late 1980s without a corresponding increase in the growth of major industrial economies, researchers began to raise question about the conclusions arrived at by Hamilton (1983) and Rasche and Tatom (1977). Mork (1989) and Mork, Olsen, and Mysen (1994), however noted that the relationship between oil price and output was asymmetric in nature and this asymmetric relationship accounted for the weak relationship between oil price and output after crude oil prices began to decline in the mid-80s. In a study was conducted on the US economy and members of the OECD, Mork (1989) and Mork *et al.* (1994) allowed for asymmetric relationship between oil price and output. In both studies, the results indicated that there existed a significant negative relationship between oil price hikes (positive change in the price of oil) and output. However, oil price decrease had no significant effect on output of the economy.

Bernanke *et al.* (1997) took the discussion on the relationship between oil price movement and output a step further by considering the role of monetary policy when it comes to the oil price-output relationship. Employing a vector autoregressive model, they found evidence to the effect that the US-economy reacted differently to oil price hikes under restricted and unrestricted monetary policy regimes. Their results indicated that when monetary authorities responded to oil price hikes by increasing interest rate it contributed to the decline in output following an oil price shock. On the other hand, when interest rate was held constant after an oil price increase, output responded positively. Bernanke *et al.* (1997) therefore argued that the declines in output that followed the 1973/74 and 1979/80 oil price shocks could have been avoided if monetary policy was neutral.

In a paper which re-examined the work of Bernanke *et al.* (1997), Hamilton and Herrera (2004), arrived at a completely different conclusion on the relative contribution of monetary policy and oil price hikes to US recessions after the oil price shocks of the 1970s. The results of Hamilton and Herrera (2004) suggested the ability of monetary policy to reduce the contractionary effect of oil price shock was not as strong as suggested by Bernanke *et al.* (1997). By employing longer lag length than Bernanke *et al.* (1997), Hamilton and Herrera (2004) showed that oil price shocks had significantly large impact on the real economy. They further showed that even if monetary policy was held constant or neutral, an oil price shock still had sizable reduction in output. Thus, Hamilton and Herrera (2004) concluded that monetary policy played very little role.

Hidthiir, Aziz, Izraf, and Fadzim (2007) analysed the link between oil price and macroeconomic performance for the UK and Malaysian economies using a multivariate VAR. Their study concentrated on five key macroeconomic variables; real GDP, short-term interest rate, real effective exchange rate, money supply and long-term interest rate. The study found that oil price hikes had a significant negative effect on output for both countries. Their results further revealed that oil price hikes significantly contributed to variability in exchange rate and long term interest rate in Malaysia. In relation to the UK, the study found that oil price hikes significantly influenced the variability of money supply and short term interest rate.

Blanchard and Gali (2007), in examining the effect of oil price shocks on the macroeconomic performance of six industrialised countries (US, UK, Germany, France, Italy and Japan), divided their sample period into two; the period after the 1970s and the last decade before 2007. They employed a VAR model and found that the relationship between oil price increase and GDP in these countries changed from negative to positive for shocks in the 2000s compared with the shocks of the 1970s and 1980s.

The results of Blanchard and Gali (2007) seem to suggest that the relationship between crude oil price and economic activities seem to have changed in 2000. This seem to have influenced the work of Kilian (2009a) who argued that the price of crude oil in itself is determined by supply and demand factors just as any other commodity, hence, an analysis of the impact of an oil price shock on macroeconomic performance which does not take into account the source of the shock may be misleading.

Kilian (2009a), employing a Structural VAR model, decomposed oil price shocks into aggregate demand shock, oil market specific shock, and oil supply. He maintained that aggregate demand shock was as result of expansion in global economic activities, which resulted in high demand for crude oil and hence led to an increase in the price of oil. On the other hand, supply shock was as a result of unexpected shortfalls in the world production of crude oil and oil market specific shock was mainly as a result of speculative activities in the oil market. In analysing the effect of these shocks on the US economy, Kilian found oil price increases which were due to aggregate demand shock did not result in reduction in GDP. However, price increases that were due to aggregate supply shock contributed to the reduction in US GDP.

In a related study, Baumeister, Peersman and Van Robays (2010) also analysed the consequence of oil price shocks across a set of industrialised countries overtime, using a Structural VAR model. Their study revealed that oil demand shocks driven by global economic activities resulted in a temporary increase in real GDP following an increase in the price of oil. Contrary to this outcome, their study found that oil specific demand shock resulted in a temporary decline in GDP of all the countries involved in the study. However, the effect of oil supply shock varied. They therefore concluded that the underlying reason for a variation in the price of crude oil is crucial in the determination of the economic repercussion and the appropriate monetary reaction.

Cunado, Jo, and de Gracia (2015) also examined the macroeconomic impact of structural oil shocks in four of top oil-consuming economies in Asia using a sign restricted Structural VAR model. Their result indicated that oil supply shock had limited impact on these economies. Oil demand shock was however found to have positive significant impact on economic activities in all four economies. They also found that monetary policy tools such as interest rate and exchange rate helped mitigate the effect of oil supply shocks in Japan and Korea.

Despite huge leapfrog in the literature on the relationship between oil price shocks and macroeconomic performance, studies on the relationship in Africa seem to suggest that some lag. In addition, most of these studies have largely concentrated on net oil exporting countries on the continent with very few of them examining the relationship for net oil importing countries including Ghana.

Bouakez and Vencatachellum (2007) quantified the effect of oil price increase on macroeconomic aggregates for oil importing and oil exporting countries in Africa. Their results indicated that a doubling of the price of crude oil on world markets with complete pass through to oil consumers would results in a 6 percent contraction of the median net-oil importing African country in the first year. For the net-oil exporting African economy on the other hand, doubling in the price of oil would result in a 4 percent increase in its gross domestic product under managed-float and by 9 percent under a fixed exchange rate regime. Their study however, added that inflation in such economies would increase by a much greater magnitude under a managed regime than a fixed exchange rate regime in a net oil exporting country.

Jbir and Zouari-Ghorbel (2009) examined the impact of oil price shocks on the Tunisian economy, paying particular attention to the role subsidies play in the relationship between oil price shocks and other macroeconomic variables. The study used quarterly time series data spanning from 1993Q1 to 2007Q2. Employing the vector autoregressive framework, their results did not indicate any direct impact of oil price shocks on economic activities in Tunisia. Contrary to results obtained by Jbir and Zouari-Ghorbel (2009) for Tunisian economy, a study by Bouzid (2012) found a negative relationship between oil price shocks and economic growth. Bouzid (2012) analysed the relationship between oil prices and economic growth in Tunisia over a period from 1960 to 2009. The study used the vector error correction model in its analysis. The granger causality test from the study indicated that oil prices granger caused real GDP in Tunisia. This implies that international oil price was a key variable that influenced economic growth in Tunisia within the sampled period. The results of the long run analysis, also showed that a 10% permanent increase in crude oil price resulted in reduction in real GDP of Tunisia by 3.36%.

Akpan (2009), employing the VAR, assessed the dynamic relationship between oil price shocks and major macroeconomic variables in Nigeria. The study found that oil price shocks resulted in higher inflation rate and this was also associated with higher real national income, given the fact that Nigeria is a net exporter of the commodity. Akpan (2009) also added that the gain in real national income was offset by losses from lower demand for exports, which was generally due to the economic recession suffered by Nigeria's trading partners.

Similarly, Chuku (2012) also employed the Structural Vector Autoregressive model to examine the linear and asymmetric impacts of oil price shocks on the Nigerian economy, paying particular attention to the supply side effects of oil price shocks. Results obtained by Chuku (2012) indicated that oil price shocks tended to have asymmetric impacts in a single direction (positive) on economic activities. His results further indicated that oil price shocks had positive impact on inflation in Nigeria. Contrary to results optained by Akpan (2009) and Chuku (2012), Ebele (2015), with the use of the Engel-Granger cointegration test and Granger Representation theorem found a negative relationship between crude oil price volatility and economic growth in Nigeria.

Also, Oriakhi & Osaze (2013) examined the consequences of oil price volatility on the growth of the Nigerian economy within the period 1970 to 2010. Employing the VAR methodology, the study found that of the six variables used, oil price volatility directly impacted on real government expenditure, real exchange rate and real import. On the other hand, oil price indirectly impacted on Real GDP, real money supply and inflation through other variables, notably real government expenditure. The implication was that oil price changes determined government expenditure levels which in turn determined the growth of the Nigerian economy.

In a related study, Chisadza, Dlamini, Gupta, and Modise (2013) investigated the effect of oil supply and demand shocks on the South African economy using a sign restriction-based structural VAR model. The results of their study showed that, an oil supply shock had a short-lived significant impact on the inflation rate only. However, it had no significant impact on other variables in their model. An aggregate demand shock also resulted in short- to medium-term improvements in domestic output and the real exchange rate.

In Ghana studies that have attempted to examine the relationship between oil price shocks and macroeconomic activities are relatively few and this includes the works of Cantah and Asmah (2015); Jumah and Pastuszyn (2007) and Tweneboah and Adam (2008). Jumah and Pastuszyn (2007) investigated the relationship between oil price shocks and monetary policy in Ghana for the period 1965 to 2004. The results of the study revealed that the international price of crude directly affected the price level which tended to negatively affect real output. The results also indicated that monetary policy is initially stilled in response to an increase in the price of oil in order to lessen any growth effects, but at the cost of higher inflation. The resultant higher inflation, however, stimulated a subsequent tightening of monetary policy. In addition, the output did not revert quickly to its initial level after an oil price shock, but declined over an extended period.

Tweneboah and Adam (2008) estimated a vector error correction model to explore the long run and short run linkages between world crude oil price and monetary policy in Ghana for the period 1970:1 to 2006:4. The results of the study indicated the existence of a long run relationship among oil price, domestic price level, GDP, exchange rate and interest rate in Ghana in which oil price positively impacted the price level while negatively impacting output. The study also showed that an unexpected oil price shock is followed by an increase in inflation rate and a decline in output in Ghana. On the response of interest rate to a rise in the price of oil, Tweneboah and Adam argued that monetary policy has in the past been with the purpose of reducing any growth consequences of oil price shocks, but at the cost of higher inflation.

Cantah and Asmah (2015) also examined the relationship between oil price and economic growth in Ghana for the period 1967 to 2011, employing the Autoregressive Distributed Lag (ARDL) approach to cointegration. The study paid specific attention to the role of fuel subsidies in the relationship between oil price and growth of the Ghanaian economy. The results of the study indicated that increases in the price of crude oil had negative impact on the growth of the Ghanaian economy both in short and the long run. The study further discovered that the negative impact of oil price increases on the growth of the Ghanaian economy was reinforced by the provision of fuel subsidies in the Ghanaian economy.

Nchor, Klepáč, and Adamec (2016) employed a VAR and a VECM to investigate the dynamic relationship between oil price shocks and macroeconomic variables in Ghana. The main variables of interest for their study were the real government expenditure, real industry value added, real imports inflation and real effective exchange rate. Their study, just as the previous study on the Ghanaian economy found that oil price shock adversely affected the Ghanaian economy.

Critique of the existing literature

Existing empirical research on the effects of oil price shocks on economic activities have largely concentrated on developed economies with very few focusing on developing economies, especially Africa. From the review of existing empirical works, it is clear that oil price shocks have the potential of affecting all facets of economic activities from the external sector through to the stock market and to the macroeconomy as a whole.

In the specific case of the Ghanaian economy, most of the studies that have examined the impact of oil price shocks have mainly focused on the impact of these shocks on key macroeconomic variables such as inflation and economic growth with little or no study on how oil price shocks affect the external balance position and stock market activities in Ghana. The external balance position of the country as well as stock market activities provide key channels through which fluctuations in the oil market could affect the Ghanaian economy. In addition to this, a number of existing studies on the subject, both in developing and developed economies, did not take into account how the various sources of oil price shocks (demand and supply shocks) as identified by Kilian (2009a) and

Kilian *et al.* (2009). The source of the price shock could influence how and the extent of the effect of an oil price shock.

In terms of the external balance position, existing studies have largely focused on just the current account balance of the country without considering other key measures of external balance such as capital account balance and trade balance. Though trade balance is a subset of the current account balance, the effect of oil price shock on external balance would have greater impact on trade balance relative to the current account balance since the current account balance includes other key components in addition to the trade balance. Thus analysis of the effect of oil price shocks on trade and capital account balance position of the economy are key for policy makers to get a holistic idea on the extent to which oil price shocks affects an economy.

Another key criticism of existing research work on the oil price shocks is the fact that these studies make very little or no room for structural change (especially over long samples). Structural breaks tend to have permanent effect of the long-run level of a number of macroeconomic time series and failing to account for such breaks can lead to biased results that may not be a true reflection of the population mean. In addition, a number of existing (especially those on the stock market) ignore non-linearity that has been identified with most financial data sets. Thus, the possibility of a non-linear relationship between oil price shocks and stock market activities is always ignored in almost all the existing empirical research.

On the impact of oil price shocks and the macroeconomy, existing empirical works on Ghana have mainly focused on the recessionary effect of the oil price shocks and have failed to examine how various underlying causes of an oil price shocks could affect macroeconomic activities and the effectiveness of monetary policy. More so, a number of the studies conducted in Ghana and Africa at large were based on the VAR framework which is known to lack structural interpretations of outcomes. These studies have also failed to examine how these shocks also tend to affect the effectiveness of monetary policy.

Unlike the existing studies, the present study examines the effect of oil price shocks on external balance (Trade Balance and Capital Account Balance), stock market activity, inflation and output in Ghana, taking into account how differences in the source of the shock influence the effect of the price shock. The study also considers both linear and non-linear relationship between oil price shocks and stock market activities in Ghana as well as how these shocks affect the effectiveness of monetary policy.

Summary

The review of theoretical and empirical literature indicates that crude oil price shocks tend to have differential impact on economic activities depending on the source of the price shocks. This is contrary to the existing perception among researchers and policymakers in Ghana as identified in the overview of the Ghanaian Economy in the previous chapter. Despite the vast amount of literature that discusses the differential impact of oil price shocks, very little (or no such literature) exist on developing economies or Ghana's economy. Studies that have examined this issues on developing economies have also largely concentrated on oil exporting countries. More so, the methodologies used in existing studies as indicated in the critique of existing literature above raises a number of questions. Thus there is the need for an empirical study that examines Ghana's situation.

CHAPTER FOUR

RESEARCH METHODS

Introduction

In this chapter, we present the procedures that were employed in the study. The order of presentation is as follows. The chapter first presents the research design. This is followed by a conceptual framework that indicates the linkages between oil prices, stock market activities, external balance position and macroeconomic activities (inflation and Output). The chapter then proceeds by describing the specific theoretical and empirical models that link oil price to the three main issues of concern (External Balance, Stock market activities and macroeconomic activities).

Research Design

In line with the objective of the study to analyse the effect of oil price shocks on external balance, stock market activity, inflation and output in Ghana, the study adopted the positivist philosophy within the framework of Keynesian economics. The positivists believe that social reality is stable and for this reason, can be observed and described from an objective viewpoint without any form of interferance with the phenomena being studied (Levin, 1988). Thus, positivist philosophy provides an opportunity for the researcher to study social and economic processes in an objective manner as well as explain relationships between variables. In addition, the positivist philosophy favours the use of quantitative approaches to research as in the case of this thesis. The positivist philosophy is appropriate for the development of mathematical models to examine the relationship between quantitative measurements. Based on the positivist philosophy, this study employed the quantitative method.

The quantitative approach enables the researcher to put the social and economic world into a structure of causality and nullifies the role of human effect through the use of a quantitative instrument such as multivariate statistical analysis in analyzing data as used in this study. More specifically, since the objective of the study is explanatory in nature, the study adopted the explanatory research under the quantitative approach. The explanatory design allows the researcher to identify the magnitude and nature of the cause-and-effect relationships. Explanatory research design is mainly used to examine the effects of specific changes on existing processes. Based on the general objective of the present study, the explanatory research design provides the best approach to the research.

Conceptual Framework

The review of theoretical literature clearly indicated that there was no single theory that linked oil price shocks to external balance, stock market activities and key macroeconomic variables such as inflation and output concurrently. Hence, the current study developed a conceptual framework that showed the various linkages between these variables and how oil price shocks transmitted to affect external balance, stock market activities and inflation and output. The framework was adapted from the works of Cantah (2013); Chuku, Effiong, and Sam (2010) and Das *et al.* (2014). The framework basically inked the various theories on oil price shocks and the economy as reviewed in the previous chapter.

The framework, as depicted in Figure 10, shows the various channels via which an oil price shock could affect an economy. From Figure 10, an increase (decrease) in the price of crude oil would translate into higher (lower) import bills for the net crude oil importer all other things being equal. Given the value of exports, the high (low) oil price has the potential to increase (reduce) trade deficit and consequently contribute to the deterioration (improvement) of the current account position of the country. For an oil exporting economy, an increase (reduction) in the price of crude oil results would contribute to increase (reduce) exports and this could improve (worsen) the trade balance position of the oil exporting country; hence, the current account balance which eventually affects the GDP of the economy.

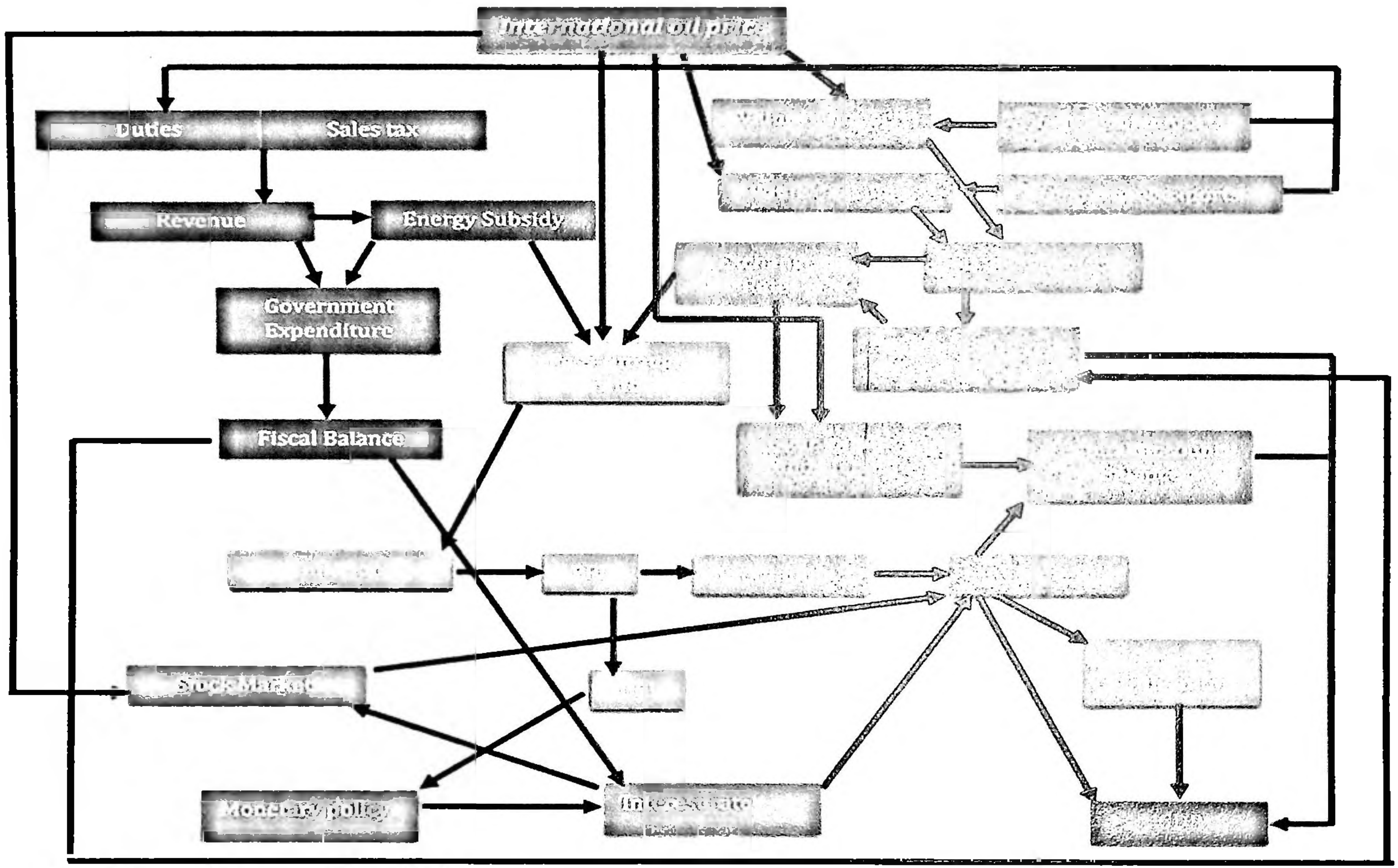

Figure 10: Transmission channel of oil price changes
Source: Adapted from Cantah, 2013; C. Chuku et al., 2010; Das et al., 2014)

Since international trade provides some form of revenue to the government in the form of trade tariffs and excise taxes, the quantity of crude oil exported or imported also has the potential to affect the revenue stream of the government, which could also influence the fiscal balance position of the government, given the level of expenditure. It is also important to note that since crude is a key input in the production of energy, a change in its price has the potential to affect the amount of money spent on energy subsidies, which still has implications on government expenditure and fiscal balance position. Thus, high crude oil prices could contribute to the deterioration of the fiscal balance position of an economy that tend to have a passive effect on the current account position of the economy (twin deficit hypothesis).

Similarly, high crude oil prices tend to have adverse effects on asset prices which have the potential to influence the international movement of capital. That is, oil price increases would cause asset prices and dividends to decrease in oil importing economies. This could adversely affect the inflow of foreign capital and consequently affect the capital account balance of the economy. Again, budget deficit that may result from increased energy subsidies may lead to higher interest rates in the domestic economy and this could also influence the inflow of foreign capital to help finance the fiscal deficit.

With regards to the stock market activities, the effect of an oil price increase could be both direct and indirect. As major input of production for a number of firms (about 20 of the firms) are listed on the stock market, an increase in the price of crude oil tend to affect the expected cash flow of firms listed on the stock market, as such the stock prices of such firms would be affected and this could affect the overall activities on the stock market. Activities on the stock market could also be affected indirectly through the effect of oil price shocks on macroeconomic variables such as inflation and interest rates. Higher interest rate that is as a result of monetary policy responses to high inflation rate resulting from oil price hikes could move funds from the stock market to high yielding bonds and this could adversely affect the level of activities in the stock market.

Another key channel via which oil prices affect an economy (as indicated in Figure 10) is through the domestic price channel. However, the extent to which oil price increase is transmitted into the domestic economy would depend on the exchange rate and the amount of energy subsidy provided by the government. It is important to note that despite these intervening variables, an increase in the price of oil, all other things being equal, would lead to increase in the cost of production (PPI) which would also affect firm profitability and later influence their investment decisions. This would have implications on capacity utilisation and the growth of the economy as a whole. More so the high cost of production due to the oil price hike could contribute to increase the consumer price index which could trigger response from monetary authorities thereby increasing their monetary policy rate which could further contribute to the reduction in investment and capacity utilisation and for that matter economic growth.

Oil Price Shocks and External Balance

Theoretical model specification

Trade balance

The theoretical model used in this study was based on the Imperfect Trade Substitution Model of Goldstein and Khan (1985), Rose (1991) and Rose and Yellen (1989). The imperfect trade substitution model is a two-country model of trade which is based on the assumption that the domestically produced goods and imported goods are imperfect substitutes. The model further assumes that the volume of imported goods by citizens of the domestic economy is positively related to domestic income and negatively related to relative import prices. Similarly, the volume of imports by foreign economies from the domestic economy is positively related to the income of foreign economies and negatively related to relative prices. The imperfect trade substitution model can, thus, be specified as;

$$D_{QM} = f(Y, p_m) \quad (1)$$

$$D_{QM}^{*} = f(Y^{*}, p_m^{*}) \quad (2)$$

Where $D_{QM}(D_{QM}^{*})$ is the quantity of goods imported by the domestic (foreign) economy; $Y(Y^{*})$ is the level of income measured in domestic (foreign) output; p_m is the relative import price of goods that are imported into the domestic economy and P_m^{*} is the corresponding relative price of imports abroad. Equations (1) and (2) constitute the Marshallian demand functions, with relative income elasticities and price expected to be positive and negative in sign respectively.

In terms of the supply of exports, Rose and Yellen (1989) maintain that the supply of exports depends largely on the relative price of exportable goods. This is shown in the equations below.

$$S_{QX} = f(p_x) \tag{3}$$

$$S_{QX}^* = f(p_x^*) \tag{4}$$

Where $S_{QX}(S_{QX}^*)$ is the supply of exports from the domestic (foreign) economy; p_x represents the relative price of exports measured as a ratio of the domestic currency price of exported goods (P_x) to domestic price level (P); similarly p_x^* is analogously referred to as the relative price of foreign economy's exports, which is P_x^* divided by P^*.

The domestic economy's relative import prices can be expressed as

$$p_m = E \times \frac{P_x^*}{P} = \left(E \times \frac{P^*}{P}\right) \times \left(\frac{P_x^*}{P^*}\right) \equiv q \times p_x^* \tag{5}$$

Where E is the nominal exchange rate; consequently, the domestic currency of foreign exchange and q $\left(q = E \times \frac{P^*}{P}\right)$ captures the real exchange rate. Similarly, the relative price of foreign imports is given by

$$p_m^* = \frac{p_x}{q} \tag{6}$$

At equilibrium, transacted quantities and the relative prices of exports in each country are determined by the equilibrium conditions specified in equations (7) and (8)

$$D_{QM} = S_{QX}^* \tag{7}$$

$$D_{QM}^* = S_{QX} \tag{8}$$

The value of the domestic economy's trade balance (TB) in real terms is the value of net exports in domestic currency divided by the domestic price level as specified in equation (9)

$$TB = (p_x \times D^*_{QM}) - (q \times p^*_x \times D_{QM}) \tag{9}$$

Rose and Yellen (1989) argued that in the presence of capital flows, TB must not necessarily be equal to zero. Domestic demand for import however can be separated into oil imports and other imports. Oil imports are mainly influenced by activities in the oil. Other imports are mainly influenced by the fiscal balance position, terms of trade and activities in the oil market (see Bodenstein et al., 2011; Kilian et al., 2009). Equations (1) to (9) can be solved for levels of domestic exports and imports and their relative price ratios p^*_x and p_x, taking into consideration the various factors that affect domestic demand for imports. Consequently, TB can be written as a partial reduced form as:

$$TB = f(q, FB, TOT, ODS, ODSS, OSS, Y, Y^*) \tag{10}$$

Where q is real exchange rate, FB is fiscal balance, TOT is terms of trade, ODS is oil demand shock, $ODSS$ is the oil market specific demand shocks, OSS is oil supply shock and Y *and* Y^* are domestic and foreign income respectively.

Capital Account

The theoretical basis of our capital account model is derived from the Mundell Fleming model on capital mobility. According to the Mundell Fleming model on capital mobility, the international movement of capital is largely influenced by international interest rate differentials. Thus the capital account component of the Balance of Payment of an economy depends on the differences in interest rates in the domestic economy and that of the rest of the world.

$$KA_t = k(r^d - r^f) = k(r^*), \qquad k' > 0 \tag{11}$$

Where KA_t is the capital account balance, r^d is the domestic interest rate, r^f is the interest rate for the rest of the world and r^* is the interest rate differential between domestic and interest rate of the rest of the world.

Empirical model specification

Trade Balance and Oil price shocks

The imperfect substitution model of Rose (1991) and Rose and Yellen (1989) as discussed in the theoretical model specification above does not completely capture some key factors that could affect trade balance of a developing country like Ghana. As a result, the function specified in equation (10) is modified to capture important variables that would significantly influence Ghana's Trade balance position. A number of studies have identified interest rate, terms of trade and fiscal balance as key determinants of trade balance in Ghana (see for example, Akoto, 2016; Duasa, 2007; Sakyi & Opoku, 2016). In addition, since crude oil is an essential component of Ghana's import commodities, it is key to also analyse the extent to which oil price shocks (taking into account the source of the price shock) affects Ghana's trade balance position. Hence, equation (10) is re-specified as:

$$TB_t = f(q_t, FB_t, TOT_t, ODS_t, ODSS_t, OSS_t, Y_t, Y_t^*, r_t,) \tag{12}$$

$$TB_t = f(q_t, FB_t, TOT_t\ OP_t, Y_t, Y_t^*, r_t,) \tag{13}$$

Where q, Y, Y^* are as previously defined, r is short term interest rate, FB is the fiscal balance, TOT is the terms of trade ODS oil demand shock, $ODSS$ oil market specific demand shock, OSS oil supply shocks and OP is the price of crude oil. Equation 13 is a re-specification of equation 12, however this includes only the world price of crude oil in order to examine the effect of oil price increases on trade balance.

$$TB_t = \alpha_0 + \alpha_1 Lq_t + \alpha_2 LY_t + \alpha_3 r_t + \alpha_4 FB_t + \alpha_5 LTOT_t + \alpha_6 LY_t^* + \alpha_7 ODS_t + \alpha_8 ODSS_t + \alpha_9 OSS_t + \epsilon_t \quad (14)$$

$$TB_t = \beta_0 + \beta_1 Lq_t + \beta_2 LY_t + \beta_3 r_t + \beta_4 FB_t + \beta_5 LTOT_t + \alpha_6 LY_t^* + \beta_6 LOP_t + \varepsilon_t \quad (15)$$

Where α_i and β_i are parameters to be estimated, t is the time period, ϵ and ε represents the error terms and L represent the natural logarithm operator. All other variables are as previously defined.

With the exception of interest rate, fiscal balance and the measures of oil price shocks (ODS, ODSS and OSS), the natural log of each variable was used. This was done because variables such as domestic and foreign income are multiplicative in nature. Also, taking the natural log allows the variables to be converted to the same unit of measurement and helps in minimising the problem of heteroscedasticity (Gujarati, 2009).

Capital Account Balance and Oil price shocks.

To analyse the effect of oil price shocks on the capital account balance, we augment equation (11) to include other control variables since in the case of

Ghana an interest rate differential may not be the only factor that could influence the flow of capital in and out of the economy. This is because the fiscal balance position of the country, the inflow of foreign investment, the exchange rate, income levels, capital account openness and domestic price levels are possible variables that could influence the capital account balance of Ghana (see Brafu-Insaidoo & Biekpe, 2014; Cantah, Brafu-Insaidoo, Wiafe, & Adams, 2016; Edwards, 1990). In addition, given the fact that oil price shocks has the capacity to affect the flow of investment into the country (see Kilian *et al.*, 2009), we also include the measures of oil price shocks (i.e. ODS, ODSS, and OSS) in the model.

$$KA_t = k(r_t^*, FDI_t, CAO_t, REER_t, FB_t, y_t, CPI_t, ODS_t, ODSS_t OSS_t) \qquad (16)$$

Where $Y_t, r_t^*, FB_t\ q_t, ODS_t, ODSS_t OSS_t$ are as previously defined, FDI_t foreign direct investment as a percentage of GDP, CAO_t capital account openness and CPI_t is the consumer price index. Natural logs of some variables were taken based on the reasons alluded to earlier in this section. Hence the equation to be estimated is defined by

$$KA_t = k_0 + k_1 r_t^* + k_2 FDI_t + k_3 CAO_t + k_4 Lq_t + k_5 FB_t + k_6 LY_t + k_8 ODS_t$$
$$+ k_9 ODSS_t + k_{10} OSS_t + \mu_t \qquad (17)$$

Just as we did for trade balance, we estimate another model maintaining just the world price of crude oil rather than the various oil price shocks. Thus,

$$KA_t = k_0 + k_1 r_t^* + k_2 FDI_t + k_3 CAO_t + k_4 Lq_t + k_5 FB_t + k_6 LY_t + k_7 LOP + \mu_t \quad (18)$$

Justification, Measurement of Variable and Sign Expectations

Trade Balance (TB) as used in the study, is the difference between exports of goods and imports of goods as a percentage of Gross Domestic Product in Ghana. The trade balance is one of the proxies the study employed to measure external balance. Despite the fact that the trade balance is part of the current account balance, the study analysed the effects of oil price shocks on trade balance alone due to the key influence of trade balance in the external balance position of Ghana's economy. Various editions of the Bank of Ghana Annual Report attest to this fact.

Capital Account Balance (KA) is the last measure of external balance employed in the study. The capital account captures the net variation in physical or financial ownership of assets for a nation. It also includes changes in the reserve account. The capital account balance is key to achieving favourable balance of payment position of the country. In a developing country like Ghana where the inflow of capital is key to national development, it would be very important to examine the extent to which oil price shocks affects the capital account and identify the best strategies to deal with it.

Real Gross Domestic Product (*Y*): The real GDP is employed in this study as a proxy for domestic income. Real GDP measures the value of all goods and services produced within an economy and adjusted for inflation. Real GDP is used in the model as a control variable to capture the effect of changes in income levels on the external balance position of Ghana. As a developing economy, it is expected that higher income levels would increase the demand for imported goods and as such would contribute to the deterioration of the trade balance. In relation to the capital account balance, it is expected that increases in income levels should lead to the inflow of foreign capital into the domestic economy. This expectation is in line with arguments made by Sakyi and Opoku (2016).

Another key control variable employed in the study is the interest rate. The study used the 91-day treasury bill rate of Ghana as a measure of short term interest rate. An increase in interest rate in an economy could contribute to reduce consumer spending, which could result in reduction in demand for imported goods and services. In addition, the increase in interest rate may cause some level of declines in the rate of inflation which could make exports of the domestic economy more competitive in the world market, hence, improving trade balance. On the other hand, increases in the interest rate may attract the inflow of foreign capital into the domestic economy. The increase in the inflow of foreign capital into the domestic economy may lead to the appreciation of the domestic currency. This makes exports from the domestic economy more expensive and imports less expensive and may result in the deterioration of the trade balance (Ener & Arica, 2012). Hence, the effect of interest rate on trade balance could either be positive or negative.

In place of the interest rate that was used for the trade balance, the study employed interest rate differential (r^*) as a control variable. The interest rate differential was computed by subtracting the three-month LIBOR (London Interbank Offered Rate), which was used as a measure of interest rate for the rest of the world, from the 91-day Treasury Bill rate of Ghana. A positive interest rate differential is an indication that interest rate in Ghana exceeds that of the rest of the world and hence would attract more inflows of foreign capital. On the other hand, a negative interest rate differential implies that interest rates in Ghana are far less than that of the rest of the world. This would lead to the outflow of capital and lead to the deterioration of the capital account balance. Thus, the study expects a direct relationship between interest rate differential and capital account balance.

The study also includes *Fiscal Balance* (FB) to control for the possible effect of fiscal deficit on external balance. The twin deficit hypothesis postulates that increase in fiscal or budget deficit causes interest rates in the domestic economy to rise. This would result in the inflows of foreign capital leading to the appreciation of the domestic currency. The appreciation of the domestic currency makes the economy's exports less competitive and makes imports much cheaper. This situation leads to the deterioration of trade balance. Hence, the present study expected a direct relationship between fiscal deficit and trade balance. On the other hand, the study expected that higher fiscal deficits should result in higher capital inflows and improved capital account balance. Fiscal Balance was measured by the difference between government revenue and expenditure as a percentage of GDP.

Real Effective Exchange Rate (q) is measured as the value of the cedi against a weighted average of major currencies adjusted for inflation. In terms of the effect of q on trade balance, the Marshall-Lerner condition postulate that depreciation of the domestic currency would have a positive impact on trade balance balance if the sum of the elasticities of demand for exports and imports is greater than one (Henry & Longmore, 2003). The study therefore expected a direct relationship between q and trade balance. In relation to the capital account balance, based on the theoretical arguments of Agénor (1998), Lartey (2008) and Combes, Kinda, and Plane (2012), which indicated that appreciation of the domestic currency tend to have an adverse effect on the inflow of capital, the study also expected direct relationship between capital account balance and q.

Terms of Trade (TOT) is measured as the index of export prices in relation to import prices. Improvement in the terms of trade implies export prices are increasing faster than import prices and this could result in reduction in demand for the economy's exports. Hence, the study expected an inverse relationship between terms of trade and trade balance.

World Income (Y^*) is also included in the model as a control variable to control for its effect on the demand for Ghana's exports and subsequently on trade balance. The study postulated a positive relationship between, trade balance and world income at least in the short run. In the long run, due to the possible effect of increase demand on the exchange rate, there was the expectation of an increase in world income to have a negative effect on trade balance.

Foreign Direct Investment (FDI) is the inflow of investment by citizens of a particular country in another country. It is measured as a percentage of GDP. FDI is also a key determinant of the capital account balance. The study expected a direct relationship between capital account balance and FDI inflows.

Oil Supply Shock (OSS) captures the factors that affect the current physical availability of crude oil (Kilian, 2009a). Thus, shocks to current availability of crude oil prices may cause an increase in the price of the commodity and as such with Ghana being a net importer of crude oil, an increase in the price of the commodity is likely to contribute to increase the import bills of the economy. This would lead to the deterioration of trade balance of the country. The study expected an inverse relationship between oil supply shock and trade balance at least in the short run. In relation to the capital account balance, oil supply shocks which result in the depreciation of the domestic currency may lead to gains in net foreign assets for the oil importing economy at least in the short run (see Kilian *et al.*, 2009).

Oil Demand Shock (ODS) basically captures shocks to the current demand for crude oil, which is usually as a result fluctuation in the business cycle of the world. A typical example is what happened to the global demand for crude oil due to the increased demand from mainly China and India as a result expansion in their growth. Increases in the price of crude oil due to demand shock is usually associated with increased demand for other primary commodities. Hence, the effect of oil demand shock on trade balance depends on the non-oil trade surplus that is likely to occur due to increase in global economic activities. Thus, its effects on the trade balance could either be positive or negative. In the case of the effect of oil demand shock on the capital account balance, high oil prices that are due to demand shock may signal investors of the need to invest in oil exporting economies due to the possible capital gains from investing in the booming oil sector, as such net oil importing economies are likely to see some declines in the flow of capital which would invariably affect the capital account balance adversely.

Oil Market Specific Demand Shock (ODSS) captures the shocks to the price of crude oil that is not due changes in demand or supply conditions, rather as a result of shifts in the precautionary demand for crude oil. Kilian *et al.* (2009) maintains that the effect of oil market specific demand shock is qualitatively and to some extent quantitatively similar to the responses of external balance (Trade Balance, and Capital Account Balance) to oil supply shocks. As such, the study expected similar relationship between external balance and oil market specific demand shocks, just as that of the supply shock.

A detailed description of how oil supply, oil demand and oil market specific demand shocks are measured is provided in the next section.

Construction of the Supply and Demand Shocks in the Oil Market

In order to identify oil market related shocks that influenced the movements in the price of crude oil, the study employed a Structural VAR specification that was related to the specifications of Kilian (2009a) and Peersman and Van Robays (2012). This would help to disentangle the effects of the demand and supply components of an oil price shock on the external balance and stock market activities. The SVAR model allowed for the combination of economic theory and time series analysis in determining the dynamic responses of macroeconomic variables to independent shocks. Thus, after the relationship between the variables of interest has been captured in a linear framework, a set of restrictions based on economic theory are imposed on the decomposed innovations to the variables into mutually orthogonal shocks with structural interpretations.

After the identifications of the various structural shocks, their dynamic effects on all the variables in the model can be measured while controlling for other exogenous influences on the variables. Thus, with the SVAR approach, it becomes possible to disentangle the different sources of oil price shocks and quantify their dynamic effects on external balance and stock market activity in Ghana. Given the objective of the study, we first estimated a Structural VAR model that was based on the only the oil market variables from which oil price shock variables (supply shocks, global demand shocks, and oil-market specific shocks) were constructed for use in the second stage estimation where we examined the effects of oil price shocks on stock market activity and external balance.

The structural representation of our VAR model is given by

$$A_0 y_t = \alpha + \sum_{i=1}^{T} A_i y_{t-1} + \varepsilon_t \tag{19}$$

Where A is a 3×3 matrix of coefficients, ε_t represents the vector of serially and mutually uncorrelated structural shocks and y_t, a vector of oil market variables. The set of oil market variables captured in this model are crude oil supply, measured as the percentage change in oil production (*oilsupply*), index for global real economic activity (*geademand*) and the percentage change in the world price of crude oil (*oilsds*). By pre-multiplying equation (19) by A_0^{-1} we obtain the reduced form equation:

$$y_t = A_0^{-1}\alpha + \sum_{i=1}^{T} A_0^{-1}A_i y_{t-1} + A_0^{-1}\varepsilon_t \tag{20}$$

$$y_t = C + \sum_{i=1}^{T} B y_{t-1} + e_t \tag{21}$$

The structural shocks for our model were derived by imposing exclusion restrictions on A_0^{-1} in $e_t = A_0^{-1}\varepsilon_t$. A block-recursive structure was imposed on the contemporaneous relationships between the reduced-form error terms and the underlying structural error terms of our model. That identification of the SVAR model is achieved by imposing the following exclusion restriction;

$$\begin{pmatrix} e_{1t}^{oilsupply} \\ e_{2t}^{geademand} \\ e_{3t}^{oilprice} \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{32} & 0 \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} \varepsilon_{1t}^{OSS} \\ \varepsilon_{2t}^{ODS} \\ \varepsilon_{3t}^{ODSS} \end{pmatrix} \tag{22}$$

The three identifying restrictions in equation (22) assumes a vertical short run supply curve and a downward sloping demand curve for oil. The assumption of a vertical crude oil supply curve is based on the fact that producers of the commodity world not be in a position to respond to the crude oil demand shocks at least in the same month. This is probably because of the cost involved in adjusting oil production levels and the uncertainties that exist in the crude oil market. Innovations to the production of crude oil leads to an instantaneous shift in the vertical oil supply curve.

The study also assumed that oil supply shocks could have instantaneous effect on real economic activities since oil is one of the main drivers of economic activity in the world today. Shocks to economic activities that are not as a result of oil supply shocks is referred to as aggregate demand shocks. Also, our model imposed an exclusion restriction that changes in the real oil price that was caused by shocks that were only specific to activities in the oil market would not instantaneously affect real economic activities at least in the same month. This restriction was in line with the low levels of economic activity after each major oil price hikes.

Shocks to the real price of crude oil which is not explained by oil supply or aggregate demand shocks will capture precautionary demand shock in the crude oil market. Hence, such shocks to the real price of crude oil is referred to as oil market specific demand shock. Thus, this shock tends to reflect precautionary demand for oil caused by uncertainty about the future supply of the commodity.

The structural model in equation (22) hypothesised that price of oil (conditional on lagged values of other variables) is determined by the equilibrium between the demand for crude oil and the supply of crude oil. Oil demand shocks do not result in a shift of the oil supply curve, but moves the demand curve along the supply curve, resulting in an increase in the price of oil to change. In addition, the model also allowed for oil supply shocks (for example, an unexpected oil supply interruption caused by a war or by an exogenous political decision) to shift the vertical supply curve along the downward sloping demand curve, again causing the price of oil to change. Consequently, all three shocks are allowed to affect the price of oil within a given month. Furthermore, the model indicated that the changes in the price of oil caused by oil-market specific demand shocks would not affect global aggregate demand within the same month. This assumption was in line with the slow response of aggregates to shocks in oil markets documented in the literature (see Kilian, Rebucci, & Spatafora, 2007).

Once the SVAR model is estimated, the study then decomposed the fluctuations in the price of crude oil at any point in time into components that represented the cumulative effect of all shocks of a given type from 1980 to 2015. It is important to note that one key objective of this study was to analyse the effect of the different sources of the oil price shocks identified above on Ghana's external balance. While the shocks implied by the Structural VAR model were measured at monthly frequency, other variables other than the various measures of oil price shocks were measured in quarterly series. Hence, using a similar procedure in Kilian *et al.* (2009), This study dealt with this problem by constricting measures of the quarterly shocks as averages of the monthly structural shocks for each quarter:

$$\zeta_t = \frac{1}{3}\sum_{i=1}^{3} \hat{\varepsilon}_{j,t,i}, \quad j = 1,2,3 \tag{23}$$

Where $\hat{\varepsilon}_{jt}$ refers to the estimated structural shocks for the jth structural shock in the ith month of the tth quarter of the sample. In the case of stock market activities, the study adopted the monthly estimates of the shocks rather than the quarterly series.

Estimation Procedure

The estimation procedure provided a detailed description of the process used to achieve the objective of identifying the effect of oil price shocks on the external balance position of the Ghanaian economy. The study began the estimation process by examining the time series properties of the variables used for the study and then proceeded to ascertain whether the variables involved in the study were cointegrated. When cointegration was found to exist, then the long run and short run equations were estimated.

Stationarity Test

Examining the stationarity of a particular data is key, since if economic time series are characterised by non-stationarities or is said to have unit root then the standard t-test and F-test may be inappropriate due to the fact that the limiting distribution of the asymptotic variance of the parameter estimates is infinite (Fuller, 1985). This usually leads to spurious regression estimates in conventional regression analysis.

To guarantee the reliability of the results obtained from this study, the study employed a variety of unit root tests. In particular, this study used both the ADF and the PP tests, which were two of the most widely applied unit root tests. These tests were comparable in so many ways, except that they differ with respect to the way they adjust for serial correlation in the residuals. Also, the ADF test has low power in small sample (Cheung & Lai, 1993), so the study employed the PP unit root tests as a robustness check. The PP nonparametric test generalizes the

ADF process, taking into account less restrictive assumptions for the time series in question. The null hypothesis tested was that the variable under examination had a unit root against the stationarity alternative. In each case, the lag-length was chosen using either the Akaike Information Criteria (AIC) and Swartz Information Criterion (SIC) for both the ADF and PP test. The sensitivity of ADF tests to lag selection rendered the PP test an essential additional tool for making inferences about unit roots. The basic formulation of the ADF is specified as follows:

$$\Delta X_t = \alpha + \delta t + \rho X_{t-1} + \sum_{i=1}^{P} \lambda_t \Delta X_{t-1} + \varepsilon_{1t} \tag{24}$$

Where X_t represents the series at time t, Δ is the difference operator, α, δ, ρ, and λ are parameters to be estimated, and ε is the stochastic random disturbance term. The ADF tests the null hypothesis that a series contains unit (non-stationary) against the alternative hypothesis of no unit root (stationary).

That is:

$$H_0: \rho = 0$$

$$H_1: \rho \neq 0$$

As stated earlier, the PP test is superior to the ADF test, especially in situations where time series variable in question has serial correlation and a structural break. This is based on the underlying assumptions in both tests. The ADF test assumes that the error terms are independent with a constant variance however, the PP test assumes the error terms are weakly dependent and heterogeneously distributed and hence, provides robust estimates over the ADF test. The PP test is specified as follows:

$$\Delta X_t = \alpha + \lambda_2 X_{t-1} + \theta\left(t - \frac{T}{2}\right) + \sum_{i=1}^{m} \theta_t \Delta X_{t-1} + \varepsilon_{2t} \qquad (25)$$

In both equations (24) and (25),ε_{1t} *and* ε_{2t} are the covariance stationary random error terms. The following hypotheses are therefore tested in both situations:

H_0: Series contains unit root

H_A: Series is stationary

Stationarity test with structural breaks

Although the PP test described above allowed for structural breaks in its analysis of the stationarity of variables, it only relied on visual examination of the series to determine the starting point for a structural break. Test statistics were then created by adding dummy variables that represented different intercepts and slopes, thus, extending the standard Dickey-Fuller testing procedures. However, these techniques have been criticised for the fact that particular dates may be selected to support the researcher's results and *a priori* expectations (Christiano, 1992).

Failing to account for at least a one-time structural break in a time series variable could bias the unit root tests towards non-rejection of the null, which may result in an incorrect conclusion that the series contains a unit root, when in actual fact the series may be stationary around a structural break. Several procedures have been developed using different methods to endogenously determine the break date of time series variables, but key among them is the Zivot and Andrews procedure which is widely used.

Zivot and Andrews (2002) proposed another version of Perron's (1989) test where the time of the structural break in a series is endogenised (as against being assumed exogenously prior to undertaking the testing procedure). The null hypothesis of the Zivot and Andrews test is that the variable contains a unit root with drift under the presence of no structural breaks; with the alternative hypothesis being that the time series is a trend-stationary process with a single breakpoint; with the break being permitted by either a shift in the level or the growth rate of a series. The time of the break is selected to minimise the one-sided t-statistic of $\hat{\alpha} = 1$ in the equations below.

Zivot and Andrews recommended three models for determining a structural break:

Model A

$$Y_t = \hat{\mu}^A + \hat{\theta}^A DU_t(\hat{T}_b) + \hat{\beta}^A t + \hat{\alpha}^A Y_{t-1} + \sum_{j=1}^{k} \hat{C}_j^A \Delta Y_{t-j} + \hat{e}_t \tag{26}$$

Model B

$$Y_t = \hat{\mu}^B + \hat{\beta}^B t + \hat{\lambda}^B DT_t(\hat{T}_b) + \hat{\alpha}^B Y_{t-1} + \sum_{j=1}^{k} \hat{C}_j^B \Delta Y_{t-j} + \hat{e}_t \tag{27}$$

Model C

$$Y_t = \hat{\mu}^C + \hat{\theta}^C DU_t(\hat{T}_b) + \hat{\beta}^C t + \hat{\lambda}^B DT_t(\hat{T}_b) + \hat{\alpha}^C Y_{t-1} + \sum_{j=1}^{k} \hat{C}_j^A \Delta Y_{t-j} + \hat{e}_t \tag{28}$$

Model A provides for a single change in the intercept, Model B provides for a broken trend function and Model C provides for a structural change in both the intercept and trend. DU_t is a dummy variable that captures a shift in the intercept, while DT_ttakes into account a shift in the trend occurring at time $\hat{T}_b$. As indicated above, the alternative hypothesis under the Zivot and Andrews test is that the series, Y_t, is I(0) with one structural break. $\hat{T}_b$ represents the break date, and $DU_t = 1$ when

$t > TB$ and zero otherwise, DT_t is equal to $(t - TB)$ if $t > TB$ and zero otherwise.

The null hypothesis is rejected if the coefficient, α, is statistically significant. For the Zivot and Andrews test, the time of the break point is endogenously identified by running models A through C and successively allowing for TB to be any data point with the only exceptions being the first and last observations. The optimal lag length was selected through a general-to-specific procedure.

Cointegration Test

Since the emphasis of this study was to identify the long and short run effect of oil price shocks on external balance, an appropriate procedure was to apply cointegration and error correction analysis. Econometric literature provides different approaches to empirically analyse the long run relationship and dynamic interactions between two or more time-series variables.

The most commonly used approach is the residual-based Engle and Granger (1987) two step approach and the full information maximum likelihood-based approach of Johansen (1991, 1995), and Johansen and Juselius (1990). Though the Johansen technique is the most popular, it is not without limitations. Key among the limitations of the Johansen procedure include the requirement that all variables used in the regression be integrated in order one and low power in small samples (Cheung & Lai, 1993). In addition, the presence of structural breaks in the main dependent variable made the use of the Johansen procedure in appropriate for the present study.

Due to the above stated reasons, the study adopted the ARDL model developed by Pesaran and Pesaran (1997) and Pesaran and Shin (1998) and later extended by Pesaran, Shin, and Smith (2001). The ARDL approach to cointegration allows for the estimation of both long and short run (error correction) coefficients within a single equation regardless of the order of integration of the variables under consideration. This is particularly important given the fact that the set of variables employed in the study contained both I(1) and I(0) variables. Another key advantage of the ARDL procedure is that it gives robust estimates under small samples than the Johansen procedure. Also, the ARDL technique allows for the inclusion lagged variables to account for the data generating process. The ARDL procedure further permits the use of dummy variables that correspond to the structural breaks identified in the data in order to avoid the possible problem of spurious regression estimates.

One difficulty associated with the Johansen cointegration technique that the ARDL approach to cointegration avoids pertains to the number of choices that must be made. These include choices such as the number of endogenous and exogenous variables to be included in the model, the treatment of deterministic elements as well as the order of VAR and the optimal number of lags to be used. The estimation procedures are very sensitive to the method used to make these choices and decisions (Pesaran & Shin, 1998). Lastly, with the ARDL approach is conceivable that different variables have different optimal lag lengths, whereas in Johansen-type models this is not allowed.

According to Pesaran and Pesaran (1997), the ARDL approach comprises two steps. In the first step, the presence of any long-term relationship between the variables of interest is determined using either the Wald or F-test statistic in a generalised Dickey-Fuller regression. This F-statistic is employed to test the significance of the lagged levels of the variables in a conditional unrestricted error correction model. The second step of the analysis is to estimate the coefficients of the long-run relationship and determine their values, followed by the estimation of the short-run elasticity of the variables with the error correction representation of the ARDL model. By using the ECM version of ARDL, the speed of adjustment to equilibrium was determined.

The study progressed to estimate the short run and long run elasticities by employing the Unrestricted Error Correction Model (UECM) that has unrestricted intercepts and no trends based on the assumption made by Pesaran *et al.* (2001). From the analysis, equations (14), (15), (17) and (18) can be expressed in ARDL representation as:

$$\Delta TB_t = \alpha_0 + \alpha_1 TB_{t-1} + \alpha_2 Lq_t + \alpha_3 LY_t + \alpha_4 r_t + \alpha_5 FB_t + \alpha_6 LTOT_t$$

$$+\alpha_7 LY_t^* + \alpha_8 ODS_t + \alpha_9 ODSS_t + \alpha_{10} OSS_t + \sum_{i=1}^{P} \phi_{1i} \Delta TB_{t-i} + \sum_{i=1}^{P} \phi_{2i} \Delta Lq_{t-i}$$

$$+\sum_{i=1}^{P} \phi_{3i} \Delta LY_{t-i} + \sum_{i=1}^{P} \phi_{4i} \Delta r_{t-i} + \sum_{i=1}^{P} \phi_{5i} \Delta FB_{t-i} + \sum_{i=1}^{P} \phi_{6i} \Delta LTOT_{t-i} +$$

$$\sum_{i=1}^{P} \phi_{7i} \Delta LY_{t-i}^* + \sum_{i=1}^{P} \phi_{8i} \Delta ODS_{t-i} + \sum_{i=1}^{P} \phi_{9i} \Delta ODSS_{t-i} + \sum_{i=1}^{P} \phi_{10i} \Delta OSS_{t-i} + v_t \quad (30)$$

$$\Delta TB_t = \alpha_0 + \alpha_1 TB_{t-1} + Lq_t + \alpha_3 LY_t + \alpha_4 r_t + \alpha_5 FB_t + \alpha_6 LTOT_t$$

$$+\alpha_7 LY_t^* + \alpha_8 LOP_t \sum_{i=1}^{P} \phi_{1i} \Delta TB_{t-i} + \sum_{i=1}^{P} \phi_{2i} \Delta Lq_{t-i} + \sum_{i=1}^{P} \phi_{3i} \Delta LY_{t-i} + \sum_{i=1}^{P} \phi_{4i} \Delta r_{t-i}$$

$$+\sum_{i=1}^{P} \phi_{5i} \Delta FB_{t-i} + \sum_{i=1}^{P} \phi_{6i} \Delta LTOT_{t-i} + \sum_{i=1}^{P} \phi_{7i} \Delta LY_{t-i}^* + + \sum_{i=1}^{P} \phi_{8i} \Delta LOP_{t-i} + \mu_t \quad (31)$$

$$\Delta KA_t = k_0 + \lambda KA_{t-1} + k_1 r_t^* + k_2 FDI_t + k_3 CAO_t + k_4 Lq_t + k_5 FB_t +$$

$$k_6 LY_t + k_7 ODS_t + k_8 ODSS_t + k_9 OSS_t + \sum_{i=1}^{P} \omega_{1i} \Delta KA_{t-i} + \sum_{i=1}^{P} \omega_{2i} \Delta KA_{t-i}$$

$$\sum_{i=1}^{P} \omega_{3i} \Delta r_{t-i}^* + \sum_{i=1}^{P} \omega_{4i} \Delta FDI_{t-i} + \sum_{i=1}^{P} \omega_{5i} \Delta CAO_{t-i} + \sum_{i=1}^{P} \omega_{6i} \Delta Lq_{t-i} +$$

$$\sum_{i=1}^{P} \omega_{7i} \Delta FB_{t-i} + \sum_{i=1}^{P} \omega_{8i} \Delta LY_{t-i} + \sum_{i=1}^{P} \omega_{9i} \Delta ODS_{t-i} + \sum_{i=1}^{P} \omega_{10i} \Delta ODSS_{t-i} +$$

$$\sum_{i=1}^{P} \omega_{11i} \Delta OSS_{t-i} + \psi_t \quad (32)$$

$$\Delta KA_t = k_0 + \lambda KA_{t-1} + k_1 r_t^* + k_2 FDI_t + k_3 CAO_t + k_4 Lq_t + k_5 FB_t +$$

$$k_6 LY_t + k_7 LOP_t + \sum_{i=1}^{P} \omega_{1i} \Delta KA_{t-i} + \sum_{i=1}^{P} \omega_{2i} \Delta KA_{t-i} + \sum_{i=1}^{P} \omega_{3i} \Delta r^*_{t-i} +$$

$$\sum_{i=1}^{P} \omega_{4i} \Delta FDI_{t-i} + \sum_{i=1}^{P} \omega_{5i} \Delta CAO_{t-i} + \sum_{i=1}^{P} \omega_{6i} \Delta Lq_{t-i} + \sum_{i=1}^{P} \omega_{7i} \Delta FB_{t-i} +$$

$$\sum_{i=1}^{P} \omega_{8i} \Delta LY_{t-i} + \sum_{i=1}^{P} \omega_{9i} \Delta LOP_{t-i} + \psi_t \qquad (33)$$

Where Δ denotes the first difference operator, P is the lag order selected by the Information Criterion used, $\alpha_0, \beta_0, and\ k_0$ are the drift parameters while $\upsilon_t, u_t, \mu_t, \psi_t$ are the error terms which are $N(0, \delta^2)$. The parameters $\phi, \varphi, and\ \omega$ are short-run parameters and $\alpha_{ji}, \beta_{ji}, k_{ji}, and\ \lambda$ are the long-run multipliers. All the variables are defined as before.

The study began by estimating equations (30), (31), (32) and (33) with the bounds test by employing the OLS method, which is normally the first procedure in the ARDL model. The F-test or Wald test was used to test for the presence of long-run relationship among the variables in the equations stated above as follows: The null hypotheses of no long-run relationship among the variables in the stated equations above was tested against the alternative hypotheses of a long-run.

The presence of cointegration between the variables under consideration was tested based on the F-statistics. Given that, the asymptotic distribution of the F-statistic is non-standard without considering the independent variables being I (0) or I (1), Pesaran and Pesaran (1997) provided two sets of critical values for the different numbers of regressors (k), and whether the ARDL model contains an intercept and/or trend. Therefore, the calculated F-statistic was compared with these sets of critical values developed on the basis that the independent variables are I(d) (where $0 \leq d \leq 1$).

The lower critical bound assumes that all the variables are I (0), meaning that there is no cointegration among the variables, while the upper bound assumes that all the variables are I (1). So, if the calculated F-statistic falls outside the upper critical value, then a null hypothesis of no cointegration will be rejected regardless of whether the variables are I (0) or I (1) implying a long- run relationship between the variables.

However, if the F-statistic falls below the lower bound, then the null hypothesis of no cointegration cannot be rejected. If the F-statistic lies within the lower critical and upper critical bounds, the test is inconclusive and it depends on whether the underlying variables are I (0) or I (1). This necessitates the testing for unit roots on the variables under investigation (Pesaran & Pesaran, 1997).

In order to get the optimal lag length for each variable, the ARDL procedure estimates $(P + 1)^{k+1}$ the number of regressions, where P is the maximum number of lags to be used, and k is the number of variables in the equation (Shrestha & Chowdhury, 2005). The optimal lag length of the ARDL model was chosen based on the Schwarz-Bayesian Criterion (SBC) or the Akaike Information Criterion (AIC). The SBC uses the smallest possible lag length and is therefore described as the parsimonious model.

Provided that cointegration has been established from the ARDL model, the long run and error correction estimates of the ARDL and their asymptotic standard errors are then obtained.

$$TB_t = \alpha_0 + \sum_{i=1}^{P} \alpha_1 TB_{t-i} + \sum_{i=1}^{P} \alpha_2 Lq_{t-i} + \sum_{i=1}^{P} \alpha_3 LY_{t-i} + \sum_{i=1}^{P} \alpha_4 r_{t-i} + \sum_{i=1}^{P} \alpha_5 FB_{t-i}$$

$$+ \sum_{i=1}^{P} \alpha_6 LTOT_{t-i} + \sum_{i=1}^{P} \alpha_7 LY^*_{t-i} + \sum_{i=1}^{P} \alpha_8 ODS_{t-i} + \sum_{i=1}^{P} \alpha_9 ODSS_{t-i} + \sum_{i=1}^{P} \alpha_{10} OSS_{t-i}$$

$$+\alpha_{11} TBDUM_t + \varepsilon_t \tag{34}$$

$$TB_t = \alpha_0 + \sum_{i=1}^{P} \alpha_1 TB_{t-i} + \sum_{i=1}^{P} \alpha_2 Lq_{t-i} + \sum_{i=1}^{P} \alpha_3 LY_{t-i} + \sum_{i=1}^{P} \alpha_4 r_{t-i} + \sum_{i=1}^{P} \alpha_5 FB_{t-i}$$

$$+ \sum_{i=1}^{P} \alpha_6 LTOT_{t-i} + \sum_{i=1}^{P} \alpha_7 LY^*_{t-i} + \sum_{i=1}^{P} \alpha_8 LOP_{t-i} + +\alpha_9 TBDUM_t + \varepsilon_t \tag{35}$$

$$KA_t = k_0 + \sum_{i=1}^{P} \lambda CA_{t-i} + \sum_{i=1}^{P} k_1 r^*_{t-i} + \sum_{i=1}^{P} k_2 FDI_{t-i} + \sum_{i=1}^{P} k_3 CAO_{t-i} +$$

$$\sum_{i=1}^{P} k_4 Lq_{t-i} + \sum_{i=1}^{P} k_5 FB_{t-i} + \sum_{i=1}^{P} k_6 LY_{t-i} + \sum_{i=1}^{P} k_7 ODS_{t-i} + \sum_{i=1}^{P} k_8 ODSS_{t-i}$$

$$+ \sum_{i=1}^{P} \beta_9 OSS_{t-i} + \beta_{10} KADUM_t + \mu_t \tag{36}$$

$$KA_t = k_0 + \sum_{i=1}^{P} \lambda CA_{t-i} + \sum_{i=1}^{P} k_1 r^*_{t-i} + \sum_{i=1}^{P} k_2 FDI_{t-i} + \sum_{i=1}^{P} k_3 CAO_{t-i} +$$

$$\sum_{i=1}^{P} k_4 Lq_{t-i} + \sum_{i=1}^{P} k_5 FB_{t-i} + \sum_{i=1}^{P} k_6 LY_{t-i} + \sum_{i=1}^{P} k_7 LOP_{t-i} + \beta_{10} KADUM_t + \mu_t \qquad (37)$$

The ARDL error correction representation of the series is also estimated as

$$\Delta TB_t = \sum_{i=1}^{P} \phi_{1i} \Delta TB_{t-i} + \sum_{i=1}^{P} \phi_{2i} \Delta Lq_{t-i} + \sum_{i=1}^{P} \phi_{3i} LY_{t-i} + \sum_{i=1}^{P} \phi_{4i} \Delta r_{t-i} +$$

$$\sum_{i=1}^{P} \phi_{5i} \Delta FB_{t-i} + \sum_{i=1}^{P} \phi_{6i} \Delta LTOT_{t-i} + \sum_{i=1}^{P} \phi_{7i} \Delta LY^{*}_{t-i} + \sum_{i=1}^{P} \phi_{8i} \Delta ODS_{t-i}$$

$$+ \sum_{i=1}^{P} \phi_{9i} \Delta ODSS_{t-i} + \sum_{i=1}^{P} \phi_{10i} \Delta OSS_{t-i} + \phi_{11} TBDUM_t + \xi ECT_{t-1} + v_t \qquad (38)$$

$$\Delta TB_t = \sum_{i=1}^{P} \phi_{1i} \Delta TB_{t-i} + \sum_{i=1}^{P} \phi_{2i} \Delta Lq_{t-i} + \sum_{i=1}^{P} \phi_{3i} LY_{t-i} + \sum_{i=1}^{P} \phi_{4i} \Delta r_{t-i} +$$

$$\sum_{i=1}^{P} \phi_{5i} \Delta FB_{t-i} + \sum_{i=1}^{P} \phi_{6i} \Delta LTOT_{t-i} + \sum_{i=1}^{P} \phi_{7i} \Delta LY^{*}_{t-i} + \sum_{i=1}^{P} \phi_{8i} \Delta LOP_{t-i}$$

$$+ TBDUM_t + \xi ECT_{t-1} + v_t \qquad (39)$$

$$\Delta KA_t = \sum_{i=1}^{P} \omega_{1i} \Delta KA_{t-i} + \sum_{i=1}^{P} \omega_{2i} \Delta KA_{t-i} + \sum_{i=1}^{P} \omega_{3i} \Delta r^{*}_{t-i} + \sum_{i=1}^{P} \omega_{4i} \Delta FDI_{t-i}$$

$$+ \sum_{i=1}^{P} \omega_{5i} \Delta CAO_{t-i} + \sum_{i=1}^{P} \omega_{6i} \Delta Lq_{t-i} + \sum_{i=1}^{P} \omega_{7i} \Delta FB_{t-i} + \sum_{i=1}^{P} \omega_{8i} \Delta LY_{t-i}$$

$$+ \sum_{i=1}^{P} \omega_{9i} \Delta ODS_{t-i} + \sum_{i=1}^{P} \omega_{10i} \Delta ODSS_{t-i} + \sum_{i=1}^{P} \omega_{11i} \Delta OSS_{t-i} + \omega_{12} KADUM_t$$

$$+ \xi ECT_{t-1} + \psi_t \qquad (40)$$

$$KA_t = \sum_{i=1}^{P} \omega_{1i} \Delta KA_{t-i} + \sum_{i=1}^{P} \omega_{2i} \Delta KA_{t-i} + \sum_{i=1}^{P} \omega_{3i} \Delta r^*_{t-i} + \sum_{i=1}^{P} \omega_{4i} \Delta FDI_{t-i}$$
$$+ \sum_{i=1}^{P} \omega_{5i} \Delta CAO_{t-i} + \sum_{i=1}^{P} \omega_{6i} \Delta Lq_{t-i} + \sum_{i=1}^{P} \omega_{7i} \Delta FB_{t-i} + \sum_{i=1}^{P} \omega_{8i} \Delta LY_{t-i}$$
$$+ \sum_{i=1}^{P} \omega_{9i} \Delta LOP_{t-i} + \omega_{12} KADUM_t + \xi ECT_{t-1} + \psi_t \qquad (41)$$

Where ξ is the speed of adjustment of the parameter to long-run equilibrium following a shock to the system and ECT_{t-1} is the residuals obtained from the long run equations. The coefficient of the lagged error correction term ξ is expected to be negative and statistically significant to further confirm the existence of a cointegrating relationship among the variables in the model.

Diagnostics test

Post estimation tests were carried out to ensure the robustness and goodness of fit of the model used for the study. To be sure that the estimates gotten from the models were efficient, the study carried out a serial correlation test. The study employed the Lagrange Multiplier (LM) Test of Breusch (1978) and Godfrey (1978). The LM serial correlation test has some advantages over the Durbin-Watson test for serial correlation. Unlike the Durbin-Watson statistic, the LM test may be used to test for higher order ARMA errors, and is applicable whether or not there are lagged dependent variables. The LM tests the null hypothesis of no serial correlation up to the selected maximum lag length. The study also employed the Regression Specification Error Test (RESET) proposed by Ramsey (1969) to check whether the functional form of the model used in the study is correctly specified. The RESET is a general test for; omitted variables, incorrect functional form as well as the correlation between regressors and the error term (Hall, Lilien, & Johnston, 1995). The RESET tests the null hypothesis that the correct specification of the model is linear against the alternative that the correct specification is non-linear. To examine the normality properties of the error term, the study employed the Kurtosis test of normality. Also, to make sure the estimated coefficients were efficient, heteroscedasticity test was conducted.

The structural stability test was conducted using the Cumulative Sum (CUSUM) of recursive residuals and the Cumulative Sum of Squares (CUSUMSQ) of recursive residuals as suggested by Pesaran and Pesaran (1997). This was used to determine whether the coefficients of the estimated model are stable over the study period.

Oil price shocks and Stock Market Activities

Theoretical model

The theoretical model on the effect of oil price shocks on stock market activities is derived from the work of Huang *et al.* (1996). Huang *et al.* (1996) noted that the price of a stock at any point in time is determined by the discounted value of expected cash flow.

$$P = \frac{E(C)}{E(r)} \tag{42}$$

Where E is the mathematical notation for expectation, P is the stock price, C is the cash flow stream and r is the discount rate. It is important to note that the expected cash flow is basically the returns investors expects, after the purchase of a share. These returns mainly come in the form of dividends and capital gains. Thus, the stock price can be determined by;

$$P_0 = \frac{D_1+P_1}{1+r} \tag{43}$$

Where P_0 is the initial price of stock, D_1 is the expected value of dividends in the next period, and P_1 is the stock price in the next period. From equation (43), the initial price of the stock price depends on the expected future price of the stock, hence if P_1 is given as;

$$P_1 = \frac{D_2+P_2}{1+r} \tag{44}$$

Substituting equation (44) into equation (43) we obtain:

$$P_0 = \frac{D_1+P_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{P_2}{(1+r)^2} \tag{45}$$

Subsequent stock prices would depend on expectations of returns in the relevant period by the next owners. Hence, the current price of a stock is the discounted cash flow of all future dividends for as long as the dividends are paid infinitely.

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_4}{(1+r)^4} + \cdots \tag{46}$$

Thus:

$$P_t = \sum_{t=1}^{\infty} \frac{D_{t+i}}{(1+r)^t} \tag{47}$$

From equation (47), it is clear that stock price is a function of expected future dividend and the discount rate. That is;

$$P_t = f(D_{t+i}, r) \tag{48}$$

Empirical model

Equation (48) shows that stock price at any point in time is a function of the future flow of dividend payment and the discount rate. It is important to also note that the future flow of dividend payments also depends on macroeconomic conditions as well as some external factors (see for example, Chen, Roll, & Ross, 1986; Huang *et al.*, 1996; Kalyanaraman & Tuwajri, 2014; Kilian & Park, 2009; Oyama, 1997). In addition, studies by Adam and Tweneboah (2008); Adjasi, Harvey, and Agyapong (2008) and Adjasi (2009) have identified exchange rate and domestic price level as key macroeconomic variables that affect the movement in stock market price in Ghana. Furthermore, since crude oil is an essential input in the production process of a number of firms that are listed on the GSE, changes in its price and availability can affect the profitability of a number of firms and for that matter the dividends paid. Thus

$$D_{t+i} = f(q_t, CPI_t, ODS_t, ODSS_t, OSS_t) \qquad (49)$$

Substituting equation (49) into equation (48) we have;

$$P_t = f(q_t, r_t, CPI_t, ODS_t, ODSS_t, OSS_t) \qquad (50)$$

Where q_t is the real effective exchange rate, r_t is the discount rate, CPI_t is the consumer price index, ODS_t, $ODSS_t$ and , OSS_t is as previously measured. Based on the arguments made by Gujarati (2009) we took the logs of real effective exchange rate and consumer price index and then specify the equation to be estimated as

$$lnP_t = \beta_0 + \beta_1 Lq_t + \beta_2 r_t + \beta_3 LCPI_t + \beta_4 ODS_t + \beta_5 ODSS_t + \beta_6 OSS_t + \varepsilon_t \qquad (51)$$

Just as we did in the empirical estimation of oil price shocks and external balance, we also estimate the impact of just oil price on stock market activities as specified in equation (52)

$$lnP_t = \beta_0 + \beta_1 lnq_t + \beta_2 r_t + \beta_3 lnCPI_t + \beta_4 LOP_t + \varepsilon_t \quad (52)$$

Where L is the natural log operator, β_i are coefficients to be estimated and ε_t is the error term. LOP_t is as previously defined.

Justification, Measurement of Variable and Sign Expectations

Stock Price (P_t) simply captures the cost of purchasing a security on the Ghana Stock Exchange. In the present study, it was measured by the All Share Index which is the average price of shares of all companies listed on the Ghana Stock Exchange. It is usually computed by the GSE on daily basis. This was used in the present study as a proxy for stock market activities. This is because movements or changes in share prices are most likely to reflect demand and supply conditions in the stock and thus, activities on the stock market. The natural log of the All Share Index was what was used for the purpose of analysis in this study.

Real Effective Exchange Rate (q) is measured as the value of the cedi against a weighted average of major currencies adjusted for inflation. The effect of exchange rate depreciation or appreciation on the stock market depends on the amount of international capital in the stock market and the composition of export and import oriented firms listed on the stock market. Hence, the relationship between exchange rate and stock market activities could either be positive or negative.

Interest Rate (r_t) was used in the study as a proxy for the discount rate and also to capture the cost of capital to firms on the stock market. It was measured by the 91-day treasury bill rate. The 91-day treasury bill rate in Ghana usually mimics the movement in the monetary policy rate. The study expected an inverse relationship between interest rate and stock market activities. This is because increase in interest rate increases the cost of capital to firms and this is an indication of reduction in possible future dividend payments, hence, stock prices would fall accordingly.

Consumer Price Index (CPI) was used to capture the general movement in the prices of goods and service. It is also an indication of cost of leaving and also reflective of the cost of production. Hence, increasing consumer price index could imply that the cost of production of firms seem to be on the rise. A high cost of production also mean lower profitability of firms and hence, lower dividend rate and this would eventually lead reduction in the stock price. The study therefore expected a negative relationship between stock market activities and CPI.

Oil Demand Shock (ODS) has the same measurement as previously indicated. Since oil demand shock is usually as result of changes to global economic activities, the present study expects a direct relationship between stock market activities and oil demand shock. This is because an increase in oil demand shock could be an indication of improved global economic activities and since Ghana is part of the global economy, it is expected that such boom should increase profitability and hence stock market activities would also improve.

In relation to *Oil Supply Shocks* (OSS) *and Oil Market Specific Demand Shock* (ODSS), the study expected an inverse relationship. This was due to the fact that supply shocks imply the relative scarcity of crude oil which a key input of production and as such pushes prices up. High oil prices tend to have negative impact on the returns on the stock market and hence also affects the level of activity negatively. Related to this is the effect of speculative activities in the oil market which contributes to demand specific shock. This also has a negative effect on stock market activities.

Empirical Methodology

Unlike previous studies on the effect of oil price shocks on stock market activities, this study employed a two-stage estimation method to examine the impact of oil price shocks on the Ghana Stock Exchange, making room for possible regime changes across the sample period. First, the study identified the supply and demand shocks in the oil market by employing the identification procedure developed by Kilian (2009a) which was then used to construct variables that capture supply and demand conditions in the oil market just as was done for the external balance model in equation (21) above. In the second stage of the estimation, the study empirically examined the response of stock market activity to demand and supply shocks in the oil market in a Markov-switching framework. In the context of a regression model, the constructed oil shocks are orthogonal variables. Basher, Haug, and Sadorsky (2016) argued that as long as orthogonality holds, such variables would be uncorrelated with one another and other omitted variables in the second stage of the analysis. The regression coefficients of these constructed variables would be unbiased. In addition to examining the impact of oil price shocks on stock market activity based on the Markov-switching model, the study again examined the impact of an oil price shock within the framework of a linear model.

The Markov-switching model takes into account potential nonlinearity or asymmetry in the process that drives the adjustment of the stock market prices to oil shocks. The Markov-switching framework has been developed to be beneficial in cases where the adjustment seems to be mainly caused by exogenous events. There are several examples of such events in our sample period (2002 to 2014): The Iraq War in 2003, the Global Financial Crisis in 2007/08, OPEC oil production cuts in 2009, and the European sovereign debt crisis starting in 2009, the discovery of oil in Ghana, the various electioneering years which falls within the sample period, issuance of the country's first sovereign bond among others.

It is important to note that these events, especially those related to the oil market, were treated as exogenous only with respect to triggering a regime switch for the Markov process and not with respect to their effects on the oil market and macroeconomic variables. Thus, the Markov regime generating process was exogenous.

The oil price shock variables (*ODS, ODSS, OSS*) constructed were what was used in the estimation of the effects of oil price shocks on stock market activities. Since data used for this estimation were measured in monthly series just as the measures of oil price shocks, we don't quarterlise the oil price shocks as was done for the estimation of external balance. In addition, the study also estimated equation (54), which included stock market variable, in order to examine the direct impact of oil price shocks on stock market activities in Ghana.

$$\begin{pmatrix} e_{1t}^{oilsupply} \\ e_{2t}^{geademand} \\ e_{3t}^{oilsds} \\ e^{asi} \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 & 0 \\ a_{21} & a_{32} & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} \end{pmatrix} \begin{pmatrix} \varepsilon_{1t}^{oSS} \\ \varepsilon_{2t}^{ODS} \\ \varepsilon_{3t}^{ODSS} \\ \varepsilon_{4t}^{PS} \end{pmatrix} \qquad (53)$$

The structural shocks ε_{1t}^{oSS}, ε_{2t}^{ODS} and ε_{3t}^{ODSS} are as explained in the section for the construction of oil supply and demand shocks above. The block-recursive structure of equation (53) implies that activities in the oil market are assumed to be predetermined with regards to the Ghana Stock Exchange. Given the fact that the Ghanaian economy is a small open economy, the study argued that activities in the global oil market would affect stock market activity in Ghana, but stock market activity in Ghana would not have any significant effect on the world oil market. Hence, ε_{4t}^{PS} captures the shocks to the stock market that is not explained by activities in the oil market.

Stationarity Test

Stationarity test for all the variables used in estimating the effect of oil price shocks on stock market activities was done based on equations specified from equation (26) through to equation (31). Once the stationarity was determined, then the study proceeded to estimate the Markov Switching model.

BDS Test

The Brock, Dechert and Scheinkman (BDS) test of independence was used to examine whether or not non-linearity existed in stock prices of Ghana before the study proceeded to implement the Markov-Switching model. The BDS test developed by Broock, Scheinkman, Dechert, & LeBaron (1996) is one of the widely used tests for nonlinearity. The BDS test is based on the idea of a correlational integral. Correlational integral measures the frequency with which temporal patterns are repeated in the data. It is done by testing whether increments to the series are independent and identically distributed (iid). The BDS test is asymptotically distributed as standard normal based on the null hypothesis of iid increments.

Markov-Switching Model

Before the Markov Switching model was estimated, a baseline results based on a linear regression model (OLS) was estimated. In addition to the OLS, the study also estimated an SVAR model (as specified in equation (53)) to examine the impact of oil price shocks on stock market activities in Ghana. For the OLS estimation, the study estimated the equations below:

$$\Delta lnP_t = \beta_0 + \beta_1 \Delta Lq_t + \beta_2 \Delta r_t + \beta_3 \Delta LCPI_t + \beta_4 ODS_t$$
$$+\beta_5 ODSS_t + \beta_6 OSS_t + \varepsilon_t \tag{54}$$

$$\Delta lnP_t = \beta_0 + \beta_1 \Delta Lq_t + \beta_2 \Delta r_t + \beta_3 \Delta LCPI_t + \beta_4 \Delta LOP_t + \varepsilon_t \tag{55}$$

Where Δ is the difference operator. All other variables are as previously defined. We used the first difference because of the idea that the various oil market shocks would be stationary at levels and there was the need to ensure that all other variables were integrated of the same order. The lags of the explanatory variables were not included in the model due to the fact that stock markets usually reacted quickly and efficiently to new information and this information tend to be absorbed by the stock market. Basher *et al.* (2016) and Cekin (2013) also made similar assumptions.

The advent of Markov Switching models is to a large extent related to the natural to model time series that display structural breaks or shifts in their means. Financial time series is one of the key series that potential fit into category. The dramatic changes to stock prices in Ghana potentially necessitated the use of non-linear time series modelling and the Markov-Switching framework became a natural candidate for this purpose.

Hence, to account for the possibility of non-linear relationship between stock market activity in Ghana and oil price shocks, the study re-estimated equations (54) and (55). The use of the Markov-switching model ensured that the study accounted for the possibility that the impact of oil price shocks on stock market activities in Ghana would be dependent on a specific state. The probability of shifting from state 1 at time period t to state 2 at time period $t+1$ is contingent on the state at time period t.

It is important to note that that Markov switching model within each regime is conditionally linear and the switching between regimes is fundamentally stochastic. The switch between regimes is assumed to be stochastic based on a time-varying transition probability matrix. For the present study, the transition probability matrix changes contingent on the values of the variance, values of the intercept, the three oil shocks and the other control variables. With the Markov-switching model, it is assumed that the stochastic regime generating process follows a homogeneous, ergodic, first order Markov chain with a finite number of regimes (M) and constant transition probabilities.

$$p_{lm} = \Pr(S_t = m|S_{t-1} = l),plm \geq 0, \sum_{m=1}^{M} p_{lm} = 1 \quad (56)$$

The conditional distribution of any future state, S_{t+1} is independent of the past states and only dependent on the present state given the past states and the present state. p_{lm} is called the transition probability from l to m and is defined as the probability that when the previous state is l the next state will be m. The matrix that summarise all transition probabilities is provided below:

$$\begin{pmatrix} p_{ll} & p_{lm} \\ p_{ml} & p_{mm} \end{pmatrix}$$

Given the fact that the Markov chain is unobservable, our estimation includes the probabilities of being a specific state. For a Markov-Switching model to be seen as good and fitting, the model must provide a sharp classification of regimes and should have smoothed probabilities that are either close to one or zero (Basher et al., 2016). Hence to check if our Markov-switching model is fit, we employed the regime classification measure (RCM) of Ang and Bekaert

(2002) to determine the precision of the estimated Markov-Switching models. This is calculated using the formula:

$$RCM = 100S^2\frac{1}{T}\sum_{t=1}^{T}\Pi_{j=1}^{S}\tilde{P}_{j,t} \tag{57}$$

The RCM is calculated as the average of the product of smoothed probabilities where S is the number of states or regimes. Since the switching variable follows a Bernoulli distribution, the RCM gives an estimate of the variance. The RCM statistics falls between zero and 100. Where, obtaining an RCM of zero implies perfect regime classification and 100 implying failure to detect any regime classification. Hence lower values of the RCM are preferable to higher values. Therefore, to significantly identify different regimes, it was necessary for the model's RCM to be closer to zero and its smoothed probability indicator be close to one.

Oil Price Shocks, Inflation and Output: The Role of Monetary Policy Methodology

Theoretical model

The theoretical model is used to analyse the effect of oil price shocks on inflation and output related to the Keynesian macroeconomic model. The model is derived from the work of Hove, Touna Mama and Tchana Tchana (2015) and Leu (2011). The model is a small open economy Keynesian model that is consistent with the fundamental behaviour of optimising economic agent.

IS-Equation

The output gap is based on the modified IS curve of the Mundell-type open economy model. The IS curve described in this section is similar to the IS curve of Cavoli and Rajan (1998) and Hove *et al.* (2015)

$$y_t = \varphi_0 + \varphi_1 y_{t-1} - \varphi_2(r_t - \pi_{t+1}) + \varphi_3(s_t + p_t^* - p_t) + \varepsilon_t^y \quad (58)$$

Where y_t is the output gap r_t is short-term interest rate, π_t is inflation rate, s_t is the nominal exchange rate which is expressed as the local currency cost of a unit of foreign currency. p_t is domestic price level, p_t^* refers to foreign variables (see Leu, 2011) φ_i are parameters that capture the effect of various variables on current output. Equation (58) captures the demand side of the economy where ε_t^y can be referred to as the aggregate demand shock. Current output is a function of future of its lag indicating that increases in previous period's output could have positive effect on current output through its effect on consumption. Equation (58) also implies that real interest rate $(r_t - \pi_{t+1})$ has a negative effect on current level of output and this reflects the substitution of consumption. Depreciation of the domestic currency is expected to have positive effect on current output through the expenditure-switching effect. Oil market related stocks (Oil supply shock, oil demand shock, and oil market specific demand shock) are expected to affect current output through its effect on p_t^*.

AS Equation

The Phillips curve is to capture the supply side of the economy. It is based on the Keynesian macro model of sticky prices. The Phillips curve described here is derived from Calvo (1983) staggered nominal price adjusting model with exogenous aggregate supply shock ε_t^{π} is given by:

$$\pi_t = \omega_1 \pi_{t-1} + \omega_2 y_t + \omega_3 y_{t-1} + \omega_4 (s_t + p_t^* - p_t) + \omega_5 (s_{t-1} + p_{t-1}^* - p_{t-1}) + \varepsilon_t^{\pi} \qquad (59)$$

Equation (59) indicates that inflation rate is affected by the inflation inertia (π_{t-1}) real exchange rate and output. The current and lagged output gap capture the contemporaneous and lag effects in the transmission of output shocks to inflation. The equation indicates that the higher levels of output gap leads to higher inflation rate. Similarly, depreciation of the domestic currency contributes to higher inflation rate. Just like Equation (58), the study assumed that oil market shocks would affect inflation through its effects on the foreign variable p_t^*.

Uncovered Interest Parity

A basic feature in most open economy macro models is the addition of the uncovered interest parity to describe the nominal exchange rate:

$$s_t = s_{t+1} - (r_t - r_t^*) + \varepsilon_t^{s} \qquad (60)$$

Where r_t and r_t^* are domestic interest rate and interest rate of the rest of the world respectively. ε_t^{s} represents the time varying premium shock which reflects temporary deviations from interest parity condition. Also, crude oil market shocks affect the nominal exchange rate through its effect on asset prices (see Kilian *et al.*, 2009) which also tend to affect the interest rate differential in equation (60).

Monetary Policy Rule

The model is closed with the inclusion of a generalised monetary policy rule which is akin to the forward looking monetary policy rule. The rule described here is based on the assumption that the central bank uses the Taylor rule. With the Taylor rule, the central bank adjusts domestic interest rates in response to changes in the output gap, inflation and exchange rate. The monetary policy rule is specified as follows;

$$r_t = \theta_1 r_{t-1} + \theta_2 y_t + \theta_3 \pi_t + \theta_4 \Delta e_t + \varepsilon_t^r \qquad (61)$$

Where θ_i are parameters and ε_t^r captures shocks to monetary policy. Equation (61) implies that central bank respond to inflation, output gap and exchange rate while keeping some degree of interest rate smoothing.

Empirical Model

Structural VAR

One possible shortfall associated with estimating reduced-form models as used in a number of empirical studies in Ghana and Africa was the difficulty in interpreting whether the variations were due to a different structure of shocks, in the transmission mechanism of the economy or, ultimately, in the preferences of policy makers.

In fact, a number of researchers, including Allegret and Benkhodja (2011) and Mcdermott and McMenamin (2008) among others, have recommended the use of structural models that are developed from micro-foundations as general equilibrium models (Specifically, Dynamic Stochastic General Equilibrium Models -DSGE). The DSGE models also tend to have an additional advantage of being able to address the Lucas Critique. Models based on DSGE require a comprehensive specification of the economy and its associated preferences which could also be a source of misspecification and provide misleading interpretations of the dynamics at play (Tovar, 2009).

Apart from this, DSGE models have been criticised for a number of reasons. For example, Sims (2006) argue that DSGE models are only story-telling devices and not hard scientific theories. For Sims, it doesn't make sense to expect these models to match in fine detail the dynamic behaviour of the accounting constructs and proxy variables that make up the data. An alternative approach to the DSGE modeling involves specifying a Structural Vector Autoregressive Model (SVAR) where with the imposition of some identification restrictions, one can draw some structural conclusions (Sims & Zha, 2006). Kamati (2014) has also argued that SVAR models avoid the incredible restrictions in single equations and strict restrictions in DSGE models.

The present study therefore opted to specify a Structural VAR model that was based on the traditional New Keynesian structure to analyse the macroeconomic effects of oil price shocks and the extent to which it affected the effectiveness of monetary policy.

SVAR Specification

Oil price increases and its associated effects are not alike due to the differences in the underlying cause of the increase (Baumeister *et al.*, 2010; Kilian, 2009a). Thus, identifying what drives an oil price increase is necessary for understanding its impact on macroeconomic variables and designing the appropriate monetary policy response. In this analysis, therefore, there is a definite distinction between oil supply shocks, oil demand shocks caused by global economic activity and oil specific demand shocks. Following Kilian (2009a) Peersman and Van Robays (2012), the study augmented equations (58) through to (61) with equations from the oil crude oil market and specify an SVAR framework with the following general representation:

$$\begin{pmatrix} X_t \\ Y_t \end{pmatrix} = c + A(L)\begin{pmatrix} X_{t-i} \\ Y_{t-i} \end{pmatrix} + B\begin{pmatrix} \varepsilon_t^X \\ \varepsilon_t^Y \end{pmatrix} \tag{62}$$

The vector of endogenous variables is divided into two groups. Demand and supply conditions associated with the crude oil market is captured by the first group $\boldsymbol{X_t}$ and it includes world oil production (O_t^{ss}), a measure of world economic activity (Y_t^w) and average price of crude oil expressed in US dollars (O_t^p). The second block of endogenous variables $\boldsymbol{Y_t}$ captures domestic macroeconomic variables as expressed by equations (58-61). The variables specifically captured in $\boldsymbol{Y_t}$ includes output gap (y_t —this represents the IS curve), inflation prices (π_t —the AS curve), nominal exchange rate (s —exchange rate market) and monetary policy rate (r_t — monetary policy). $\boldsymbol{c}$ is a matrix that contains the constant terms and linear trends, $\boldsymbol{A(L)}$ is polynomial matrix in the lag operator $\boldsymbol{L}$, and $\boldsymbol{B}$, is the contemporaneous impact matrix of vector of orthogonalised error terms $\boldsymbol{\varepsilon_t^X}$ (which captures structural shocks in the oil market) and $\boldsymbol{\varepsilon_t^Y}$ (which also captures structural shocks in the Ghanaian economy).

Identification

In order to effectively identify the underlying structural shocks in an SVAR model, one needs to place a number of restrictions on the relationships between the endogenous variables. Given that matrix **A** and **B** are non-singular matrices, the identifying restrictions are placed on both matrices. The restrictions placed on matrix A and B are indicated in equation (63).

$$A\begin{pmatrix} X_t \\ Y_t \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 \end{pmatrix} \times \begin{pmatrix} O_t^{ss} \\ Y_t^{w} \\ O_t^{p} \\ s_t \\ y_t \\ \pi_t \\ r_t \end{pmatrix} \tag{63}$$

The identification of the underlying structural shocks in the oil market, follows the identification scheme of Kilian (2009a) since monthly data set was used for the purpose of this study. Therefore, in order to disentangle oil supply shocks from demand shocks, the study assumed there was a short-run vertical oil supply curve. This implied that shifts in the demand for crude oil (crude oil demand shocks) would instantaneously not have any effect on the supply of crude oil at least within the same month. This was because oil-producing economies did not respond immediately to demand shocks, given the cost of changing oil production and uncertainty about the state of the oil market. Oil supply shocks are defined as unanticipated or unpredictable innovations to world oil production.

Crude oil supply shocks however could affect world economic activity given the fact oil is an important determinant of economic activity (demand for all industrial commodities). Hence, innovations to world economic activity that cannot be explained by oil supply shocks would be referred to as shocks to world economic activities. The study also imposed exclusion restriction that increases in the price of crude oil caused by shocks that were specific to the oil market would not reduce world economic activity immediately, but with a delay of at least a month. This restriction was consistent with the slow nature of world economic activity after each of the major oil price increases in the sample.

Also, innovations to the price of crude oil that is not explained by crude oil supply shocks or world economic activity, reflect changes in the demand for oil as opposed to changes in the demand for all industrial commodities (referred to as oil-specific demand shocks for short). Oil specific demand shocks reflects fluctuations in precautionary demand for crude oil caused by uncertainty about the availability of future oil supplies.

Because Ghana is a small open economy, it is believed that changes in variables such as domestic output and domestic production of crude would not have any effect on supply and demand conditions associated with the oil market. Hence, domestic macroeconomic shocks have no influence on activities in the crude oil market. It is important to note that since crude oil is an essential input of production in the Ghanaian economy, shocks in the oil market could affect macroeconomic variables in Ghana.

Next of the oil market variables is exchange rate. Given the fact that oil prices are quoted in US dollars, changes in its price could affect exchange rate between the Ghana Cedi and the US dollar. For example, an increase in the price of crude oil would increase the demand for the US dollar for the purpose of acquiring crude oil. This situation could result in depreciation of the domestic currency and subsequently affect other macroeconomic variables. However, other domestic macroeconomic variables such as output gap, inflation and monetary policy would not have an immediate effect on the exchange rate at least within the first month. Hence all other innovations to the exchange rate not explained by crude oil market activities is referred to as exchange rate shocks.

The equation after exchange rate represents the demand side of the Ghanaian economy as captured by equation (58). The output gap as captured by equation (58) reacts to changes in the oil market variables and the exchange rate. Also, short term interest rate as captured by the monetary policy rate is expected to have negative influence on the IS curve as indicated in equation (58). Thus, all other innovations that affect output in the Ghanaian economy other than those associated with the oil market shocks, interest rate and exchange rate would be referred to as output shock. The fourth row of equation (63) captured the supply side of the Ghanaian economy. Inflation, is determined by the current market conditions in the oil market, exchange rate, and the output gap.

The seventh row represents the central bank's reaction function. Here, there was an assumption that the Bank of Ghana reacts to all lags and contemporaneous shocks to inflation, output, exchange rate and changes in the world market for crude oil. The study went further to include three interaction terms to capture effect of the reaction of the Bank of Ghana to an oil market shock on domestic macroeconomic variables. The main policy tool used by the Bank of Ghana to influence monetary conditions in the country is the Monetary Policy Rate (MPR). The MPR is the interest rate at which commercial banks borrow money from the Bank of Ghana, and this, in turn, affects other interest rates in the Ghanaian economy. Changes to the MPR usually, domestic economic conditions, international economic conditions, and future prospects. Thus, in our SVAR, monetary policy shocks are identified as changes in MPR. In the style of a Taylor rule, central bank reacts to inflation rise from output and inflation gaps.

Data Description and Source

The data sets for the present study are mainly sourced from secondary sources. The dataset employed for the study was mainly time series in nature and ranges from monthly to quarterly series. Data used for the empirical work on oil price shocks and external balance ranged from 1980: Q1 to 2015: Q4. Data on the measures of external balance was sourced from the World Bank's World Development Indicators (WDI), the United Nations Conference on Trade and Development (UNCTAD) statistics as well as various editions of the State of the Ghanaian Economy by the Centre for Policy Analysis (CEPA), Ghana. Data on GDP, Terms of Trade and World Income were also obtained from the WDI. Data on Fiscal Balance was obtained from various editions of the State of the Ghanaian economy by Institute for Statistical and Social Research (ISSER), University of Ghana and Budget Statements of the Ministry of Finance, Ghana. Quarterly data on real effective exchange rate was obtained from the Brugel Institute and finally data on interest rate was obtained in monthly series from the Bank of Ghana (BoG). Monthly data on the LIBOR rate was obtained from the website of the Federal Reserve Bank of St. Louis. The study then used the average interest rate for each quarter for our estimation. Annual series were converted to quarterly series using the cubic spline interpolation method. Details of the oil market variables used to construct the various oil price shocks are provided in the next two paragraphs.

Data employed to estimate the effect of oil price shocks on stock market activities were in monthly series with the start date being January 2002 to December 2014. The start period, 2002 was chosen due to the major changes that occurred in Ghana's financial sector after the implementation of the Financial Sector Strategic Plan, which started in 2002. Data on stock prices were obtained from the Ghana stock Exchange. Domestic interest rate and consumer price index which are all on monthly basis were obtained from the BoG. Data on domestic fuel prices were obtained from the National Petroleum Authority.

The model on oil price shocks and macroeconomic activities was estimated with monthly data on Ghana and the crude oil market spanning from January 2002 to May 2015. The choice of the sample period was influenced by the fact that Ghana changed its monetary policy regime from monetary targeting to inflation targeting in the year 2002. Domestic variables included in our model were all obtained from the Bank of Ghana's monetary time series available freely on their website. To capture monthly output within the Ghanaian economy, the on real effective exchange rate was obtained from the Brugel Institute and finally data on interest rate was obtained in monthly series from the Bank of Ghana (BoG). Monthly data on the LIBOR rate was obtained from the website of the Federal Reserve Bank of St. Louis. The study then used the average interest rate for each quarter for our estimation. Annual series were converted to quarterly series using the cubic spline interpolation method. Details of the oil market variables used to construct the various oil price shocks are provided in the next two paragraphs.

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Inflation, measured using the log difference of consumer price index, the bilateral exchange rate between the Ghana cedi and the US dollar as well as the monthly monetary policy rate was also employed for our analysis. Data on world production of crude oil which was used as proxy for oil supply was obtained from the US Energy Information Administration website (www.eia.gov) . Also data on World Economic Activity (WEA) measured the changes in output of the industrial sector of the world economy. Data on WEA was sourced from the work of Kilian (2009a) which is updated on regular basis. Finally, data on crude oil price was obtained from the World Bank's Global Economic Monitor (GEM) commodity series. With the exception of MPR, the logged values of all variables were used in the estimation. Again all other variables were differenced to achieve covariance stationarity except the log ratio of output to potential output and world economic activities (Lee & Song, 2009).

Summary

This chapter presented the theoretical underpinnings of the relationship between oil price shocks and key macroeconomic variables in the Ghana's economy with specific focus on: external balance (Trade Balance and Capital

Account Balance), stock market activities, inflation and output in Ghana. The basic philosophy of this work was based on the positivist philosophy within the framework of Keynesian economics. The research design was therefore based on the quantitative research design.

The study employed three different theoretical models to analyse the effect of oil price shocks on external balance, stock markets and inflation and output in Ghana. To analyse the impact of oil price shocks on external balance, the study augmented the imperfect substitution model and the Mundell Fleming model on capital mobility. Impact of oil price shocks on stock market activities was analysed using the discounted value of expected cash flow. The final model used was based on the new Keynesian models.

This chapter also presented three different empirical models which was derived from the various theoretical models indicated in the previous paragraphs. The econometric procedures specified was mainly influenced by the characteristics of the data used and the theoretical models specified. The econometric technique used were ARDL model, Markov Switching Model, and SVAR model for the respective empirical chapters that follows this chapter.

CHAPTER FIVE

OIL PRICE SHOCKS AND EXTERNAL BALANCE IN GHANA

Introduction

This chapter provides an empirical analysis of the effect of oil price shocks on Ghana's external balance position. To achieve this, the chapter begins with an analysis of the oil market and how different shocks, that is, supply shocks, oil demand shocks and oil market specific demand shocks affect oil prices. The analysis of the oil market also elucidates the reasons why there is the need to consider how the effects of the different shocks in the oil market would affect the Ghanaian economy.

This is followed by analysing the descriptive statistics on Ghana's external balance and explanatory variables used for the study within our sample period (1980 to 2015). The time series properties of variables that were employed for the estimation are then analysed. Particular attention was given to the analysis of structural breaks that could exist in the various measures of external balance used for this study. Thus, any analysis that involves the external sector needs to take into account the structural changes that might have occurred in the economy in the past.

Results from the cointegration test are then presented after analysis of the time series properties of the variables employed in the study has been done. Once cointegration is established, the short run and long run estimates are presented and discussed in full details. The diagnostic tests are then presented.

Analysis of the Oil Market

Descriptive Statistics (oil market)

Table 1 provides a summary statistics of activities in the oil market over our sample period (January 1980 to December 2015). The measure of global economic activity (a measure of the component of global real economic activity that drives demand for industrial commodities in world industrial commodity market (Kilian, 2009a)) indicates that on the average (-1.45) world economic activities over the sample period have been relatively slow.

Table 1: Summary Statistics (Oil Market)

	Measure of Global Economic Activity (WEA)	Crude oil Price($) (OP)	Crude oil Supply (OS) (Thousands)
Mean	-1.45	41.75	74574.50
Median	-4.82	28.38	74506
Maximum	63.28	133.87	96670
Minimum	-65.55	9.45	57514.30
Std. Dev.	24.73	31.58	11277.37
Skewness	0.42	1.27	0.16
Kurtosis	2.94	3.34	1.72
Jarque-Bera	12.99	116.77	31.15
Probability	0.00	0.00	0.00
Sum	-628.252	17954.24	32216184
Sum Sq. Dev.	263635.8	427945.8	5.48E+10
Observations	**432**	**432**	**432**

NB: oil supply is in thousands of barrels
Source: Authors computations

A careful examination of the mean, median and skewness gives an indication that global economic activities seem to have increased more as the year goes by. That is, global economic activities seem to increase as the world moved from the twentieth century to the twenty first century. This could probably be due to the growth that was experienced by Brazil, Russia, India, China and later South

Africa (BRICS) as during the early years of the twenty first century. The difference between the maximum and minimum also indicates that global economic activities over the sample period have been very volatile. It is therefore not surprising that several recessions have been experienced in the global economy during the period (the most recent one being 2007/2008).

In relation to crude oil price, the average oil price over the sample period was about US$42 per barrel. The summary statistics of crude oil price just as the measure global economic activity, seem to suggest that crude oil price has generally been on the increase since the twenty first century. This can be seen in the nature of skewness (positively), indicating that high crude oil prices on the oil market are largely a recent phenomenon. It has been argued that the oil price hikes of the twenty first century have largely been due to expansion in global economic activity which also culminate into increase in the demand for crude oil and hence increase in the price of crude oil given the supply (see Baumeister *et al.*, 2010; Chuku et al., 2010; Kilian, 2009a).

The supply of crude oil over the sample period has been relatively stable. Total crude oil supply over the sample period averaged 74574.50 thousand (approximately 74,574,500) barrels per day. Though it is positively skewed, the level of skewness is less than that of the measure of global economic activity and that of crude oil price. This implies that increase in the supply of crude oil within the twenty first century has not been phenomenal. This is probably due to the fact that no new discovery of major oil deposits have been made in the century and expansion in the supply of the commodity has largely been due to improvements in the technologies for the drilling of oil.

Unit roots test results

Results on the examination of the time series properties of the oil market variables are presented in Table A1 in the Appendix. The unit root test results presented in the study are based on the ADF, PP and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. The results indicate that with the exception of global measure of economic activity (WEA) all other variables were only stationary after the first difference for all the test performed. The test results from the ADF, PP and KPSS all indicated that WEA was stationary at levels. Therefore, the study concludes that oil supply (OS) and oil price (OP) are integrated of order one (I(1)) and WEA is an I(0) variable. Hence, following the works of Lee and Song (2009), the study used the logged differenced of OS and OP in estimating the structural VAR.

Pre-Estimation Diagnostic Test

Table A2 in Appendix presents VAR lag selection criterion that was used for the SVAR estimation for the oil market variables. The FPE, AIC, SC and HQ statistics indicate the optimal lag length of three (p =3). The study therefore estimated an SVAR model with a lag order of 2. The Langrange-Multiplier test at this lag length indicates that the null hypothesis of no autocorrelation is not rejected. Also, Figure A1 which shows the graph plots of eigenvalues from the reduced form VAR indicates that all eigenvalues lie within the unit circle. This implies that the VAR from which the SVAR model is derived satisfies the stability conditions. Thus, all these statistics indicate that the system is stationary and stable.

SVAR for Oil Market

SVAR models permit one to identify the effect of structural shocks taking into account the economic theory that underpins it. This makes it possible to analyse the net effect of an unexpected variation in one variable on other variables in the model. Given the structural factorisation specified in equation (22), Table A4 in the appendix presents result of the SVAR estimates obtained from equation (22) (i.e. matrix of coefficients). It is important to note that these coefficients only offer a baseline or vague representation of the fundamental relationship that exists among the variables. The primary interest of our analysis, both in this section and the next, would be on the effect of the identified supply and demand shocks on the price of crude oil. That is a_{31}, a_{32} and a_{33}. These coefficients capture the effects of oil supply shocks, oil demand shock (aggregate demand shock) and oil specific demand shock respectively on the price of crude oil. The results presented in Table A4 indicate that crude oil price responds positively to oil supply shocks, oil demand shock and oil market specific demand shock. The coefficients of these shocks were all statistically significant at one percent with the exception of oil supply shock which was significant at ten percent. To get a better understanding of how oil prices respond to the different shocks, the impulse response functions of the various shocks are analysed.

Analysis of Impulse Response Function (IRF)

The IRF traces the responsiveness of oil price to the various shocks identified in the crude oil market. Figures A2, A3 and A4 provides the response of crude oil price to oil supply shock, oil demand shock and oil market specific demand shock. Figure A2 indicates that an oil supply shock is followed by an increase in the price of crude oil three months after the shock. Though crude oil price began to fall after the third month, it became largely insignificant. An examination of Figure A3 shows that oil demand shock, just like the oil supply shock had a positive impact on crude oil price, however, the effect of the demand shock was much more long lasting and it increased steadily overtime. The effect of oil market specific demand shock (precautionary demand shock) is more pronounced on the price of crude oil. That oil specific demand shock results in a sharp rise in the price of crude oil and only begins to fall seven months after the shock.

Results obtained from the SVAR estimation is similar to results obtained by Baumeister *et al.* (2010) and Kilian (2009a). It is clear from the analysis that the effect of various shocks on the price of crude tend to have different implication for the magnitude, timing and persistence. Thus, to the extent the time path of variations in the price of crude oil in response to oil supply shock, oil demand shock and oil market specific shocks seem to be different, the magnitude and timing of the responses of external balances, stock market activities and other macroeconomic variables in Ghana would also be different.

Implications

Analysis of the impulse response function on the effect of the identified shocks in the oil market on the price of crude oil revealed that the price of crude oil reacted differently to different shocks. The analysis revealed that increase in the price of crude oil was due to changes in global economic activity, which triggered an increase in demand for crude, is more lasting than increase in the price of crude oil that was as a result of supply side shock and oil market specific demand shock. Thus, in analysing the effect of oil price changes on an economy, it would be key to disentangle supply side shocks from demand side shocks (both oil market specific and aggregate demand) as this is key to identifying the appropriate policy response to such shocks.

Descriptive Statistics (External Balance Model)

Table 2 presents the descriptive statistics of all the variables employed in estimating the external balance model. The descriptive statistics indicate that capital account balance position of Ghana has on average been positive over the sample period.

The capital account balance over the sample period averaged about 4 percent of GDP. The positive capital account balance over the sample period was basically due to the huge inflows of foreign capital due to the implementation of a number of IMF and World Bank related reforms and programmes. For example the Economic Recovery Programme and the Structural Adjustment Programme of the 1980s brought in huge foreign capital into the Ghanaian economy (Aryeetey, Harrigan, & Nissanke, 2000). Also, the implementation of the Highly-Indebted Poor Country (HIPC) initiative in 2001 played a key role in the favourable capital account balance. In fact, Ghana has also seen huge inflow of Foreign Direct Investments since 1983 to date and this also contributed to favourable capital account balance.

In addition to the above-mentioned reasons, the average domestic interest rate (r) of about 26 percent over the sample period, exceeded that of the rest of the world by over 21 percent. Thus, interest rates in the country seemed to be on the high side and as such attracted the inflow of foreign capital into the economy. The capital account balance over the sample period was relatively less volatile compared to the trade balance.

The trade balance unlike the capital account, has for most years in the sample been in a deficit. This is evident in the average trade deficit of about 11 percent of GDP. The huge deficits in both the trade balance of Ghana's economy is largely due to the import dependent nature of the Ghanaian economy. In addition to the country being an import dependent economy, exports in the Ghanaian economy since 1980 have been driven by huge exports of primary commodities (such as Gold, Cocoa, timber and recently oil) which mostly result in unfavourable terms of trade.

Table 2: Summary Statistics for External Balance Model

Statistic	KA	CA	TB	FB	r	r*	TOT	WY
Mean	3.68	-6.05	-11.17	-5.82	26.03	21.89	135.46	8115.77
Median	3.09	-5.94	-12.43	-6.60	24.41	22.03	127.24	7996.80
Maximum	11.48	2.26	0.36	1.60	47.93	42.08	210.99	10158.54
Minimum	-1.29	-13.17	-25.27	-14.50	9.60	4.24	88.67	6155.70
Std. Dev.	3.03	3.79	6.41	4.12	10.89	10.39	32.21	1205.85
Skewness	0.73	-0.02	0.21	0.12	0.40	0.23	0.57	0.13
Kurtosis	2.76	2.00	2.17	2.13	2.33	2.24	2.22	1.78
Jarque-Bera	3.82	1.69	0.83	1.24	5.14	3.71	11.36	8.27
Probability	0.15	0.43	0.66	0.54	0.08	0.16	0.00	0.02
Sum	515.62	-846.88	-1607.85	-209.39	2914.82	2451.98	19506.10	1038819
Sum Sq. Dev.	1274.20	1991.35	5882.90	595.11	13166.14	11978.55	148403.00	185000000
Observations	140	140	144	143	112	112	144	142

Table 2: Continued

	Y	FDI	REER	CAO	ODS	ODSS	OSS
Mean	1.50E+10	2.92	358.54	-1.50	0.0004	0.0017	-0.0003
Median	1.24E+10	1.63	122.76	-1.54	0.01	0.09	-0.02
Maximum	3.48E+10	10.08	3657.31	-0.13	23.35	1.89	2.48
Minimum	6.25E+09	-0.01	69.46	-1.89	-20.12	-15.93	-13.40
Std. Dev.	8.20E+09	3.19	713.84	0.44	4.58	1.47	1.35
Skewness	1.05E+00	0.95	3.48	0.80	0.37	-8.98	-7.05
Kurtosis	3.03E+00	2.36	14.94	3.52	10.03	98.75	71.65
Jarque-Bera	2.64E+01	23.92	286.64	4.26	0.88	887.47	0.61
Probability	2.00E-06	0.00	0.00	0.12	0.00	0.00	0.74
Sum	2.16E+12	419.98	12907.28	-54.09	0.48	-0.24	-0.04
Sum Sq. Dev.	9.62E+21	1455.94	17835039	6.69	2833.58	304.59	247.74
Observations	144	144	144	140	142	142	142

Source: Author's Computation

The unfavourable terms of trade experienced by the country over the sample period can be seen by critically examining the summary statistics on the terms of trade. The terms of trade which was measured as a ratio of export value indexes to import value indexes averaged 135.5. Compared with the minimum and maximum values of the terms of trade, the descriptive statistics indicated that the average terms of trade was much closer to the lower bound (minimum) rather than the upper bound (maximum). Thus, over the sample period, Ghana experienced relatively poor terms of trade and this probably contributed to the huge deficits the country experienced in its trade balance over the sample period.

The descriptive statistics also shows that fiscal balance over the sample period recorded an average deficit of about 6 percent of GDP. The best fiscal balance position recorded in Ghana between 1980 and 2015 was 1.7 percent of GDP, clearly indicating that Ghana has performed poorly in terms of fiscal policy management over the sample period.

The descriptive statistics also reveals that oil demand shocks and oil market specific demand shock over our sample period has been positive. The average value of the oil market specific demand shock is relatively higher than the average value of oil demand shock. This probably provides some indication that movement in the international price of crude oil over the sample period has been driven by speculative and precautionary demand for the commodity. This could be as a result a number of red alerts coming from the Middle East and the threat of war in some major oil exporting countries over the sample period. For example the U.S. Energy Information Administration (2012) noted that oil prices in 2012 started above US$100 per barrel and peaked in early March at a little over US$125 as result of positive economic news that led to stronger demand and worries about supply disruptions that were linked to the Iran nuclear programme. The Iran nuclear programme attracted a lot of media attention due to the threat of sanctions at the time and this could have possibly caused an increase in the precautionary demand for crude oil.

Though the average supply shock was negative, it is relatively the smallest (in absolute values) when compared to the oil demand and oil market specific demand shocks. This is probably because of the fact that there has not been a lot of supply side disruptions relative to the demand side shocks within the sample period.

Stationarity Test

Table 3B in Appendix B presents the unit roots test results for all the variables employed for the estimation. The study presented test results from ADF, PP and KPSS in order to ensure that the test results for the stationarity analysis are robust. Results from the ADF test indicates that domestic interest rate (r_t), interest rate differential (r_t^*), the natural log of consumer price index ($LCPI_t$) and all the measures of oil price shocks ($ODS_t, ODSS_t$ and OSS_t) are all integrated of the order zero (I(0)). All other variables are integrated of the order one (I(1)).

Contrary to the results from the ADF test, the PP test indicated that r_t and r_t^* were both integrated of order one. The results from the PP test however confirmed the results of the ADF test on the stationarity of the measures of oil price shocks. All other variables, with the exception of capital account balance

(KA), world income (WY), LCPI and the measures of oil price shocks were integrated of order one per the PP test.

The KPSS test, unlike the ADF and the PP test has a null hypothesis of stationarity and an alternative hypothesis of non-stationarity. Hence with respect to the KPSS test, a rejection of the null hypothesis does not imply the absence of unit root, but rather the presence of it. An examination of the KPSS test in Table 3B indicates that KA, r_t^*, r_t, the log of terms of trade, WY, capital account openness (CAO), LCPI and all the measures of oil price shocks are stationary at levels. The rest of the variables employed in the estimation process are stationary only after first difference.

The results of the unit root test indicate that the variables employed for the estimation of the effect of oil price shocks on external balance have two different order of integration (I(0) and I(1)), hence ARDL model would be more appropriate for our analysis.

Timing of Structural Breaks of Dependent Variables

Table 4B (see appendix) presents results of the Zivot-Andrews unit root test for both stationarity and the existence of structural breaks. The results of the stationarity test based on the Zivot-Andrews test indicates that all our dependent variables are stationary around one structural break. This gives contrary results obtained for the ADF unit root test. The result is however consistent with the test results obtained from the PP test for Capital Account balance.

Table 4B also presents the various break points in TB, and KA that could correspond to a number of events. The results of the test could also indicate the significance of some policy initiatives undertaken by the country to improve on its external balance position. The result of the Zivot-Andrews test for trade balance for example identifies the second quarter of 2008 as a break point. 2008 was the year the global economy experienced record increases in energy and food prices. This is corroborated by the Bank of Ghana quarterly bulleting which indicated the trade balance of the country deteriorated by 36 percent in the second quarter of 2008 when compared to the same quarter in 2007 (Bank of Ghana, 2008a). This still occurred despite the strong export performance that same quarter. The Bank of Ghana attributed this development to the hikes in energy and food prices.

The breaks recorded in the first quarters of 2004 and 2005 in trade balance also corresponds to the reduction of import duties and removal of VAT on selected imported raw materials which were captured by the 2004 budget statement of Ghana. Following the implementation of this policy the country experienced one of the highest increase in import bill in 2004 compared to developments between 1999 and 2003. Import bill increased by over 32 percent. This contributed to the deficit of sover 100 percent increase in trade deficit of the country from a deficit of US$681 million in 2003 to US$1,512.7 million in 2004 (CEPA, 2006). This development might have contributed to the structural break experienced in trade balance in the first quarters of 2004 and 2005.

The Zivot-Andrews test for the capital account identified the fourth and third quarters of 1992 and 2000 as the main periods of structural breaks within the capital account data set. These two periods were both associated with major turning points in the Ghanaian economy. They were both periods that preceded crucial elections that could determine the continued political stability in Ghana. Due to the fear of the unknown after the 1992 and the 2000 elections, the capital account was adversely affected during the periods identified by the test. For example, the capital account which had witnessed an increasing trend since 1987 (increasing from a deficit of US$17.8 million in 1986 to US$237.1 million in 1987 and continued till 1991 where it peaked at US$391.9 million) declined by 30 percent to about US$274 million (Harrigan & Oduro, 2000).

Similarly, the third quarter of 2000 was associated with declines in the capital account balance of Ghana. The period between July and September was part of the most uncertain periods in the history of the Ghanaian economy as it was unclear whether President Rawlings would hand over power when the opposition party won the general election. This uncertainty probably might have contributed to a decline in the capital account by over 66 percent from US$726.3 million in 1999 to US$246.5 million in 2000 (CEPA, 2002). Foreign Direct Investment also declined by over 50 percent from US$244 million in 1999 to US$115 million by the end of 2000. Thus, the uncertainty that surrounded the outcome of the 1992 and 2000 elections had a profound effect on the capital account balance of the country.

Results from the stationarity test indicate that the series employed for the current estimation contain both stationary and non-stationary series. In addition, the structural breaks test also indicate that the measures of external balance have structural breaks in them. The timing of these breaks seems to coincide with major economic, political and policy developments in Ghana. The structural break test suggest that conventional cointegration procedures such as Johansen (1991, 1995) which require that all series entering into an equation be non-stationary cannot be used for the present study. In addition, the presence of structural break in our series implies that the conventional cointegration methods cannot be used since such methods are unable to account for endogenous structural breaks.

To overcome these challenges, the analytical model adopted for the present study was based on Autoregressive Distributed Lag (ARDL) or the bounds testing approach to cointegration. This procedure allows for greater degree of flexibility in terms of combining both stationary and non-stationary series in the estimation and can also accommodate extra variables that can represent structural breaks.

Cointegration and Error Correction Modelling

This sections presents results from the application of the ARDL procedure presented in Chapter four. Thus, the section applies the Bounds testing to the analytical framework. The study first tested for the presence of cointegrating relationships among the variables of interest after which the long and short run parameters values were estimated.

It is important to note that three additional variables were included during the process of conducting the cointegration test. This was done to control for the structural breaks identified in the preceding section. These variables are mainly dummy variables that captures the structural breaks. For the break identified for

Trade Balance, the study included the variable TBDUM with values 1 for periods after the first quarter of 2004 and zero otherwise. For the capital account balance, the study used KADUM. KADUM had values of 1 for periods after the second quarter of third quarter of 2000 and zero otherwise.

Results of the cointegration tests are presented in Table 5B in Appendix B. Where Trade Balance (TB) is the dependent variable (with ODS, ODSS and OSS as part of the explanatory variables), the calculated F-statistic of 3.61 is greater than the critical value at the 5 percent level. The cointegration results were however inconclusive when TB was used as the dependent variable with the log of oil price as part of the independent variables rather than ODS, ODSS and OSS. The F-statistic of 2.20, though greater than the lower bound at 5 percent significant level, is less than the upper bound limit. This makes it difficult to determine the existence of long run relationship, hence, the study did not estimate that particular model.

Considering capital account balance models, the cointegration test revealed the existence of cointegration among the variables used in the model at the 5 percent bound. Specifically, the F-statistic for the capital account balance also had an F-statistic of 3.15 and 3.71 for models containing the various measures of oil prices shocks and the log of oil price respectively.

Since the null hypothesis of no cointegration has been rejected for almost all the models, it implies that there exists a long run relationship between oil price shocks and external balance. This also implies an error correction mechanism exist.

Long Run Estimation Result

Given the fact that the study found cointegrating relationship between oil price shocks, the control variables and external balance, the study proceeded to estimate the long run effect of oil price shocks on external balance. Since the study only found cointegrating relationship in five out of the six equations, the study only estimated the long run model for just the five equations. The estimates of the selected ARDL model was based on the Akaike Information Criterion (AIC) for the trade balance model and the Schwarz Bayesian Criterion (SBC) for the Capital account models. The analysis of the long run impact of oil price shocks on external balance would be based on the various measures of external balance identified. The study first analysed the impact of oil price shocks on trade balance, followed by on capital account balance.

Trade Balance Model

The empirical results of the long run trade balance model (TB1) is presented in Table 6B in Appendix B. The results of the study as presented in Table 6B suggest that oil price shocks tend to have differential impact on trade balance of Ghana. Whereas oil demand shock (ODS) had significant (statistically significant at 5 percent level) positive impact on Ghana's trade balance, the impact of oil market specific demand shock (ODSS) was negative (statistically significant at 10 percent level). Though oil supply shock had the expected sign, it was insignificant. The insignificant long run effect of oil supply shock could be inferred from the impulse response function in the previous section. The result from the impulse response function in the previous section shows that the effect of an oil supply shocks within the sample period has only lasted for a short while, hence this could possibly explain the insignificant impact of oil supply shock on trade balance in Ghana.

Results obtained from the study suggest oil demand shock contributes to improve the trade balance position of the Ghanaian economy in the long run. That is, a percentage increase in oil demand shock leads to about 0.41 percentage improvements in Ghana's trade balance position. This is probably because oil demand shock gives an indication of an expansion in global economic activity and hence, such shock would increase demand for Ghanaian exports such as cocoa, gold, timber among others and this in the long run is what contributes to the improvement in the trade balance position of the country.

The results obtained in the present study corroborates with a number of reports of the Bank of Ghana. For example, in 2008 global oil price reached an all-time high of about US$147 per barrel. This increase in oil price at the time was attributed to high global demand for the commodity due to high economic growth rates in the BRICS. The Bank of Ghana annual report indicated that Ghana's export earnings for 2008 improved. Export earnings of Ghana's economy grew by 26.3 percent (Bank of Ghana, 2009). The growth in exports was mainly fuelled by improved prices in Gold (which increased by an average of 25.9 percent) and timber (which increased by 14.6 percent) exports. This implies increases in oil demand that is due to high global demand for industrial commodities tend to improve Ghana's export gains.

On the other hand, oil market specific demand shock tends to contribute to the deterioration of the trade balance of Ghana in the long run. Oil market specific demand shocks are mainly not due to increase in economic activities in the global economy, but rather due to precautionary demand for crude oil and speculation in the oil market. As result they may not have significant effect on improving exports of the country rather result in an increase in the value of import even if quantity of oil imports remains the same in the Ghanaian economy. Thus, increased value of imports due to increases in the price of crude oil which is also as result of speculation in the oil market would contribute to the deterioration of the trade balance of the country.

The 2006 edition of the Bank of Ghana Annual Report indicated the deterioration in Ghana's trade balance in 2005 was mainly due to high oil imports. Oil imports rose by 41 percent. The increase in oil price was mainly due to increase in the price of the commodity. Average price of oil rose by 43 percent while volume of oil imports also rose by just 3.1 percent. Beidas-Strom and Pescatori (2014) attributed the oil price hikes of 2005 to speculative activities in the oil market. During this period export earnings from cocoa declined by 23.5 percent (CEPA, 2006). Thus, the deterioration of the trade balance after an oil market specific demand shock is due to the fact that import bill of the country increases and since demand for industrial commodities may not have gone up, exports of the country may either decline or remain the same. In either case the trade balance of the economy would deteriorate. The result obtained is consistent with results obtained by Chuku *et al.* (2011) and Kilian *et al.* (2009).

From the discussions above and from the regression output, it is obvious that oil price shocks tend to have differential impact on trade balance. That is, the effect of an oil demand shock on trade balance differs from the effect of an oil market specific demand shock on the trade balance of the country. To do this scientifically, the study used the Wald test to test for the differences in the coefficients of oil demand shocks and oil market specific demand shocks. The following null hypothesis was tested

$$H_0: \alpha_7 - \alpha_8 = 0 \tag{64}$$

Where α_7 and α_8 are the respective coefficients of ODS and ODSS. Result of the test is presented in Table 7B in appendix B. The Wald test indicates that the null hypothesis stated equation (64) is rejected at one percent level of significance. This clearly indicate that oil price shocks have differential impact on trade balance in Ghana.

In relation to other control variables in the trade balance model, the results indicate that income levels tend to have a positive long run effect on the trade balance of Ghana. Thus, a percentage increase in levels of income improves the trade balance of the country by 0.386 percent. The result is consistent with the monetary theories on external balance. The theories indicate that an increase in domestic income levels increases demand for money and hence increase exports and improve trade balance (Duasa, 2007). That is in the long run, high income levels give an indication of improved productivity and as a result exports within the economy also expands. This could be observed in the growth experience of the Ghanaian economy since the start of the twenty first century. For example, with economic growth rate improving from 4.8 percent in 2009 to 7.9 percent in 2010, exports of the economy also grew by 24.7 percent in 2010 from a previous growth of 7.6 percent. Similar trends were recorded in the years 2011, 2012, and 2013. Results obtained in this study is consistent with results obtained by Duasa (2007) for the Malaysian economy.

The long run estimate also indicates the existence of a direct relationship between trade balance and fiscal balance (FB). That is an improvement in fiscal balance (measured by the difference between government revenue and expenditure) contributes to improve the balance of trade of the economy. Conversely, deterioration in the fiscal balance (fiscal deficit) contributes to the deterioration of the balance of trade. Thus results obtained from the present study confirms the twin deficits hypothesis for Ghana. The result suggests that when fiscal balance improves by one percent, trade balance of the economy also improves by 0.018 percent in the long run. Results obtained in the present study is consistent with results obtained by Wiafe (2013) for Ghana and Egwaikhide (1999) for Nigeria. The result is also consistent with results obtained by Nickel and Vansteenkiste (2008) for 22 industrialised countries.

Though interest rate had the expected sign, the result suggest that it has an insignificant long run effect on trade balance. Similarly, the real effective exchange rate was also insignificant in the long run. This suggests that the Marshall-Lerner condition and the J-curve are not held in the long run in the case of Ghana. This result is consistent with a study by Oshota and Adeleka (2015) which established that role of the exchange rate is insignificant in initiating changes in the trade balance in the case of Ghana. The insignificant relationship between the exchange rate and trade balance could be as result of the periodic intervention of the government in the exchange rate market to help stabilise the free fall of the domestic currency at some points in time. Thus, these interventions help stabilise the domestic currency make it difficult for the linkage between trade balance and exchange rate to observed in the Ghanaian economy. The insignificant effect of the exchange rate could also be explained by the nature of Ghana's export which is mainly dominated by primary commodities which may not necessarily respond to changes in the exchange rate (Saruni, 2007). Akoto (2016) and Danquah (2008) also obtained similar result for the Ghanaian economy.

The long run estimates also indicate that terms of trade (TOT) has a negative long run effect on trade balance of the Ghanaian economy at 10 percent level of significance. Thus, improvement in the terms of trade tends to have adverse effect on the trade balance of the country. An increase in terms of trade is an indication that export prices are relatively higher than import prices, hence it leads to reduction in exports of the country relative to its imports and this situation results in the deterioration of the trade balance of the economy in the long run.

World income (WY) was found to be positive and significant and this clearly indicated expansion in the world economic activity resulted in improvement in the trade balance position of Ghana in the long run. Specifically, a percentage increase in world income leads 0.97 percentage increase in trade balance. That is higher world income leads to increase in the demand for Ghanaian exports which contribute to increase the trade balance of the country. Akoto (2016) and Danquah (2008) also finds evidence of a positive significant relationship between world income and trade balance. Contrary to the effect of world income, the coefficient of the dummy variable (DUMTB) was found to be negative and significant. The result suggests that the removal of VAT on selected imported raw materials in 2004 as overtime had a devastating effect on the economy's trade balance position.

Capital Account Model

Unlike the trade balance model, all the measures of oil price shocks were found to be significant in the capital account model. Specifically, oil market demand shock was found to be significant at 5 percent level of significance. The result shows that an increase in the price crude oil that is as result of expansion in global economic activities tend to have positive impact on the capital account balance of the country.

This is expected since expansion in global economic activities gives an indication of an increase in demand for industrial commodities. Since Ghana is also involved in the supply of such commodities, such shocks encourages the inflow of foreign investments which in the long run helps to improve the capital balance position of the economy. For example, following the 2008 oil price shock, which have been largely attributed to oil demand shock (see, Kilian, 2009a; Peersman & Van Robays, 2012), Foreign direct investment in Ghana increased from 5.6 percent of GDP to 9.5 percent of GDP by the end of 2008. The capital account during this period also improved from 0.76 percent of GDP in 2007 to 1.6 and 2.2 percent of GDP in 2008 and 2009 respectively. Results obtained in the study is consistent with theoretical and empirical arguments made by Kilian *et al.* (2009).

As expected, oil market specific demand shock had a negative effect on the capital balance position of the country. That is an increase in the price of crude oil that is as a result speculation and precautionary demand in the oil market, would cause a reduction in the capital account balance of the country. It is important to note that Kilian *et al.* (2009) have argued that the effect of oil market specific demand shock on the capital account depends largely on how the valuation effects manifest themselves in capital gain or losses. Given the fact savings is quite low in Ghana, the composition of ownership of capital is largely foreign in nature, hence an oil market specific shocks could affect the Ghanaian economy in two ways. First such shock would have negative effect on the profitability of firms and as such could encourage investors to halt their investments or even reverse already existing ones. This could adversely affect the capital account balance position of the country. Secondly, oil market specific shocks also signal investors of a boom in the oil market and in order to take advantage of that would have to invest in oil net exporting countries, this means Ghana would lose out in the inflow of foreign capital to the outflow causing deterioration in the capital account balance of the country. Following the oil price hikes of 2005 (which was mainly due to speculative demand for oil-(Beidas-

Strom & Pescatori, 2014)), the inflow of foreign direct investments into Ghana declined from 1.56 percent of GDP to about 1.35 percent of GDP. This confirms the results obtained in the present study. Kilian *et al.* (2009) also obtained similar results for the US economy. A similar result was obtained in the second model of the capital account (KA2) where the log of crude oil price is included and the various oil market shocks are excluded, the study found that oil price increases tend to have adverse effect on the capital account balance of Ghana. Specifically, a percentage increase in the price of crude oil result in 0.18 percentage reduction in the capital account position of the country.

Contrary to results obtained by Kilian *et al.* (2009) results from the capital account model indicate that oil supply shock tends to have a positive effect on the capital account balance of Ghana. Thus, oil price increases that is due to supply shock result in improvement in the capital account balance of the country. This was contrary to the expectations of the study. This could probably be explained by the effect of high oil prices on the US dollar.

Researchers have evidence to the fact that high crude oil prices in time past have resulted in the depreciation of the US dollar (see Baffes, Kose, Ohnsorge, & Stocker, 2015; Feldstein, 2008; Fratzscher, Schneider, & Van Robays, 2014; Grisse, 2010). The depreciation of the US dollar leads to increase demand for Gold as an alternative store of value and to provide a hedge against the risk of depreciation in value (Wang & Chueh, 2013; World Gold Council, 2016). With Ghana being among the ten top producers of gold such demand for the commodity is likely to influence the flow of capital to expand production to meet growing demand.

Following the 2003 US invasion of Iraq which gave rise to an oil supply shock for example, growth in mining sector FDI (of which gold dominate) more than quadrupled from a growth of 14.5 percent in 2002 to a growth of 72.8 percent in 2003. Thus, the positive effect of oil supply shocks on the capital account balance is due to the effect of the shock on the US dollar and its subsequent effect on the demand for gold.

In relation to the other control variables in the capital account balance model, the result indicated that on FDI, capital account openness and the dummy for the structural break had significant long run effect on capital account balance. Interest rate differential and the consumer price index had no significant effect on long run capital account balance.

The result specifically indicates that a percentage increase in FDI increases capital account by 0.12 percent, all other things being equal in the long run. This is expected since the inflow of foreign investment only adds up to the capital account rather than taking it out. On the other hand, capital account openness was found to have negative effect on the capital account balance. That is a percentage increase in capital account openness leads to a 0.3 percentage deterioration of the capital account balance of the country. The nature of the Ghanaian economy implies that the kind of FDI the Ghanaian economy would attract would be based on the extraction and primary commodity sector which tends to have very volatile prices in the world market. Hence, in the situation where capital account openness increases, investors can easily take away their investments in the long run when prices of the commodities they invested in are down, and this would adversely affect the capital account balance.

Short Run Estimation Results

Once the long run relationship between the variables has been established within the framework of the ARDL approach to cointegration, the study proceeded to estimate the short-run dynamics on the relationship between oil price shocks and external balance. Engle and Granger (1987) argued that, when variables are cointegrated, their dynamic relationship can be specified in an error correction representation in which an error correction term is computed from long run equation is incorporated to capture both short and long run relationships. The coefficient of the ECT gives an indication of the speed with which variables in the model converge to long run equilibrium after a shock. The ECT is expected to be negative and significant. Banerjee, Dolado, and Mestre (1998) have argued that a highly significant error correction term provides further proof of the existence of a long-run relationship. Table 8B in Appendix B presents results from the short run estimates.

From Table 8B, the coefficient of the lagged of error correction term (ECT_{t-1}) is negative and significant at one percent level for all the models estimated (TB1, KA1 and KA2). For the trade balance model (TB1) the error correction term indicates that about 9 percent of the deviations from the long run balance of trade position caused by a shock in the previous quarter is corrected in the current quarter. The capital account balance models (KA1 and KA2) seem to have the fastest speed of adjustment. The results indicate that about 10.7 and 13.8 percent of the deviations from long run capital account position cause by previous quarter's shock is corrected in the current quarter for models KA1 and KA2 respectively.

Evidence from the error correction term (ECT) indicates that trade balance takes about 12 quarters (3 years) to revert to its long run equilibrium position after a shock. This is relatively high when compared to the capital account balance which on average takes about 8 quarters (2 years) to revert to long run equilibrium after a shock. The differences in the speed of adjustment could be as results of the various components of each measure of external balance. It would take a lot of productive man hours to increase output in order to increase exports to restore balance in trade when an oil price shock for example increases trade deficit in the economy. For capital account, it involves activities that does not require a lot of time to materialised hence its faster speed of adjustment. In relation to the external balance as a whole it takes about 9 quarters (2 years three months) to restore to long run equilibrium after a shock to the external balance of the country. This could probably explain why the International Monetary Fund (IMF) approved a three-year programme for the Government of Ghana to help improve the Balance of Payment challenges the Ghanaian economy was facing.

Short run effects of oil Price Shocks on External Balance

The results of the trade balance model indicate that oil demand shock and oil market specific demand shocks are the only oil market variables that affect trade balance in the short run. Oil supply shock was found to be insignificant. The contemporaneous effect of the two variables (ODS and ODSS) was found not have significant effect on trade balance. The capital account balance on the other hand was affected by the contemporaneous effect of oil demand shock, oil market specific shock and oil supply shock. The difference in the timing of the effect could be due to the fact that capital markets reacts quickly to information than the goods market.

Considering the capital account balance, the result indicates that a unit increase in oil market shock will cause the capital account balance to improve by 0.03 percentage point. The positive link between oil demand shock and the capital account could be due to the fact that oil demand shock signals increase in global economic activities which implies increased demand for industrial commodities (see Kilian, 2009a) of which Ghana is a key producer. Hence, the capital account responds positively probably due to influx of FDI to expand domestic production of industrial commodities such as gold, cocoa, timber etc. For example, following the oil demand shock of 2008 which resulted in oil prices reaching an all-time high of about US$147 per barrel by July 2008, Ghana's capital account balance, during the third quarter of 2008 improved by US$801.43 million dollars (Bank of Ghana, 2008). The Bank of Ghana attributed this improvement to improvement in net receipts which reflected proceeds of US$900 million obtained from the sale of Ghana Telecom as well as the FDI inflows of US$461.22 million.

The result of the study also shows that trade balance is affected by the lag of oil demand shocks at one. Specifically, a unit increase in oil demand shock would cause trade balance to deteriorate by 0.07 percentage point. The deterioration in the trade balance could be due to increase in the cost of crude oil which contribute increase the value of imports even when the quantity of oil imported into the country remains the same. For example the trade balance position of Ghana deteriorated by 28.7 percent in 2008 mainly due to the oil demand shock of 2008 (CEPA, 2009). Das *et al.* (2014) maintain that such shocks contribute to the transfer of income from oil importing economies to oil exporting economies. The adverse effect of oil demand shock on trade balance persist till the third quarter. This is probably due to the time that is required to increase domestic export to counter the effect of the oil price shock. It is therefore not surprising that the influx of FDI in response to expansion in global demand for industrial commodities, as indicated by the effect of ODS on the capital account, starts yielding results in the long run where the effect of ODS on trade balance turns positive.

The effect of oil market specific shock was only felt on the trade balance after the first quarter. As expected, oil price increase that is due precautionary demand for the commodity leads to the deterioration of the trade balance a quarter after the shock and this persist till the end of the second quarter after the shock. The effect oil market specific shock on trade balance turns positive in the third quarter after the shock. This could be the result of the effect of oil price increase on the depreciation of the US dollar as indicated earlier in the long run analysis. Once investors decide to reduce the risk of loss of value the is coming from the depreciation of the US dollar, they resort to the use of Gold as a store of value.

This causes an increase in demand for Gold in Ghana, which contribute to reduce the trade deficit that is created by high oil imports.

Oil supply shocks was found not to have significant effect on trade balance. However, it had a positive significant effect on capital account balance. The positive impact of oil supply shock could be explained by investment gains into the mining industrial due to an anticipated increased demand for precious metal as an alternative store of value following an anticipated depreciation of the US dollar. In addition, since most oil supply shocks are usually sparked by conflicts in oil exporting economies (see Economou & Agnolucci, 2016), investors may find it inappropriate to invest in such economies and would want a more stable economy to invest, hence, the positive relationship between oil supply shock and capital account balance in Ghana.

The results of the dependent variable lagged one period indicates that improvements in trade balance and capital account balance persist for at least one quarter. Thus, improvements in the external balance position of the country in the previous quarter tend to have positive effect on external balance. However, this turns negative when it persists for more than one quarter. This evident by the effect of ΔKA_{t-2} *and* ΔKA_{t-3} on capital account balance in model KA1 and KA2. The negative effect of the lagged measures of external balance could be due to the fact that continuous improvements in capital account balance may lead to the appreciation of the local currency which would make imports relatively cheaper when compared to exports.

The short run estimates indicated that income level, fiscal balance and short term interest rate had effect on all the measures of external balance. Dummy variables that was included in the various models to capture the effect of structural break identified were insignificant in the short run.

The result of the short run estimate reveals that the appreciation of the domestic currency against its major trading partners tend to have positive effect on external balance. Specifically, a percentage increase in the real effective exchange rate improves trade balance (TB1) and capital account balance (KA1) by 0.013, and 0.75 percent respectively. This implies that depreciation of the exchange rate would result in the deterioration of the external balance position of the country. The results seem to satisfy the first condition of the J-curve effect (see Bahmani-Oskooee, Amor, Harvey, & Karamelikli, 2017; Rose & Yellen, 1989b) in which trade balance worsens initially after depreciation. The study could not fully confirm the J-curve effect in the case of Ghana since the coefficient of real effective exchange rate, though negative for most of the measures of external balance, was insignificant. Akoto (2016) using nominal exchange rate arrived at the same conclusion for Ghana.

The contemporaneous effect of terms of trade was found to be significant and positive at one percent level of significance. That is, a percentage increase in the terms of trade resulted in a 0.39 percentage improvement in the trade balance of the country. The improvements in the trade balance would largely be as a result of improved values of exports (even when volume of exports remains the same) due to higher prices. The lag of terms of trade tend to have an adverse effect on trade balance due to the fact that over time exports of the country becomes relatively expensive as trade balance improves and imports becomes cheaper which tends to have negative effect on the trade balance. The deterioration of the trade balance due to increase in imports that resulted from relatively cheaper import could contribute to the depreciation of the local currency which would later make imports relatively expensive and this improves the terms of trade. Exports also expands as a result of this. This is why the effect of the third lag of terms of trade on trade balance turns from negative to positive. Akoto (2016) obtained similar results for the Ghanaian economy.

As expected, improvement in world income leads to increase in demand for Ghanaian exports. The short run estimate confirms this as a percentage increase in world income leads to 0.07 percentage improvement in the trade balance of the country.

The short run estimates also reveal that interest rate differential has a positive effect on the capital account balance of the country. The result specifically indicates that an increase in interest rate differential leads to improvement in the capital account by 0.04 and 0.2 percent for KA1 and KA2 respectively. That is high domestic interest rate serves as motivation for individuals who wish to earn more on their investment, hence they invest in domestic investment instrument which goes to improve capital account balance. Liyanage (2016) obtained similar results for the Sri-Lankan economy.

As expected the coefficient of FDI is positive and significant at one percent. The contemporaneous effect of FDI indicates that a percentage increase in the inflow of foreign direct investment leads to a 0.38 percentage increase in the capital account. The effect of capital account openness on capital account balance was also found to be positive. Indicating that the greater the level of openness, the higher the inflow of capital in the short run. The results from the long run estimates revealed the effect of capital account openness on capital account is not lasting, it turns negative in the long run. The capital account model also shows that inflation is inimical to improvements in the capital account balance. This is because a percentage increase in the lag of inflation leads to 0.11 reduction in the capital account balance. This situation persists till the second quarter. This is probably due to the effect of inflation on real interest rate. since increase inflation implies reduction in the real interest rate of the country, high inflation implies lower real returns on investments which hampers the inflow of foreign capital into the Ghanaian economy. Results obtained in this study is consistent with results obtained by Arshad, Majeed and Shah (2012) and Liyanage (2016).

Model Diagnostics and Stability Tests

Since estimated parameters of time series data could vary over time (Hansen, 1992), it is critical to conduct parameter tests in order to check for model specification errors that may arise due to unstable parameters and subsequently lead to biased estimates.

The results presented in Table 9B in Appendix B indicate that over 90 percent of the variations external balance (Trade Balance and Capital Account Balance) are explained by variations in oil price shocks and the variations in the other control variables. The F-test for the overall significance of the estimated external balance model indicates that all the estimated models of external balance are significant at one percent. This implies that, explanatory variables employed for the current estimation are good predictors of external balance in Ghana.

The post estimation test on the residual term for the estimated three models indicates the absence of serial correlation in all five models. Also, the test on the residual also indicated the absence of heteroscedasticity in two out of the three models. The test on heteroscedasticity on the KA2 model however indicated that the error term is heteroscedastic at 10 percent level of significance. Test for the normality of the error terms for all the estimated three models also shows that the errors are normally distributed. The estimated models also pass the Ramsey RESET test for correct specification of the model.

In order to check the stability of the coefficients of the models estimated, the study used the CUSUM and CUSUM Square of recursive residuals stability tests as suggested by Pesaran and Pesaran (1997). The tests are based on the null hypothesis the coefficient vector is the same in every period. An examination of the plot of CUSUM and CUSUMSQ of recursive residual stability test in Appendix B indicates that all the coefficients of the estimated models are stable over the study period since they are within the 5 percent critical bounds.

Summary

This chapter empirically examined the impact of oil price shocks on external balance in Ghana. The results indicate that oil demand shocks had a positive impact on external balance in the long run whereas oil market specific demand shock was found to have negative long run effect on external balance. In terms of the effect oil supply shocks, the study found that it only impacted on the capital account component of the external balance in the long run. Its effect was found to be positive. The results from the chapter shows that oil price shocks tend to have deferential impact on external balance in Ghana. That is the effect of oil price increase on external balance in Ghana largely depended on the source of the shock. Since oil price shocks affects Ghana's external balance position (as indicated by the results from this chapter) it would be important to understand how its impact on the external balance position of Ghana is transmitted into other sectors of the economy.

Given the fact that the stock market is known for its high efficiency when it comes to the incorporation of information into its activities and the fact that changes in the price and availability of crude oil affects a number of firms (directly and indirectly) listed on the stock exchange, an analysis of the impact of oil price shocks on these firms would go a long way to understand the transmission of these shocks into the economy as a whole. The next chapter therefore, analyse the effect of oil price shocks on stock market activities in Ghana.

CHAPTER SIX

OIL PRICE SHOCKS AND STOCK MARKET ACTIVITIES

Introduction

This chapter examines the effects of oil price shocks on stock market activities in Ghana. To achieve this, the study used monthly time series data from 2002 to 2014. The descriptive statistics for the various variables used for the present estimation was first analysed. The time series properties of all variables used in the study was then examined. Structural VAR estimates and the impulse response function (IRF) on the effect oil price shocks on stock market activities in Ghana are after the examination of the time series properties. Results from OLS and Markov-Switching model on the effect of oil price shocks on stock market activities are also analysed and discussed in this chapter.

Descriptive Statistics

The descriptive statistics on the effect of oil price shocks on stock market activities are presented in Table 3. Analysis of stock price index (measure of stock market activity) in Table 3 shows that the stock market since 2002 has been relatively volatile. When compared to other variables used for the estimation, stock market activity recorded the highest standard deviation of 2806.86 and the highest range of 9926.29. The volatile nature of the data used reflects what happened to the stock market over the study period. For example, whereas the value of traded shares on the stock market increased by 455.81 percent between 2006 and 2008, the value of traded share declined by 81.93 percent by the end of 2009 (Adjasi, 2009).

Relative to the measure of stock market activity, short term interest rate (proxied by 91 T-bill rate) has been less volatile over the sample period. Average interest rate recorded over the sample period is 18.43 percent. This implies that interest rate over the sample period has been on the high side when it is compared to the recorded interest rate of about 16 percent (T-Bill rate) at the end of 2015. This is likely to have negative impact on stock market activity since T-bills tend to risk free investment opportunities than the stock market itself. Just as stock market activity, short term interest rate is slightly skewed to the right.

The Consumer Price Index (CPI) has also been very volatile over the sample period. This is characteristic of Ghana's inflation experienced since independence (Ocran, 2007). CPI has been relatively high over the sample period with an average of 237.28. This can be observed in the various inflation episodes the country has experienced over the years. The inflation rate over the period has consistently exceeded 14 percent. The real effective exchange rate (REER) over the period averaged 91.37. With a minimum value of 53.40 and a maximum of 106.37, the average REER indicates that the domestic currency has performed strongly against all its major trading currencies. It has also been relatively less volatile over the sample period.

Table 3Descriptive Statistics (Oil shocks and Stock Market Activities)

	P	r	CPI	REER	OIL PRICE	ODS	ODSS	OSS
Mean	4238.092	18.43403	237.2809	91.37358	75.51939	8.74E-14	9.61E-15	-1.52E-16
Median	4782.527	17.30000	202.1000	91.40083	78.41510	0.337517	-0.003850	-0.000116
Maximum	10882.70	39.30000	1401.100	106.3661	140.2145	19.84715	0.159966	0.012444
Minimum	956.4085	9.130000	96.40000	53.40086	23.04740	-20.67884	-0.163398	-0.012061
Std. Dev.	2806.858	6.799745	138.1023	9.564810	28.06160	6.249489	0.058569	0.004399
Skewness	0.532860	0.276799	3.866994	-1.233097	-0.043652	-0.025416	-0.056158	-0.049417
Kurtosis	2.366506	2.181453	32.27508	5.526469	1.983036	4.012814	3.161342	3.013009
Jarque-Bera	9.990977	6.347188	6150.500	81.02351	6.771947	5.870317	0.220605	0.056726
Probability	0.006768	0.041853	0.000000	0.000000	0.033845	0.053122	0.895563	0.972035
Sum	661142.3	2875.709	38202.22	14254.28	11781.02	1.21E-11	1.32E-12	-2.08E-14
Sum Sq. Dev.	1.22E+09	7166.663	3051560.	14180.27	122055.3	5311.631	0.466527	0.002631
Observations	156	156	161	156	156	137	137	137

Source:

Crude oil price over the sample period averaged about US$75.52. This is relatively high when compared with average oil price of US$41 between 1980 and 2014. The relatively high oil price recorded over the sample period is due to relatively high demand for the commodity (Allegret & Benkhodja, 2011; Baumeister et al., 2010; Kilian, 2009a).Oil demand shock (ODS) over the period has been very volatile given the range of 40.52.

Stationarity Tests

The time series properties were examined using the ADF and the PP tests for the purpose of achieving a more reliable result. This was further enhanced via the use of the KPSS test which is seen to be more robust than the ADF and PP tests. These results are presented in Table 1C in Appendix C. The results of the ADF and the PP tests indicate that the oil market variables (ODS, ODSS and OSS) were all stationary at levels as expected. The KPSS test, which is based on the null hypothesis of stationarity, also corroborated the results of ADF and the PP tests. The ADF test indicated that interest rate was stationary at levels. All other variables (*P, LCPI, LREER,* and *LOP*) were found to be stationary only after first differenced. The KPSS test however, indicated that interest rate and LCP were all stationary at levels. Given the fact that variables involved are both I(1) and I(0) variables, the study differenced the I(1) variables to ensure that they are all I(0).

SVAR Estimation Results

This section presents results of the SVAR estimation of the impact of oil price shocks on stock market activities. The SVAR is based on equation (53). Variables used in this estimation are world oil supply, measure of global economic activity, crude oil price and stock prices (stock market activity). The pre-estimation diagnostic test results are presented in Table 2C and Table 3C in appendix C. In relation to the optimal lag length, the FPE and AIC test statistic selected a lag length of three (3) lags. At this lag length, the Lagrange-multiplier test indicated that null hypothesis of no autocorrelation is rejected. The plots of eigenvalues showed in Figure 1C from the reduced form VAR indicate that all eigenvalues lie within the unit circle. This implies that the system is stationary and stable.

Impact of Oil Price Shocks on Stock Market Activity

Figure 11 shows the impact of oil supply shock on stock market activity in Ghana. The result indicates that an oil supply shock does not have an immediate impact on stock market activity in Ghana. This is probably due to the fact that short-term price elasticity of demand for crude oil is usually inelastic (Hamilton, 2008; Wang *et al.*, 2013), hence, changes in the price of crude oil that is as result of oil supply shock may not have significant effect on stock market activity, particularly when the supply shock does not affect the global economy positively. The result is consistent with results obtained by Wang *et al.* (2013) for net oil importing countries. It is also consistent with results obtained by Effiong (2014).

This implies oil supply shocks is less important in explaining stock market activity in Ghana.

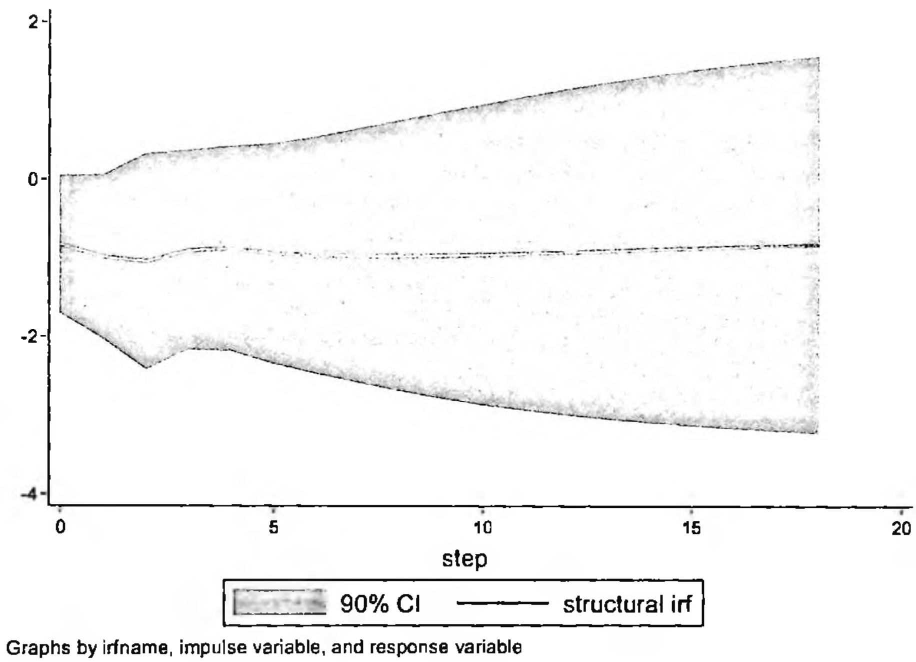

Figure 11: Response of Stock Market Activity to Structural oil supply shock
Source: Author's Computation (2017)

Unlike the effect of oil supply shock on stock market activity, the oil demand shock had a significant effect on stock market activity (see Figure 12). The impact of oil demand shock driven by increased global economic activity leads to a gradual but consistent increase in stock market activity. The increase stock market activity persists until the fifth month after the shock. Stock market activity then begins to decline towards its initial level six months after the shock. As in Kilian and Park (2009) and Wang *et al.* (2013), an unanticipated increase in world demand for industrial commodities has a positive effect in crude oil prices and stock prices. In the case of Ghana, expansion in global economic activity tends to increase demand for such industrial commodities such as Gold, Cocoa, timber, etc. This contributes to increase returns to the stock market which in turn increases stock market activity. The result of the impulse response function reflects trend in the movement between oil price hikes and stock market activities from the first quarter of 2008 to the first quarter of 2009 as shown in Figure 7 of Chapter 2. It is important to note that the oil price shocks of 2008 was attributed to demand shocks in the oil market.

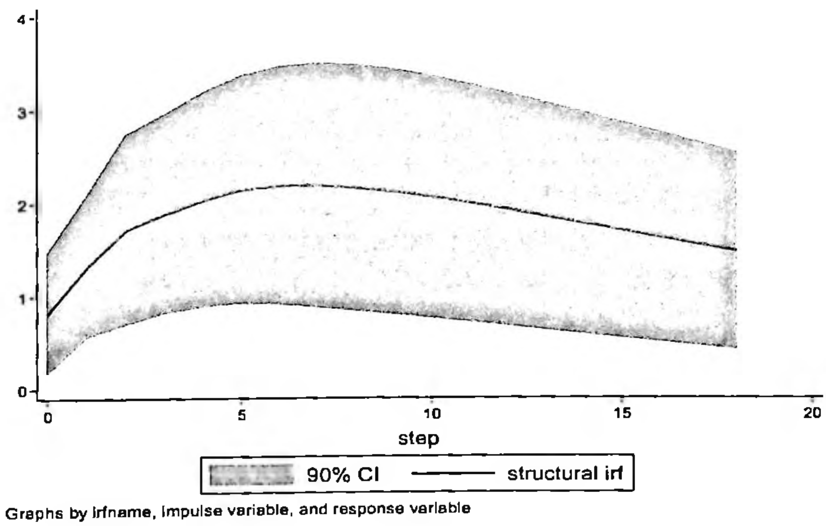

Figure 12: Response of Stock Market Activity to Structural Oil Demand shock
Source: Author's Computation (2017)

The declines in the stock market after the sixth month is due to the fact that it takes time for the adverse effect of the price increase that follows an oil demand shock to be felt on the stock market. That is, the persistent increase in the stock market activity is partly due to inelastic short term demand for oil and partly due to the increase demand for industrial commodities across the world. However, after the sixth month the stock market begin to experience the adverse effect of oil price hikes which tend to reduce the profitability of listed firms. Reduction in profitability contributes to reduce stock prices and hence stock market activity begins to decline.

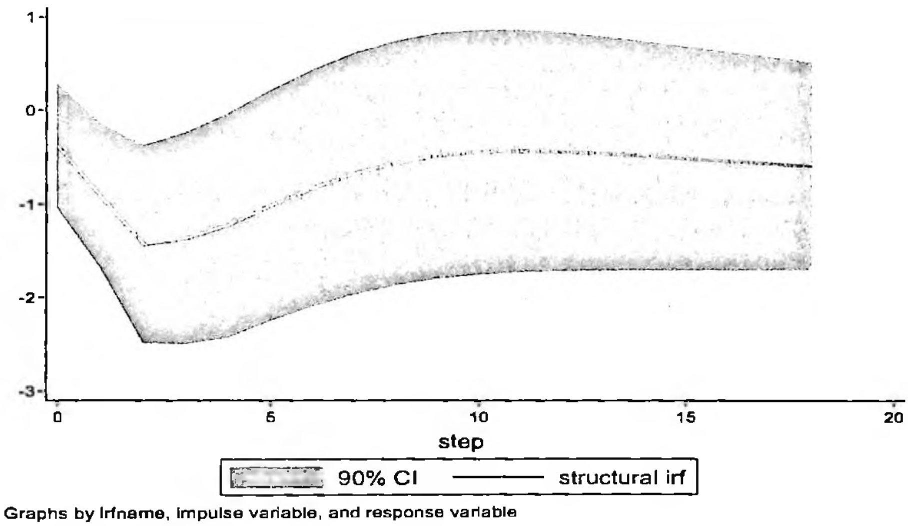

Figure 2: Response of Stock Market Activity to Structural Oil Market Specific Demand shock
Source: Author's Computation (2017)

Contrary to results obtained by Wang *et al.* (2013) for net oil importing economies, oil market specific shock, which captures increase in the price of crude oil that is due to precautionary and speculative demand for crude oil, was found to have significant effect on stock market activity in Ghana (See Figure 13). The effect of oil market specific demand shock can be explained by the indirect effect of oil price shocks on stock market activity as explained by Bernanke *et al.* (1997). Since oil price shock contributes to increase inflation rate, Jumah and Pastuszyn (2007) and Tweneboah and Adam (2008), have found evidence to this effect in the case of Ghana. The central bank could respond by increasing interest rate to help curb inflation and this would reduce the investment that goes to the stock market resulting in a reduction in stock market activity. The effect of oil market specific demand shock is reflected in Figure 7 of Chapter two. That is in 2005 (The year which oil price increase was due to speculative activities (see Beidas-Strom & Pescatori, 2014)) changes in the price of oil and stock market activities moved in opposite directions in the second to fourth quarter of 2005.

It is important to note that stock market activities begin increase after the third month. This could possibly be due to the adverse effect of oil price on the US currency which contributes to increase the demand for Gold as a store of value rather than the US dollar. Given the fact that Anglo Gold Ashanti has a major influence on stock market activity in Ghana (it owns over 25 percent of the total market capitalisation of the stock exchange), hence increase demand for Gold, due to high oil prices, could have positive effect on stock market activity in Ghana. The impact of oil market specific shock becomes insignificant four months after the shock. Results obtained in this study is consistent with the work of Kilian and Park (2009).

Variance Decomposition of Structural Shocks

The relative contributions of the various measures of oil price shocks and shocks peculiar to stock market activity to variations in stock market activity is captured through the use of structural forecast error variance decomposition (SFEVD). The results of the SFEVD of the SVAR model in equation (53) are presented in Table 4C in appendix C. The figures reported show the percentage of the forecast error of the four shocks at different time horizon from 1 month (short-term) to 18 month (long-term).

The results of the SFEVD indicates that only 6.1 percent of the variation in stock market activity in Ghana is explained by the cumulative effect of the three oil price shocks in the short-term. Out of the three oil market specific shocks accounts for the lowest variation in stock market activity accounting for just 0.6 percent of the variation in stock market activity in the short term. In the long term, about 36 percent of the variability in stock market activity is accounted for by the three measures of oil price shocks. Out of this oil demand shock accounts for about 26 percent, whilst oil supply shocks and oil market specific demand shocks account 6 percent and 4 percent respectively. This result is consistent with the findings of the structural impulse response function in which oil demand shock was found to have significant positive impact on stock market activity. The explanatory power of the oil price shocks to variations in stock market activity indicate crude oil market shocks, especially oil demand shock, are important fundamentals for the Ghanaian stock market.

The SFEVD obtained in this study is consistent with those of Wang *et al.* (2013) for the Indian stock market and Apergis and Miller (2009). Results of Wang *et al.* (2013) indicated that the effect of the three oil price shocks on the stock market was less than 10 percent with oil demand shock recording the highest effect within the first month. The effect of these shocks increase to over 20 percent with oil demand shocks dominating the others after 12 months.

OLS Estimation Results

As a second look at the impact of oil price shocks on stock market activity in Ghana, a linear regression model (equations (54) and (55)) is estimated where monthly stock market activity is regressed on one period lag of stock market activity, real effective exchange rate, short term interest consumer price index, crude oil price and all three measures of oil price shocks. These results together with the SVAR results can be seen as baseline results showing the relationship between oil price shocks and stock market activity. These results are presented in the second and third columns of Table 6C in Appendix C. The results of the OLS indicates that oil price shocks, real effective exchange rate, interest rate, consumer price index accounted for only 7 percent of the variations in stock market activity. The model with only the price of crude oil on the other hand accounted for only 3 percent of the variations in stock market activity.

Results from the OLS estimates indicates that oil supply shocks and oil market specific demand shocks had no significant effect on stock market activity. Oil price in the third column of Table 6C was also found to be insignificant. Oil demand shock was however found to significantly influence stock market activity. The OLS estimates on the effect of oil price shocks on stock market activity seem to be consistent with results obtained from the SVAR estimates. The insignificant relationship between crude oil price, oil supply shocks and oil market specific demand shocks on stock market activity in OLS estimation may be the case. It is also possible that the kind of relationship between stock market activity and oil price shocks is nonlinear and hence the linear regression framework is unable to detect such a relationship.

BDS Test Results

To examine the possibility of a nonlinear relationship between oil price shocks and stock market activity in Ghana, the study examined results from the Markov-Switching models specified in equation (57). However before proceeding to estimate the Markov-Switching model, BDS test was conducted to check the nonlinearity and the suitability of the series (Stock Market Activity) for the Markov Switching Model. The results of the BDS test are presented in Table 5C in Appendix C. From Table 2C, the null hypothesis that the data series are iid is rejected for all combinations of m (embedding dimension) and ε (epsilon value for close points) at one percent level of significance. The result of the BDS test seems to suggest the existence of a nonlinear structure in the data for stock market activity. This is further corroborated by the plot of stock market activity in Figure 2C of Appendix C. Figure 2C indicates very little evidence of a linear structure in stock market activity.

Markov-Switching Results

Since the BDS test indicates that the dependent variable is non-linear in nature, the study proceeded to examine the possibility of a nonlinear relationship between oil price shocks and stock market activity. The results of the Markov-Switching model are presented in the fourth to the seventh columns of Table 6C in appendix C. The study employed the Regime Classification Measure (RCM) statistic by Ang and Bekaert (2002) to check the appropriateness of the estimated MS model. An RCM statistic that is equal to zero implies prefer regime classification and RCM that is equal to 100 implies failure to detect any regime classification. The RCM of 0.054 and 0.020 for the $lnP_t - Shocks$ and $lnP_t - LOP$ models respectively indicates a near perfect regime classification. This is because they are closer to the zero mark for a perfect regime classification than 100.

The results of the MS model indicate that the effect of oil demand shock on stock market activity in Ghana is not regime dependent. In both Regime 1 and 2, oil demand shock tends to have a positive effect on stock market activity. That is oil demand shock that is as a result of increase in global demand for industrial commodities results in the growth stock market activities by 0.072 percentage points. In the second regime, the effect of oil demand shock on stock market activity reduces from 0.072 to 0.0013 though it's still positive.

This is probably due to the fact that Ghana is a major producer of primary industrial commodities and a number of firms listed on the stock market also supply such commodity, hence increase in global demand for the industrial commodity provides some form of signal to investors of a possibility of increased returns from the stock market and thus increase the level of stock market activity. The effect of oil demand shock on stock market activity seem to reflect the performance of the Ghana stock exchange during the oil demand shock of 2008. The value of traded shares on the stock market increased from US$51.6 million in 2006 to about US$286.8 million by the close of 2008 (Adjasi, 2009). This performance as indicated in Chapter 2 was attributed to increase investor and economic activity which also reflects in the effect of oil demand shock on the capital account balance in Ghana.

Oil market specific demand shock was found to have negative effect on stock market activity in regime one and positive effect on stock market activity in regime 2. The negative effect of oil market specific demand shock on stock market activity reflects the impulse response result obtained for oil market specific demand shock. The result of the second regime implies that increases in the price of crude oil that is due to precautionary and speculative demand in the oil market leads to increase in stock market activity on the Ghana Stock Exchange. This could be as result of the effect of such shocks on the stability of the US-dollar which seem to be an international store of value.

Studies such as Baffes *et al.* (2015); Feldstein (2008) and Fratzscher *et al.* (2014) have all found evidence to the fact that increases in the price of crude oil (mostly due to speculative demand for the commodity) results in the depreciation of the US-dollar and this induce a number of investors to store their value in Gold rather than the dollar. As a major gold producing country and with Anglo-Gold Ashanti and Golden Star Resources listed on the stock market, increase in demand for gold has the potential to increase stock market activity in Ghana. This is because Anglo-Gold Ashanti and Golden Star Resources together owns over 26 percent of the total market capitalisation on the Ghana stock exchange and changes in their stock price could have great influence on general stock market activity.

Oil supply shocks was however found not to have any significant effect on stock market activity in both regimes. The log of oil price in the $lnP_t - LOP$ model in Table 6C was only significant in the second regime. The result indicates a percentage increase in the price of crude oil would result in 0.31 percentage reduction in the growth of stock market activity. Results obtained in the MS model seem to some extent confirm results obtained in the SVAR model on the effect of oil price shocks on stock market activity in Ghana. The result is also consistent with the works of Effiong (2014); Kilian and Park (2009); Park and Ratti (2008) and Wang *et al.* (2013)

In terms of the control variables, interest rate and the log of consumer price index were found to be significant with the expected signs. Both interest and consumer price index were found to have negative effect on stock market activity. This results are consistent with results obtained by Adam and Tweneboah (2008) for the Ghanaian economy.

Transition Probability and Expected Durations

The regime transition probabilities and expected durations are presented in the last rows of Table 6C in Appendix C. For $lnP_t - Shocks$ model, the probability of remaining in regime 1 is only about 34 percent. However, the probability of transitioning from regime 1 to regime 2 is about 66 percent. In terms of regime 2, the probability of transitioning from regime 2 to regime 1 is only about two percent as opposed to the probability of remaining in regime 2 which is about 98 percent. Thus, for the $lnP_t - Shocks$ model, regime 2 is more likely to last longer in the economy than regime 1. Regime 1 can therefore be seen as a passive regime. This result is confirmed by the expected duration of each regime. For the $lnP_t - Shocks$ the expected duration for regime 1 is less than two months. However, the expected duration for the second regime is about 57 months (4 years, 10 months). This is quite significant in the life of a stock market. Thus, results obtained in the second regime is what really matters.

In relation to the $lnP_t - LOP$ model the probability of remaining in regime 1 was found to be 99 percent with the probability of transitioning from regime 1 to regime 2 being just about one percent. On the other hand, the probability of transitioning from regime 2 to regime 1 was 51 percent with the probability of remaining in regime 2 being 49 percent. The expected duration indicates that regime 1 would last for about 147 months (a little over 12 years) whilst regime 2 last for just about two months. This implies that effect of oil price increases on stock market activity is not as lasting as the effect of the various measures of oil price shocks.

Summary

This chapter examined the effect of oil price shocks on stock market activities in Ghana taking into account the source of the shock. The results indicate that oil price shocks that occurs as a result of demand shock had a positive effect on activities on the stock market. Oil market specific effect also had significant effect on stock market activities in Ghana. The results also showed that oil supply shock had no significant effect stock market activities.

The fact that these shocks had significant impact on stock market activities calls for further analysis of the effect of oil price shocks on output, inflation as well as an understanding of the extent to which response of monetary policy tend to affect the economy as whole. This is because understanding the effect of oil price shocks on these key macroeconomic variables would help us to get a better understanding about how these shocks translate to affect the productive sectors of the economy as well as the effect of monetary policy response to these shocks on external balance and stock market activities.

CHAPTER SEVEN

EFFECTS OF OIL PRICE SHOCKS ON INFLATION AND OUTPUT: THE ROLE OF MONETARY POLICY

Introduction

This Chapter examines the impact of oil price shocks on key macroeconomic variables such as exchange rate, inflation and economic activity. The chapter further explores the role of monetary policy in minimising the effect of oil price shocks on key macroeconomic variables in Ghana. This Chapter begins with an analysis of the descriptive statistics of all the variables used in the estimation. It is then followed by analysis of the time series properties of all variables involved. Analysis and discussion of empirical results follows after the analysis of the time series properties.

Analysis of Descriptive Statistics

A careful examination of the descriptive statistics (see Table 4) for the study indicate that Consumer Price Index (CPI) averaged 237.7 between January 2002 to May 2015 with average inflation rate within the sample period hovering around 15 percent (World Bank, 2016b). This clearly on the high side given the fact that average inflation rate among Lower Middle Income and Sub-Saharan African countries within the same period hovered around 7.2 and 7.6 percent respectively (World Bank, 2016b). Thus, Ghana's inflation rate is twice more than the average among its peers. The wide gap between the minimum and maximum inflation rate indicates that inflation rate in Ghana has been highly volatile. Monetary Policy Rate (MPR), which is set by the Bank of Ghana as the cost of borrowing to Commercial Banks for onward lending to firms and households has consistently been on the high side. Average MPR over the period under consideration is 17.3 percent with the minimum and maximum values around 12.4 and 33.6 percent respectively.

This is relatively on the high side given the fact that commercial banks would also charge their clients interest rates that far exceed what is being charged by the Central bank in order to cover their cost. This situation is clearly reflected in Ghana's cost of borrowing relative to other countries in the Sub-region. Whereas lending rate in a number of Sub-Saharan African countries averaged 17.5 percent in 2014, that of Ghana averaged 38.8 percent. This situation is partly due to the high monetary policy rate. The domestic currency has also been relatively unstable against the US dollar over the period under consideration. It ranged between GH₵0.73 and GH₵3.82 and the average exchange rate within the period stood at GH₵1.41. The huge gap between the minimum and maximum values clearly indicate that the domestic currency has been very volatile over the years. The growth of economic activity in Ghana has been very slow over the years as increased by an average of 0.93 percent per month between 2002 and 2015.

Oil price within the sample period (2002-2015) averaged US$73.2. This is relatively high, when compared to the average of US$41.75 between 1980 and 2015. Thus, oil prices within the twenty first century have been on the high side. Despite the relatively high crude oil prices over the sample period, the average supply of crude oil increased from 74,574.50 barrels a day between 1980 and

2015 to over 84,000 barrels a day between 2002 and 2015. Average world economic activity has improved from -1.45 between 1980 to 2015 to 11.54 between 2002 to 2015. This seems to suggest that high oil prices over the sample period is more likely to be as a result of demand pressures rather than supply side activities as articulated by Kilian (2009a).

Stationarity Test

The time series property of the series indicates that with the exception of the measure for world economic activity (Y_t^W) and output gap (Ω_t), which were stationary at levels, all the other series were only stationary after first difference. The KPSS test confirmed results obtained for all other series with the exception of the log of CPI. The null hypothesis of stationarity for the KPSS test was however not rejected for the log of CPI at levels. Given the fact that the KPSS test provides a stronger power of test than the ADF and PP test, the result from the KPSS test are used. Given the fact that there are both stationary and non-stationary series and since SVAR requires that variables are covariance stationary (see Lee & Song, 2009), the study differenced the non-stationary series before they were used in the SVAR model. Results of the stationarity test are presented in Table 1D in Appendix D.

Table 4:Descriptive Statistics

	CIEA	CPI	Exchange Rate	MPR	Oil Price	World Oil Production	World Economic Activity
Mean	226.91	237.69	1.41	17.30	73.20	84162.58	11.54
Median	220.70	205.26	1.13	16.24	68.09	83881.41	15.84
Maximum	418.73	1367.03	3.82	27.65	123.81	93211.46	63.28
Minimum	100.62	96.54	0.73	12.37	21.28	74481.39	-62.82
Std. Dev.	96.06	135.97	0.70	4.04	30.96	4341.09	30.38
Skewness	0.38	3.73	1.62	0.92	-0.03	-0.27	-0.33
Kurtosis	1.82	30.70	5.12	2.99	1.68	2.89	2.17
Jarque-Bera	13.20	5488.28	99.67	22.62	11.56	2.03	7.42
Probability	0.00	0.00	0.00	0.00	0.00	0.36	0.02
Sum	36304.96	38030.90	226.14	2768.32	11712.51	13466013.00	1846.51
Sum Sq. Dev.	1467251.00	2939489.00	77.73	2591.83	152447.00	3000000000.00	146723.50
Observations	160	160	160	160	160	160	160

Source: Author's Computation (2016)

Analysis of Empirical Results

This section presents results of the SVAR estimation on the effect of oil price shocks on macroeconomic variables in Ghana. The analysis of the effects of oil price shocks has been done under three sub-themes. First, the study analyses the effects of oil supply shocks on macroeconomic variables. This is followed by analysis of the effects of oil demand and oil market specific demand shocks on macroeconomic variables in Ghana.

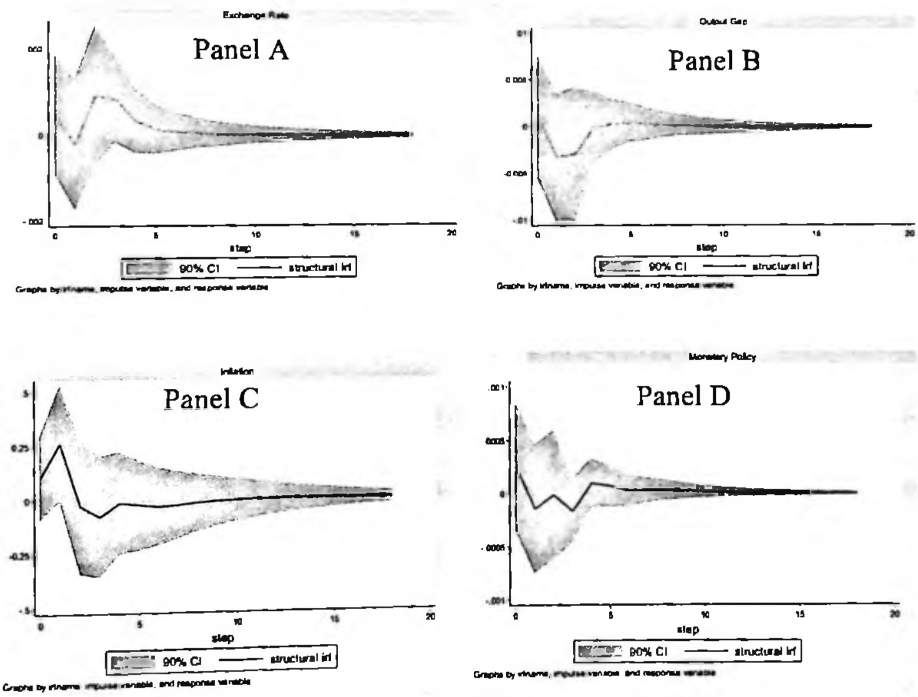

Figure 34: Response of Macroeconomic Variables to Oil Supply Shocks
Source: Author's Computation (2016)

Oil Supply Shocks and Macroeconomic Variables

Figure 14 presents results from the impulse response function on the effect of oil supply shocks on macroeconomic activity in Ghana. Panels A, B, C, and D in Figure 13 present the response of; exchange rate, output gap, inflation and monetary policy respectively to an oil supply shock. Contrary to results obtained in previous empirical works, the study found that oil supply shocks over our sample period (2002 January to 2015 December) did not have significant effect on macroeconomic activity in Ghana.

The insignificant effect of oil supply shocks on macroeconomic activities in Ghana could be due to the fact that the sample period of the study does not capture a lot of supply shocks. Between 2002 and 2015, there has been just about three supply shocks in the oil market. That is, the invasion of Iraq by America, the war in Libya and the Iran nuclear crises. These shocks were probably not enough to cause major macroeconomic problems in the Ghanaian economy. Cunado *et al.* (2015) obtained similar results for South East Asian economies.

Oil Demand Shocks and Ghana's Macroeconomic Variables

Figure 14 shows the impact of oil demand shock which is driven by global economic activity, which is very distinct from that of an oil supply shock. Unlike the effect of supply shocks on macroeconomic variables in Ghana, the effect of oil demand shocks had significant impact on macroeconomic variables in Ghana. Panels A, B, C, and D in Figure 15 presents the respond of exchange rate, output gap, inflation and monetary policy respectively to an oil demand shock.

The results of the structural impulse response function indicate that the domestic currency depreciates against the US within the first month after the shock by about 1.3 percent. The depreciation of the cedi in the first month could be attributed to the fact that an increase in world demand for crude oil contributes to the increase in the price of the commodity in the world market. Increase in the price of crude oil leads to increase in the import bill of the country and subsequently results in the depreciation of the cedi. The depreciation could also be caused by the activities of speculators in the currency market. That is, with oil prices going up, speculators may increase their demand for the US dollar in anticipation of a possible depreciation of the Ghana Cedi which eventually contribute to the over depreciation of the cedi in the first month.

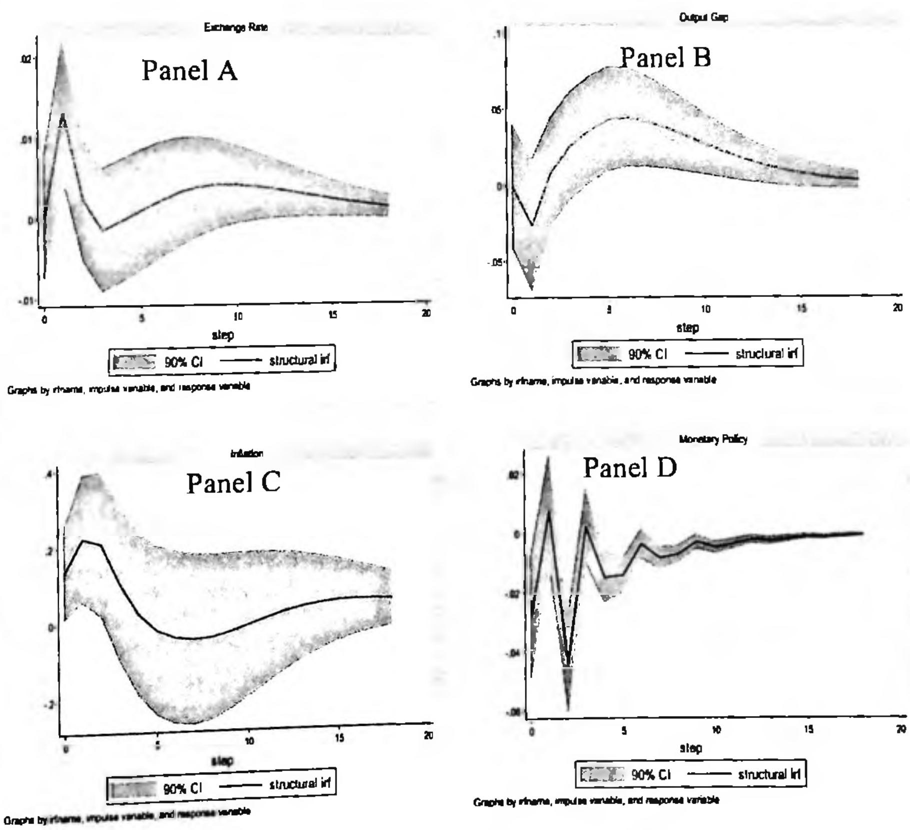

Figure 15: Response of Macroeconomic Variables to Oil Demand Shock
Source: Author's Computation (2016)

The domestic currency begins to appreciate in the second month probably due to boost in domestic economic activity caused by higher demand for exports of primary commodities. The appreciation of the domestic currency in the second month could also be due to the adverse effects of oil price hikes on the US dollar (see Wang & Chueh, 2013) and also the increase in demand for Gold when the US-dollar begins to perform poorly. It is important to note that the effect of an oil demand shock on the domestic currency becomes insignificant three months after the shock.

Oil demand shock tend to have negative effect on economic activity within first month probably due to the effect of the shock on the exchange rate and value of import. It is worth mentioning that effect of oil demand shock on economic activity is however insignificant within the first four months after the shock. The effect of oil demand shock is felt on the Ghanaian economy four months after the shock. From Panel B of Figure 15 an oil demand shock result in an increase in domestic economic activity.

Since Ghana mainly exports of primary commodities which are used as raw materials in the production process, a stronger world economic activity boosts the demand for Ghanaian exports which results in expansion of economic activity in the country. This view is supported by Cashin, Mohaddes, Raissi, and Raussi (2012) who argued that output in the domestic economy could rise because the economy itself is in a boom or because it indirectly benefits from trade with the rest of the world. The view also reflects the movement in the growth of oil price and Ghana's GDP growth rate since 2007. That is oil price increases tend to be associated with growth of Ghana's economy. The expansion in economic activity peaks in sixth month after the shock and the begin to revert back to its initial levels. This result is consistent with results obtained by Herwartz and Plödt (2016); Cunado *et al.* (2015) and Kilian (2009a).

The effect of oil demand shocks on economic activity also implies that actual output exceeds potential output and this could contribute to an increase in inflation in the economy. An examination of Panel C shows that an oil demand shock immediately causes inflation to rise probably as result of the initial depreciation of the domestic currency after an oil demand shock. Inflation however declines after the third month. Monetary policy rate on the other hand increases immediately after an oil demand shock, though not significant. Monetary policy only becomes significant in the third month when it falls from its initial increase.

Oil Market Specific Demand Shocks and Ghana's Macroeconomic Variables

Figure 16 displays the impulse responses to the oil-specific demand shock. Contrary to results in a number of empirical studies, the study finds that an oil market specific demand shock results in a sharp appreciation of the domestic currency (see Panel A of Figure 16) within the first two months after the shock. The exchange rate however, begin to depreciate after the second month till reverts back to its initial levels after the eighth month. It is important to note that oil market specific demand shocks reflect fluctuations in precautionary demand for crude oil which is caused by uncertainty about the availability of crude oil in the future (Kilian, 2009a). This situation leads to an increase in the price of crude oil which also tends to weaken the US dollar (see Baffes, Kose, Ohnsorge, &

Stocker, 2015; Feldstein, 2008; Fratzscher, Schneider, & Van Robays, 2014; Grisse, 2010). Thus, the depreciation of the US dollar which is due to high oil price, leads to the appreciation of the Ghana cedi within the first two months after an oil specific demand shock. Cunado *et al.*, (2015), obtained similar result for the Korean and Japanese economies.

As shown by the impulse response function in Figure 16 (Panel B), an oil specific demand shock causes economic activity to decline within the first three months after the oil specific demand shock. We can relate the result to the composition of Ghana's export commodities. An increase in the price of oil without a clear surge in global economic activity can lead to a slump (Cunado *et al.*, 2015; Kilian, 2009a), since it only causes factor prices to increase. The decline in global economic activity implies lower demand for Ghana's main exports commodities (which are mainly primary commodity in nature) and hence decline in economic activity. In addition to this, oil being an essential input of production in Ghana, an increase in its price implies that import bills from oil would increase and this could contribute to the decline of economic activity. The appreciation of the domestic currency could also contribute to decline in economic activity as exports of the economy decline due to appreciation of the domestic currency. This result is consistent with the argument of Brown and Yucel (1999) and Rasche and Tatom, (1977). The result is also consistent with results obtained by Baumeister *et al.* (2010); Cunado *et al.* (2015) and Kilian (2009a)

Unlike the exchange rate and economic activities, inflation in the economy rises slightly in the first month after the oil specific demand shock and then begin to fall persistently till the seventeenth month. The decline in inflation after oil specific demand shock could be as result of the initial appreciation of the Ghana cedi and the low demand for goods and services due to slump in economic activities following the oil specific shock. Thus, the appreciation of the domestic currency against the US dollar reduces the pass-through effect of higher international price of crude oil to the domestic economy and inflation. This result differs from results obtained in a number of empirical studies for oil importing economies (see Baumeister *et al.*, 2010; Cunado *et al.*, 2015; Herwartz & Plödt, 2016; Kilian, 2009a).

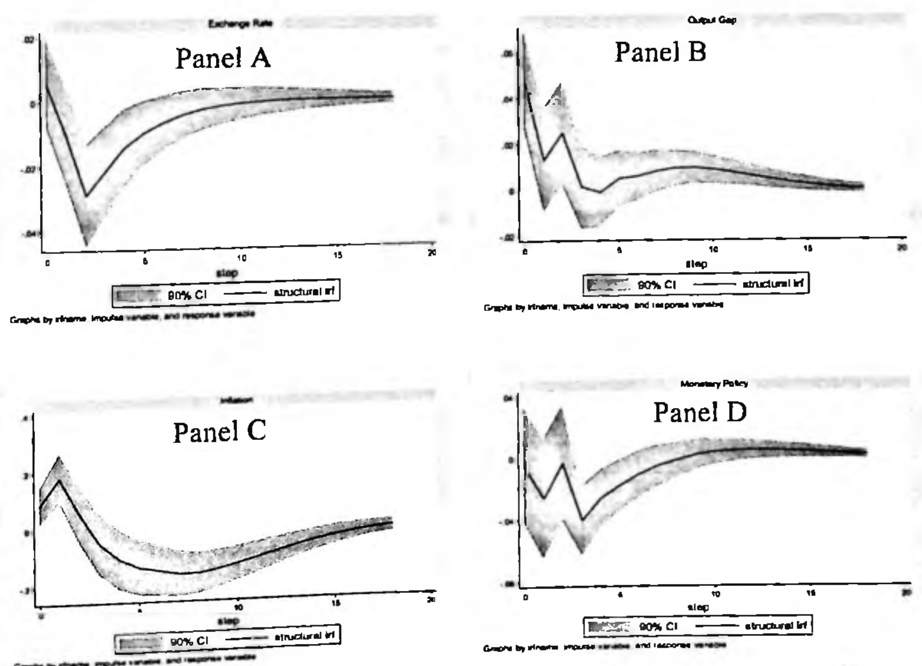

Figure 46: Response of Macroeconomic Variables to Oil Market Specific Demand Shock
Source: Author's Computation (2016)

On the impact of oil specific demand shocks on interest, the results indicate that interest rate in Ghana does not respond immediately to the shock until after second month, when interest rate begins to rise. The high interest rate contributes to the persistent decline in the domestic economic activity. Also, the appreciation of the domestic currency reduces the pass-through effect of the oil price increase to domestic fuel prices as domestic fuel prices increase slightly in the first month after the shock and the begins to fall.

Counterfactual Analysis

In this section, the study examines the role of monetary policy adjustments in the transmission of oil price shocks on inflation, output and exchange rate in Ghana by conducting a counterfactual analysis. In other words, the study closes down the monetary policy channel in our benchmark SVAR model by maintaining the respective variables unchanged in response to oil price shocks throughout the impulse response horizon. This exercise provided different perspectives regarding monetary policy, in addition to its own impulse response to the shocks arising endogenously inside the SVAR framework.

Since oil supply shock was found not to have significant effect on inflation, exchange rate and output in Ghana, our counterfactual analysis focuses mainly on oil demand shocks and oil market specific demand shocks. In Figure 17 the study presents the counterfactual impulse responses of exchange rate, output gap and inflation in Ghana to an oil demand shock along with the benchmark results (baseline results). Movements in Exchange rate, Output Gap and Inflation rate suggest that monetary policy plays a significant role in the transmission of oil demand shocks into the Ghanaian economy.

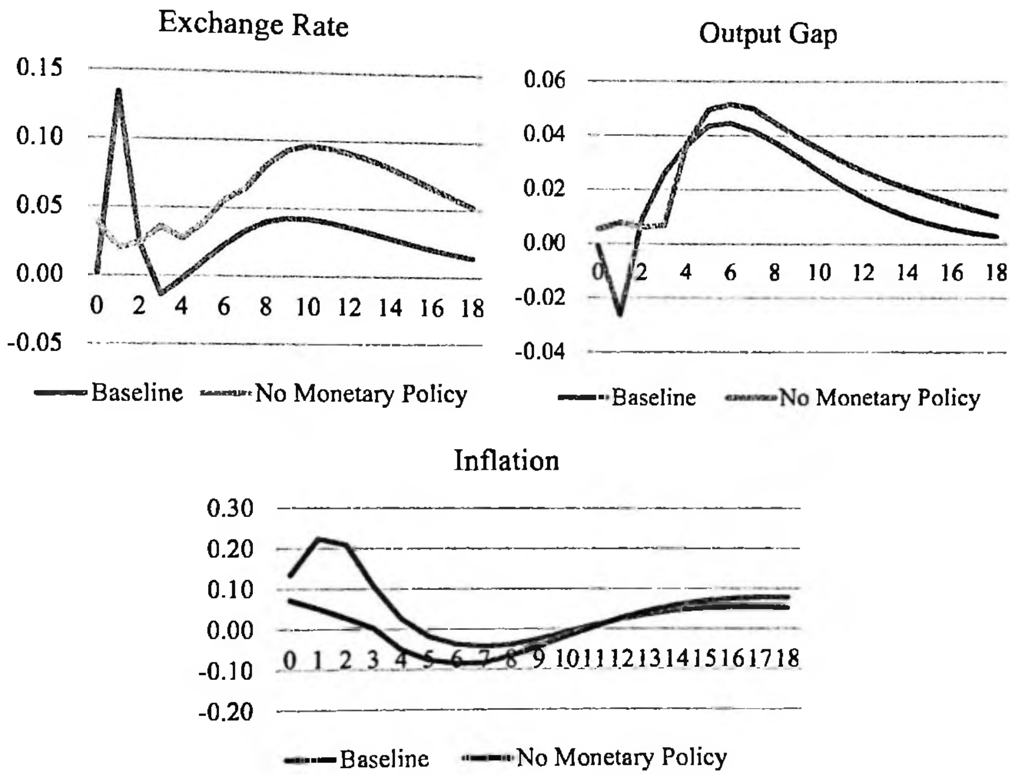

Figure 17: Counterfactual IRF of Exchange Rate, Output gap and Inflation to and Oil Demand Shock.
Source: Author's Computation (2017)

The impulse response function in Figure 15 suggest that monetary policy makers respond to an oil demand shock by raising the monetary policy rate. Such increase in policy rate does not immediately lead to reduction in the inflation rate of the country due to the low level of development in Ghana's financial sector. Increase in monetary policy over the years have been associated with an increase in the inflation rate at least in the short run. This is probably the reason why inflation is higher under a non-neutral (baseline) monetary policy than the situation where monetary policy is neutral within the first eight months after the shock. Thus, the response of monetary policy to oil demand shock is what mainly contribute high inflation rate within Ghana's economy within the first three months of the shock. Due to the underdeveloped nature of the financial sector, inflation rate responds slowly to changes in the policy rate, hence, the baseline inflation rate only falls below the counterfactual inflation rate (see Figure 17) in the 12^{th} month.

In relation to the exchange rate, the counterfactual result indicates (see Figure 17) that the exchange rate is relatively stable within the first four months after an oil demand shock with neutral monetary policy (counterfactual-no monetary policy) than when monetary policy is not neutral (baseline). Beyond the first four months, the domestic currency depreciates much faster under neutral monetary policy than when monetary policy is not neutral. Also, the exchange rate reverts faster to its initial level under a non-neutral monetary policy than neutral monetary policy. This situation is due to the role of monetary policy. High monetary policy over time contribute to increase the inflow of foreign capital which help to reduce the depreciation of the domestic currency following an oil demand shock. Thus, monetary policy is more effective in stabilising the domestic currency after an oil price shock.

The output gap is also more stable under neutral monetary policy (counterfactual) within the first three months after oil demand shock than when monetary policy is non-neutral (baseline). Output increases faster under neutral monetary policy beyond the fifth month than non-neutral monetary policy. This is because high monetary policy rate in response to oil demand shock tend to slow down economic activities. Monetary policy plays a key role in restoring the economy back to its initial levels after an oil demand shock. Results obtained here is consistent with the work of Cunado *et al.* (2015) for Indian and Japanese economies.

The analysis of the counterfactual impulse response of inflation, exchange rate and output gap to oil market specific demand shock is presented in Figure 18. The results in Figure 18 suggest that the counterfactual impulse responses are not systematically different from the baseline responses of exchange rate, inflation and output gap at least within the first two months after an oil market specific demand shock.

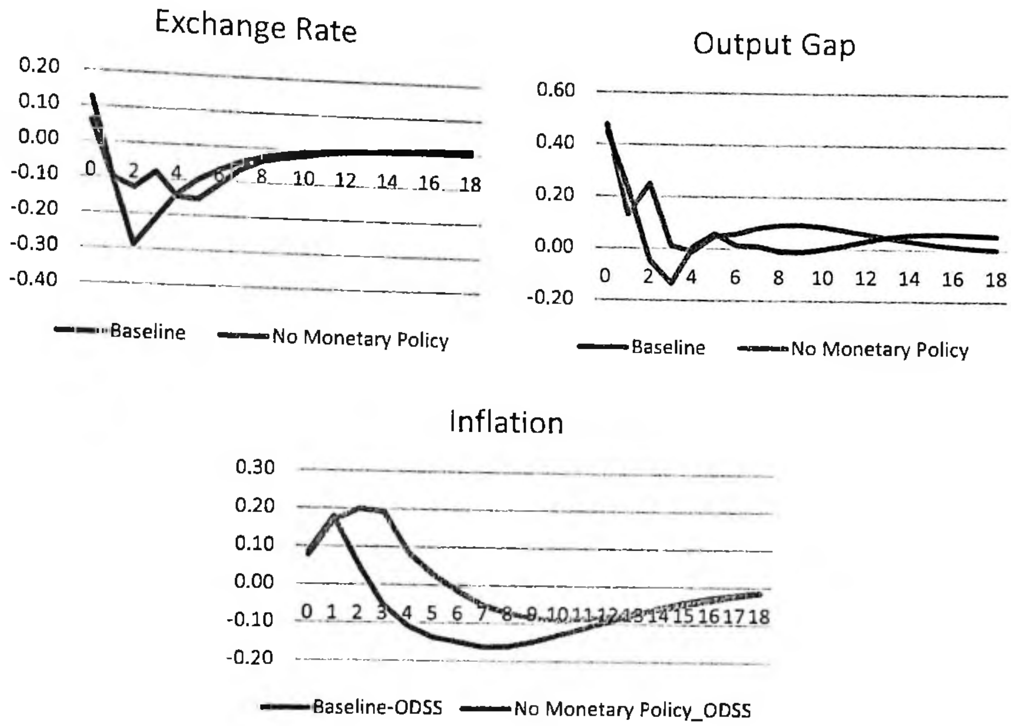

Figure 58:Counterfactual IRF of Exchange Rate, Output gap and Inflation to and Oil Market Specific Demand Shock.
Source: Author's Computation (2017)

The effect of monetary policy response to the shock is felt after the third month. That is, beyond the third month inflation falls faster in the baseline model (non-neutral monetary policy) than in the counterfactual. Hence, monetary policy tends to reduce inflation faster after an oil market specific demand shock than oil demand shock. The differences in the response of inflation to monetary policy is due to the effect of oil market specific demand shock on economic activity (output) in Ghana. Since oil market specific demand shock tend to slow down economic activity, an increase in monetary policy rate also contributes to reinforce the effect of oil market specific demand shock (see Figure 17) on output.

Hence, as economic activity declines in the country, it is natural to expect inflation to also decline but higher monetary policy makes it fall faster.

The effect of monetary policy on the exchange become glaring in the second month. The baseline impulse response indicates that the domestic currency appreciates against the US dollar, whilst the counterfactual impulse response shows that the domestic currency only appreciates by a very small margin against the US dollar two months after the shock. The slight appreciation of the domestic currency is due the effect of the oil price shock on the US dollar and subsequent increase demand for Gold in from the Ghanaian economy. On the other hand, an increase in monetary policy rate tend to promote the inflow of foreign capital which also further leads to the appreciation of the domestic currency in the second month. This is probably why the appreciation of the domestic currency in the baseline (with monetary policy) is higher than the counterfactual impulse response. The domestic currency begins to depreciate after the third month. The currency depreciates faster under the non-neutral monetary policy than neutral monetary policy. This is because once the oil market specific demand shock begin to have adverse effect of asset prices (see Kilian *et al.*, 2009) foreign investors may start to take their capital back and this would contribute to the fast depreciation of the domestic currency under a non-neutral policy regime relative to neutral policy regime.

In relation to the output gap, the response of output to oil market specific demand shock tend to vary from the baseline model in the second month. Whilst output increases slightly in the second month when monetary policy is non-neutral, output continue to fall with the counterfactual impulse response. It is important to note that the output gap revert back to its initial level faster with no monetary policy than when monetary policy is non-neutral (see Figure 18)

Summary

This chapter examined the impact of oil price shocks on inflation and output in Ghana. the results of the study indicated that oil demand shock resulted in increased domestic output and also inflation. On the other hand, oil market specific demand shock had negative effect on out whilst it still led higher inflation rate. The counterfactual analysis also shows that monetary policy played significant role in stabilising the domestic economy after oil price shocks.

CHAPTER EIGHT

SUMMARY CONCLUSIONS AND POLICY RECOMMENDATIONS

Introduction

The objective of this chapter is to provide a summary of the entire thesis, present the main conclusions of the research and offer some policy recommendations. The first section presents the summary of the entire work. This is followed by conclusions that are drawn from the study. The policy recommendations which are based on the conclusions drawn from the study are also presented in this chapter. The Chapter ends with presentation of the limitations that was faced in the process of conducting the research as well as the direction for future research.

Summary

Since the first oil price shock of the 1970s, researchers and policy makers have made several efforts to identify how to minimise its effect on an economy. Whereas this has culminated into a number of empirical research works in advanced countries, very little has been done in developing countries including Ghana. Previous studies on the subject have largely considered oil price as operating in isolation without taking into account the oil market specific factors that affect movements in the price of crude oil. The current study therefore examines effects of oil price shocks on the Ghanaian economy taking into account how differences in oil market factors influence the effect oil price shock on Ghana's economy. The study specifically set out to examine how oil market factors account for differences in the effect of oil price hikes on Ghana's external balance, stock market activity and key macroeconomic variables, taking into account the role of monetary policy.

To examine the differential effects of oil price shocks on external balance, the study employed quarterly macroeconomic time series comprising; trade balance, capital account balance, GDP, short term interest rate, interest rate differentials, fiscal balance, real effective exchange rate, terms of trade, income of the rest of the world, foreign direct investment, capital account openness and consumer price index. The data ranged from 1980 to 2015. Monthly data on world crude oil price, measure of global economic activity and world production of crude oil were also used to estimate the oil price shocks.

In order to estimate the impact of oil price shocks on Ghana's external balance, the study employed a two-stage estimation procedure in which monthly oil price shocks was estimated using Structural VAR. The predicted structural shocks from the SVAR model were then quarterlise to conform to the frequency of the macroeconomic data used. A unit root test was conducted using the ADF, PP and the KPSS test. The test results revealed that variables involved in our estimation were both I (1) and I (0) variables.

Furthermore, a test for the possibility of structural breaks was conducted on our dependent variables using the Zivot-Andrew test which revealed the existence of structural breaks in the dependent variables. Given the fact that the variables involved in our estimation were both I (1) and I (0) and the existence of structural breaks in the dependent variable, the most appropriate estimation procedure used was the bounds testing approach to cointegration which allowed for the use of both I (1) and I (0) variables in the same model and also makes room for the use of dummy variables to capture structural breaks in the estimations. In all three models four different cointegration tests (oil shocks and trade balance; oil shocks and capital account balance; oil price and trade balance; oil price and capital account balance) were conducted to test the existence of long run and short run relationship between external balance and oil price shocks.

Results of the cointegration test revealed the existence of cointegrating relationship in three out of the four models. Cointegration was not found for the oil price and trade balance model. Hence the study then proceeded to estimate the short run and long run models for the five cointegrating equations.

The results of the ARDL estimation indicated that oil price shocks had differential impacts on external balance in Ghana. For example, whereas oil supply shock was found to have significant positive effect on capital account its effect on trade balance was insignificant, though it was negative. The long run effect of oil demand shock on the other hand was found to have positive effect on both trade balance and capital account balance. The long run effect of oil market specific demand shock was found to be negative for all the measures of external account. The long run effect of changes in the price of crude oil was only found to have significant negative effect on capital account balance of the country.

The short run results also revealed that oil supply shocks had significant (positive) effect only on capital account and had no significant effect on trade balance. Contrary to the long run results, oil demand shock was found to have negative effect on both trade and current whilst its effect on capital account balance was found to be positive. In terms of oil market specific demand shock, the results indicated that its contemporaneous effect on all the three measures of external balance was negative however its effect on trade balance tends positive in the fourth quarter.

The study also examined the impact oil price shocks on stock market activities in Ghana using monthly time series from 2002 to 2014. The choice of the time period was largely influenced by availability of data and the fact that reforms of the financial sector after the SAP took place in 2002. Variables used in estimating the effect of oil price shocks on stock market activities included real effective exchange rate, short term interest rate, consumer price index and stock prices.

Due to the possibility of a nonlinear relationship between stock market activity and oil price shocks the study estimated both linear and nonlinear models. The estimated linear models were based on the SVAR and OLS whereas the estimated nonlinear model was based on the Markov-Switching model.

The results of the short run SVAR model revealed that oil demand shocks had positive impact on stock market activity whereas the impact of oil market specific shock was found to have negative effect on stock market activity. The effect of oil market specific demand shock unlike the oil demand shock was not lasting as it gradually leads to improvements in stock market activity in later months. Oil supply shocks was found to have insignificant effect oil stock market activity in the short run. The structural variance decomposition revealed that oil demand shocks played significant role in explaining stock market activities. The

OLS estimate revealed that only oil demand shock had significant effect on stock market activities. Contrary to results obtained from the SVAR model, the results of the MS model indicated that both oil demand shock and oil market specific demand shocks had positive effect on stock market activity. Oil supply shocks though positive as well, had insignificant effect on stock market activity in Ghana. The regime transition probability revealed that the second regime of the of the $\ln P_t -$ Shocks was persistent and the first regime was more or less a passive one.

The final part of the work sought to examine the impact of oil price shocks on key macroeconomic variables in Ghana, considering the role of monetary policy. The study made use of measures of oil prices shocks suggested by Kilian, (2009a) to identify three different structural shocks, oil supply shocks, oil demand shocks driven changes in world economic activity, and oil specific demand shock driven by speculative and precautionary demand for oil.

To achieve this, the study employed monthly time series data set spanning from January 2002 to May 2015. The sample period was chosen basically due to the changes in the implementation of monetary policy which took place in 2002 and the fact that data for monthly economic activity was only available from 2000. To analyse the effect of oil price shocks on macroeconomic variables in the Ghana, the study estimated a SVAR consisting of world production of crude oil, measure of global economic activity, world price of crude oil, exchange rate, composite index of economic activity in Ghana, consumer price index, and monetary policy rate.

The results of the study provide the following insights. First, the study found that that oil supply shocks had no significant influence on the Ghanaian economy between January 2002 to May 2015. Contrary to the effect of oil supply shocks on the Ghanaian economy, oil demand shocks driven by world economic activity had a positive impact on domestic economic activity in Ghana. Oil specific demand shock, also resulted in an immediate increase in the country's inflation rate though this effect does not last beyond the second month due to the appreciation of the domestic currency which contribute to reduce the pass-through effect of the shock on the Ghanaian economy. A counterfactual analysis also revealed that monetary policy in Ghana played significant role on the extent to which oil price shocks affects Ghana's economy.

Key Findings

The major key finding of this study was the fact that the impact of oil price increases on key economic indicators in Ghana largely depends on the source of the price shock. The following are the specific findings of the study:

1. Price increase that occurs as a result of demand shocks improves Ghana's external balance position.
2. On the other hand, oil price increases that occurs as a result precautionary/speculative activities in the oil market was found to have adverse effect on external balance of the economy.
3. Unlike a number of existing studies, this study found that oil price increases that occurred as a result of supply related shocks tend to have positive impact on the capital account balance of Ghana.

4. Oil demand shock have significant positive impact on stock market activities in Ghana.
5. The effect of oil market specific demand shock on stock market activities was regime dependent. Its effect was initially negative in the first regime and tends positive in the second regime.
6. Oil demand shock led to increase in output and inflation in Ghana.
7. Oil market specific demand shock was found to have negative effect on output and contributed to increases in the inflation rate in Ghana.

Conclusions

The main purpose of the study was to examine the differential impact of oil price shocks on the Ghanaian economy. The results obtained in this study clearly indicates that this purpose was achieved as the result of the study revealed that oil price shocks has differential impact on the Ghanaian economy. The following specific conclusions were drawn from the study.

In relation to external balance, the study concludes that oil supply shock is only inimical to trade balance, however it tends to have positive effect on capital account balance both in the short run and the long run due to the effects of inflow of investments. Oil demand shock on the other hand enhances trade balance and capital account balance in the long run but detrimental to trade balance in the short run. From the result, we conclude that oil market specific demand shock is detrimental to external balance in the long run. In the short run, however oil market specific demand shock has a mix effect on trade balance, but inimical to capital account balance.

In the case of stock market activity, the study concludes that oil supply shocks between 2002 and 2015, had no significant effect on stock market activity. Oil demand shock on the other has a positive impact on stock market activity in Ghana and played significant role in explaining stock market activity in Ghana relative to oil market specific demand shock and oil supply shock. The effect of oil market specific demand shock on stock market activity is however mixed. From the SVAR estimation we can conclude that its impact on stock market activity depends on time and could be both positive and negative. However, the MS model revealed that its impact on oil demand shock is positive. From the study we also conclude that the relationship between oil price shocks and stock market activity is a nonlinear one.

In terms of oil price shocks and macroeconomic variables, the study found that oil supply shocks had no effect on macroeconomic variables in Ghana. Oil demand shocks lead to improvements in economic activity, increased inflation and depreciation of the domestic currency. Monetary policy however responds to this shock by raising the policy rate. On the other hand, oil market specific demand shock results in reduction in economic activity, reduction inflation rate and appreciation of the domestic currency. The response of monetary policy to this shock is an increase in the policy rate.

Recommendations

Based on the results of the study and conclusion drawn, the following policy recommendations are made;

1. To reduce the adverse effect of oil supply shocks on external balance, efforts should be made by the Ghana Investment Promotion Council to increase the inflow of foreign capital to help neutralise the adverse effect of supply shocks on trade balance. This is because the country can benefit from investment inflows into the mining sector due to high demand for precious metals following an oil supply shock
2. Given the fact that the adverse effect of oil demand shocks on trade balance is a short-term phenomenon, effort should be made by the Ministry of Trade and Industry to increase domestic production of industrial goods to help mitigate the adverse effect of oil price hikes on import value in the balance of trade. This would go a long way to reduce adverse short run effect of oil demand shock on external balance. In addition, efforts should be made to increase the gains from the capital account balance through the Ghana investment promotion council to help reduce adverse short run effect of oil demand shocks.
3. Since oil market specific shock demand shock tend to have adverse effect on all measures of external balance and given the fact that demand for crude oil is relatively inelastic, efforts should be made to hedge against a possible oil market specific demand shocks in order to reduce its effect on trade balance and overall external balance.
4. In terms of the stock market, the study recommends that financial experts and investors should pay close attention to news coming out of the international oil market is key in building accurate asset pricing models,

risk management and future predicting stock market price movement in other to make optimal portfolio allocation decisions.

5. Since oil demand shock leads to the situation where actual output exceeds potential output, it has the potential to increase inflation in the economy, hence there is the need for monetary policy makers (Bank of Ghana) to increase the policy rate. This is particularly important since the counterfactual analysis revealed that monetary policy is more effective under oil demand shock relative to oil market specific demand shock.
6. Given the fact that oil market specific demand shock leads to declines in output and appreciation of the domestic currency which has the potential to affect exports, there is the need for the monetary policy makers (Bank of Ghana) to implement an expansionary monetary policy to help boosts domestic economic activity, given the fact that it would have minimal effect on inflation and depreciation of the domestic currency.

Limitations of the study and Direction for Future Research

The main limitation of the study was the availability of consistent data from 1980 to 2015. This situation culminated into the use of different samples of the three empirical chapters. This made it relatively difficult to relate results in the first empirical chapter which span from 1980 to 2015 to results obtained in the second and third empirical chapters of the work. This is because the nature and the level of integration of the Ghanaian economy between 1980 and 2002 is different from the nature and level of integration between 2002 and 2015 and this is what makes it difficult to relate the two results. Nevertheless, results obtained in the external models still provides a clear idea of how the country can react to oil price shocks to maintain stability in the country's external balance.

Future studies should consider a general equilibrium analysis that considers the impact of oil price shocks on various sectors of the economy. This would provide a clear understanding of the extent to which different sources of oil price shocks individually affects various sectors of the economy. This would go a long to give specific recommendations that would be directed specifically to a sector of the economy.

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APPENDICES

Appendix A: Oil Market Tables and Figures

Table A1: Oil Market Variables

Variable	Test Statistic											
	ADF				PP				KPSS			
	Levels	Lag	Diff	Lag	Levels	BW	Diff	BW	Levels	BW	Diff	BW
OS	0.35 (0.98)	0	-20.99 (0.00)^{a}	0	0.32 (0.98)	6	-20.99 (0.00)^{a}	6	2.59^{a}	16	0.26	6
WEA	-3.13 (0.03)^{b}	2	-12.45 (0.00)^{a}	3	-2.69 (0.07)^{c}	15	-15.22 (0.00)^{a}	29	0.37	16	0.11	20
OP	-1.72 (0.42)	1	16.24 (0.00)^{a}	0	-1.60 (0.48)	3	15.98 (0.00)^{a}	7	1.57^{a}	16	0.11	4

Note: Diff represents difference, ^{a}, ^{b}, and ^{c} denotes significance level at 1%, 5% and 10% respectively. The respective critical values for the KPSS at 1%, 5% and 10% test are 0.739, 0.463 and 0.347. Numbers in brackets are P-Values. *Lag* and BW are the lag length and Bandwidth respectively.

Source: Author's Computation (2017)

Table A2: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2302.476	NA	10.88042	10.90060	10.92930	10.91194
1	-1411.306	1765.486	0.167956	6.729579	6.844398	6.774948
2	-1383.770	54.15968	0.153865*	6.641941*	6.842874*	6.721336*
3	-1379.990	7.382179	0.157712	6.666620	6.953667	6.780041
4	-1365.992	27.13476	0.154034	6.642990	7.016152	6.790439
5	-1362.431	6.853654	0.158054	6.668704	7.127980	6.850179
6	-1355.744	12.77307	0.159804	6.679641	7.225031	6.895142
7	-1345.177	20.03456*	0.158640	6.672232	7.303737	6.921760
8	-1339.665	10.37263	0.161299	6.688724	7.406343	6.972278

Source: Author's Computation

Source: Author's Computation (2017)

Table A3: LM Serial Correlation Test

Lags	LM-Stat	Prob.
1	12.92554	0.1660
2	10.60851	0.3035
3	11.31825	0.2545

Source: Author's Computation (2017)

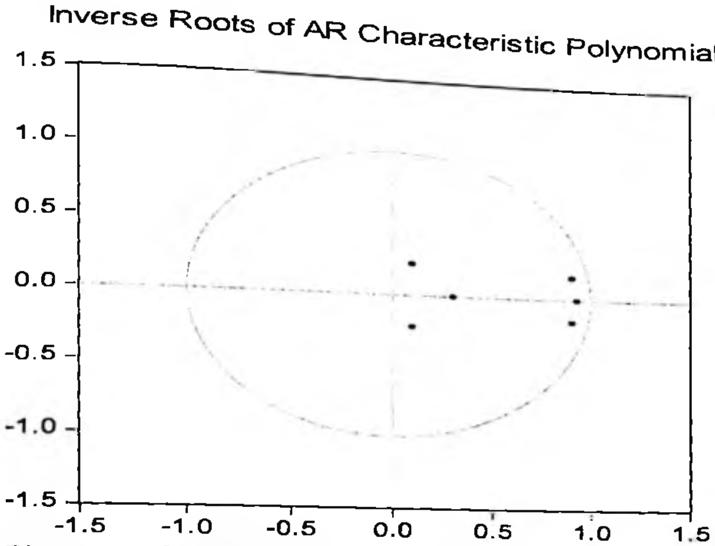

Figure A1: Stability condition test with eigenvalues plot in the unit circle
Source: Author's Computation (2017)

Table A4: SVAR Estimates

	Coefficient	Std. Error	z-Statistic	Prob.
a_{21}	-0.624167	0.021877	-28.53069	0.0000
a_{22}	0.580781	0.230656	2.517953	0.0122
a_{23}	0.776078	0.322612	2.405608	0.0166
a_{31}	0.003234	0.001805	1.791680	0.0739
a_{32}	0.002110	0.000644	3.278155	0.0010
a_{33}	0.085455	0.002995	28.53069	0.0000

Source: Author's Computation (2017)

Response to Structural One S.D. Innovations ± 2 S.E.

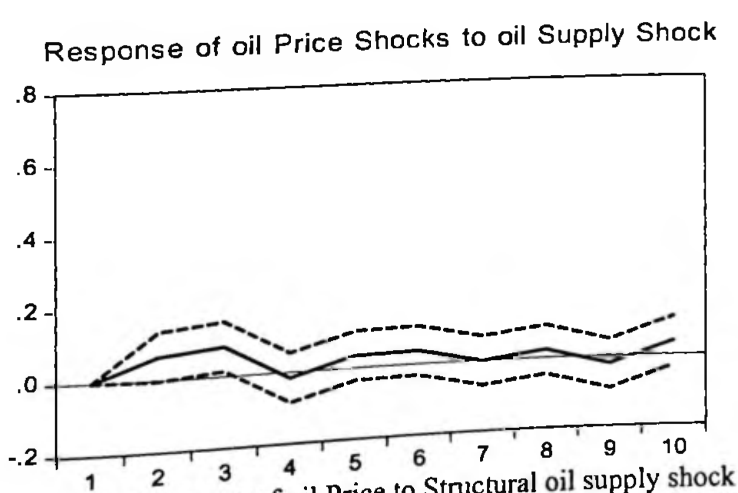

Figure A2: Response of oil Price to Structural oil supply shock
Source: Author's Computation (2017)

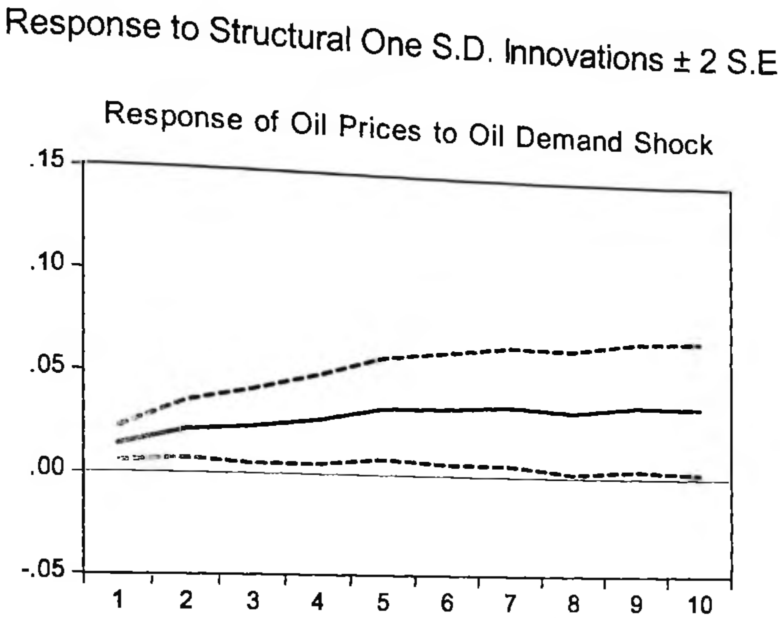

Figure A3: Response of oil Price to Structural oil demand shock
Source: Author's Computation (2017)

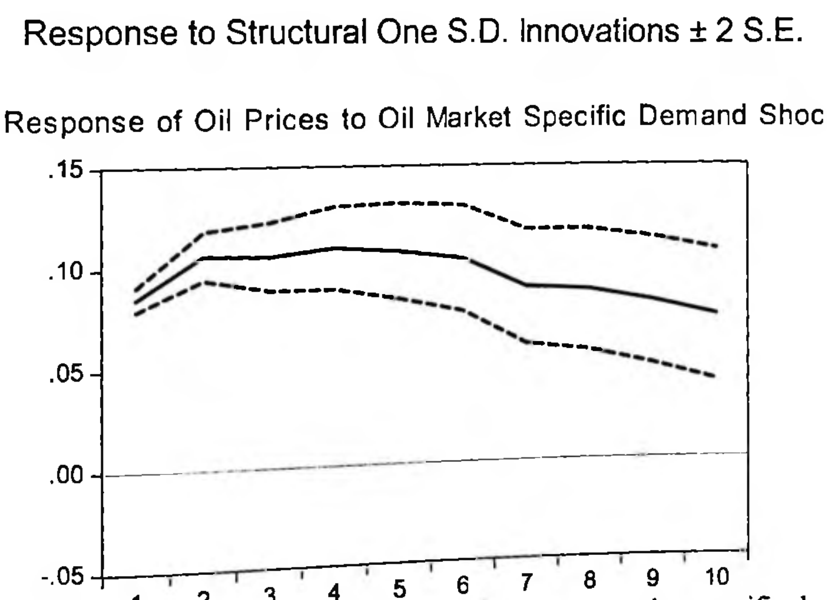

Figure A2: Response of oil Price to Structural oil market specific demand shock
Source: Author's Computation (2017)

Appendix B: Oil Price shocks and External Balance Tables and Figures

Table 3B: Stationarity Test

	ADF Test				PP Test				KPSS test			
Variable	Levels	Lag	Diff	Lag	Levels	BW	Diff	BW	Levels	BW	Diff	BW
TB_t	-1.81 (0.37)	5	-5.02^{a} (0.00)	4	-1.59 (0.48)	2	-7.60^{a} (0.00)	10	0.89^{a}	9	0.368	2
CA_t	-1.70 (0.43)	10	-4.49^{a} (0.00)	13	-3.04^{b} (0.03)	3	-3.00^{b} (0.04)	9	0.75^{a}	9	0.07	3
KA_t	-1.51 (0.53)	10	-4.81^{a} (0.00)	13	-2.90^{c} (0.05)	5	3.15^{b} (0.03)	9	0.31	8	0.06	6
ly_t	1.34 (0.99)	10	-4.97^{a} (0.00)	9	2.40 (1.00)	8	-2.68^{c} (0.08)	7	1.37^{a}	10	0.59	9
r_t	-2.79 (0.06)	1	-6.47^{a} (0.00)	1	-2.19 (0.23)	3	-5.36^{a} (0.00)	12	0.49	8	0.06	4
r_t^*	-3.07 (0.03)	1	-6.0^{a} (0.00)	0	-2.21 (0.20)	2	-5.24^{a} (0.00)	13	0.29	8	0.06	4
FB_t	-1.38 (0.59)	10	-4.65^{a} (0.00)	9	-1.99 (0.29)	8	-2.70^{c} (0.07)	85	0.77^{a}	9	0.05	9
$REER_t$	-1.54 (0.51)	0	-10.9^{a} (0.00)	0	-1.58 (0.49)	2	-10.84 (0.00)	5	0.92^{a}	10	0.07	3
$LTOT_t$	-2.22 (0.20)	1	-4.94^{a} (0.00)	0	-1.90 (0.33)	5	-4.17^{a} (0.00)	22	0.50	9	0.53	5
LWY_t	-2.06 (0.26)	10	-5.56^{a} (0.00)	9	-3.27^{b} (0.02)	2	-3.07^{b} (0.03)	16	0.20	8	0.03	1
FDI_t	-0.32 (0.92)	10	-3.81^{a} (0.00)	13	-0.83 (0.81)	6	-2.93^{b} (0.04)	11	1.08^{a}	10	0.08	6
CAO_t	-1.53 (0.51)	10	-3.79^{a} (0.00)	13	-2.26 (0.19)	5	-3.3^{b} (0.02)	8	0.55	9	0.09	5
$LCPI_t$	-4.04^{a} (0.00)	5	-4.9^{a} (0.00)	4	-3.73^{a} (0.00)	3	-7.30^{a} (0.00)	5	0.39^{a}	9	0.41	3
ODS_t	-12.5^{a} (0.00)	0	-9.36^{a} (0.00)	5	-12.59^{a} (0.00)	4	50.58^{a} (0.00)	16	0.27	4	0.02	4
$ODSS_t$	-11.5^{a} (0.00)	0	-10.5^{a} (0.00)	3	-11.51^{a} (0.00)	1	100.28^{a} (0.00)	74	0.39	0	0.37	103
OSS_t	-10.5^{a} (0.00)	0	-9.99^{a} (0.00)	3	-10.41^{a} (0.00)	3	-91.60^{a} (0.00)	131	0.33	2	0.45	117

Note: Diff represents difference, ^{a}, ^{b}, and ^{c} denotes significance level at 1%, 5% and 10% respectively. Numbers in brackets are P-Values. *Lag* and BW are the lag length and Bandwidth respectively.
The respective critical values for the KPSS at 1%, 5% and 10% test are 0.739, 0.463 and 0.347.
Source: Author's Computation (2017)

Table 4B: Structural Breaks and Unit Root Test for Dependent Variables

Variable	Intercept	Break	Trend	Break	Both	Break
TB_t	-1.52 [c] (0.06)	2008Q2	-3.95[a] (0.00)	2005Q1	-4.00 [c] (0.07)	2004Q1
KA_t	-4.00 [a] (0.00)	2000Q3	-3.31 (0.27)	1992Q4	-4.14 [a] (0.00)	2000Q3

Source: Author's Computation (2017)

Table 5B: Bounds Tests for the existence of cointegration

Dependent Variable	No. of Explanatory Variables (K)	Critical Values						F-Statistics	Conclusion
		1%		5%		10%			
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)		
$F_{(TB)} = F_{(TB\|y,r,FB,REER,TOT,WY,ODS,ODSS,OSS,TBDUM)}$	9	2.5	3.68	2.04	2.08	1.8	2.8	*3.61*	**Cointegrated**
$F_{(TB)} = F_{(TB\|y,r,FB,REER,TOT,WY,LOP,TBDUM)}$	7	2.73	3.90	2.17	3.21	1.92	2.89	*2.20*	**Inconclusive**
$F_{(KA)} = F_{(KA\|,r^*,FDI,CAO,REER,FB,y,CPI,ODS,ODSS,OSS,KADUM)}$	10	2.41	3.61	1.98	3.04	1.76	2.77	*3.15*	**Cointegrated**
$F_{(KA)} = F_{(KA\|,r^*,FDI,CAO,REER,FB,y,CPI,LOP,KADUM)}$	8	2.62	3.77	2.11	3.15	1.85	2.85	*4.61*	**Cointegrated**

Source: Author's Computation (2017)

Table 6B: Long run estimates

Independent Variables	TB1	KA1	KA2
Ly_t	0.386[b]	-0.492[b]	-0.126
	(0.151)	(0.207)	(0.215)
FB_t	0.018[a]	0.131	0.074
	(0.005)	(0.118)	(0.096)
r_t	0.032		
	(0.185)		
$LREER_t$	0.145	-0.460[b]	-0.295
	(0.107)	(0.224)	(0.193)
$LTOT_t$	-0.220[c]		
	(0.122)		
LWY_t	0.965[a]		
	(0.259)		
ODS_t	0.411[b]	0.352[b]	
	(0.198)	(0.144)	
$ODSS_t$	-0.128[c]	-0.288[c]	
	(0.048)	(0.107)	
OSS_t	-0.754	0.122[b]	
	(0.671)	(0.055)	
LOP_t			-0.180[b]
			(0.084)
$DUMTB_t$	-0.122[a]		
	(0.046)		
$DUMCA_t$			
r_t^*		0.041	-0.057
		(0.048)	(0.039)
FDI_t		0.119[c]	0.839[b]
		(0.065)	(0.407)
CAO_t		-0.292[c]	-0.132[b]
		(0.149)	(0.063)
$LCPI_t$		0.133	0.844
		(0.142)	(0.997)
$DUMKA_t$		-0.359[b]	-0.293[a]
		(0.153)	(0.108)
C	0.643	2.578[b]	4.835
	(3.381)	(0.979)	(5.168)

Source: Estimated by Author (2017)
Note: [a], [b] and [c] denotes significance at 1%, 5% and 10% respectively. Standard Error in parenthesis ()

Table 7: Results of Wald Test

Test Statistic	Value	df	Probability
t-statistic	3.476989	85	0.0008
F-statistic	12.08945	(1, 85)	0.0008
Chi-square	12.08945	1	0.0005

Source: Author's Computation (2017)

Table 8B: Estimated Short-Run Dynamic Relationships

Independent Variables	TB1	KA1	KA2
ΔTB_{t-1}	0.479[a]		
	(0.072)		
ΔCA_{t-1}			
ΔCA_{t-2}			
ΔKA_{t-1}		0.856[a]	0.835[a]
		(0.077)	(0.078)
ΔKA_{t-2}		-0.032	0.006
		(0.113)	(0.117)
ΔKA_{t-3}		-0.325[a]	-0.317[a]
		(0.073)	(0.077)
ΔLy_{t}	0.017	-0.244	-0.888
	(0.055)	(2.287)	(2.469)
ΔFB_{t}	0.124	0.031	0.039
	(0.082)	(0.026)	(0.028)
Δr_{t}	0.018		
	(0.027)		
$\Delta LREER_{t}$	0.013[c]	0.752[b]	0.672[a]
	(0.007)	(0.311)	(0.252)
$\Delta LTOT_{t}$	0.390[a]		
	(0.093)		
$\Delta LTOT_{t-1}$	-0.419[b]		
	(0.165)		
$\Delta LTOT_{t-2}$	0.252[b]		
	(0.101)		
ΔLWY_{t}	0.074[c]		
	(0.043)		
ΔODS_{t}	-0.010	0.025[a]	
	(0.016)	(0.008)	
ΔODS_{t-1}	-0.065[a]		
	(0.022)		

Table 8B: Continued

Independent Variables	TB1	KA1	KA2
ΔODS_{t-2}	-0.090[a] (0.020)		
ΔODS_{t-3}	-0.048[a] (0.015)		
$\Delta ODSS_{t}$	0.003 (0.068)	-0.229[a] (0.055)	
$\Delta ODSS_{t-1}$	-0.314[b] (0.169)		
$\Delta ODSS_{t-2}$	-0.612[a] (0.142)		
$\Delta ODSS_{t-3}$	0.478[a] (0.122)		
ΔOSS_{t}	-0.008 (0.020)	0.191[a] (0.049)	
ΔOSS_{t-1}	-0.023 (0.020)		
ΔOSS_{t-2}	0.031 (0.21)		
LOP_{t}			-0.317 (0.222)
$DUMTB_{t}$	-0.350 (0.861)		
$DUMCA_{t}$			
Δr^{*}_{t}		0.041[a] (0.010)	0.024[b] (0.010)
Δr^{*}_{t-1}		-0.052[a] (0.041)	
ΔFDI_{t}		0.385[a] (0.144)	0.388[b] (0.152)
ΔCAO_{t}		0.074[b] (0.035)	0.493[c] (0.284)
$\Delta LCPI_{t}$		-0.010 (0.191)	-0.026 (0.040)
$\Delta LCPI_{t-1}$		-0.112[a] (0.017)	-0.276[a] (0.040)
$\Delta LCPI_{t-2}$		-0.110[a] (0.019)	-0.291[a] (0.043)
$DUMKA_{t}$		-0.340 (0.306)	-0.456 (0.322)
C			
ECT_{t-1}	-0.090[a] (0.015)	-0.107[a] (0.015)	-0.138[a] (0.021)

Source: Estimated by Author (2017)
Note: [a], [b] and [c] denotes significance at 1%, 5% and 10% respectively. Standard Error in parenthesis ()

Table 9B: Model Goodness of Fit and Diagnostics

	Model		
Test Statistic	TB1	KA1	KA2
R-Squared	0.977	0.953	0.912
Adjusted R-Square	0.920	0.931	0.890
F-Statistic	137.945(0.00)	538.21(0.00)	527.50(0.00)
S.E. of Regression	0.834	0.309	0.320
Sum Squared Residual	59.178	7.256	7.891
Durbin-Watson	1.898	2.24	1.960
Serial Correlation	0.999(0.61)	1.403(0.25)	0.027(0.97)
Normality	2.297(0.32)	0.724(0.696)	0.18(0.91)
RESET Test	2.235(0.14)	0.029(0.86)	0.493(0.49)
Heteroscedasticity	1.161(0.30)	1.409(0.15)	2.361(0.06)

Source: Author's Computation (2017)

Stability Test for model TB1

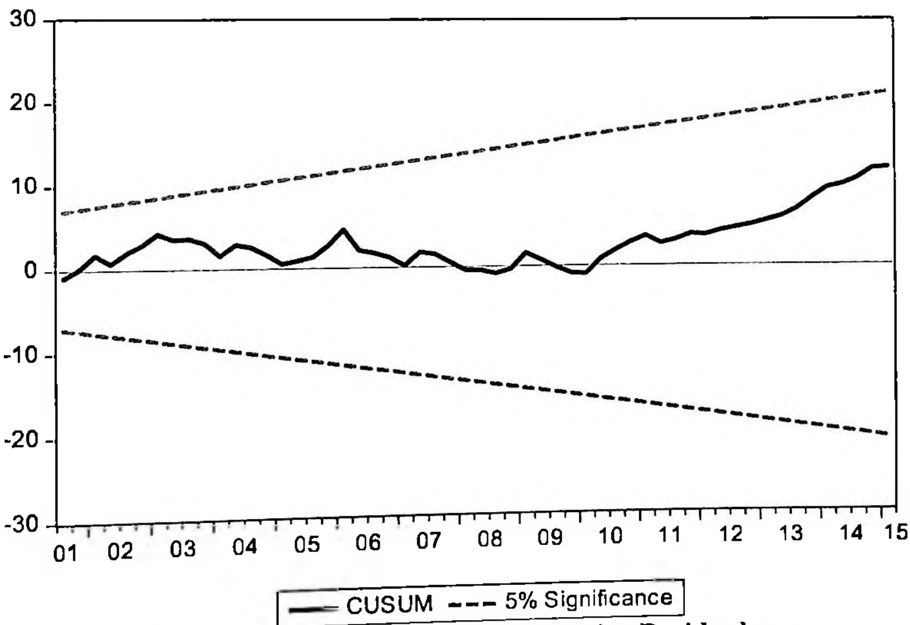

Figure B1a: Plot of Cumulative Sum of Recursive Residuals
Source: Author's Computation (2017)

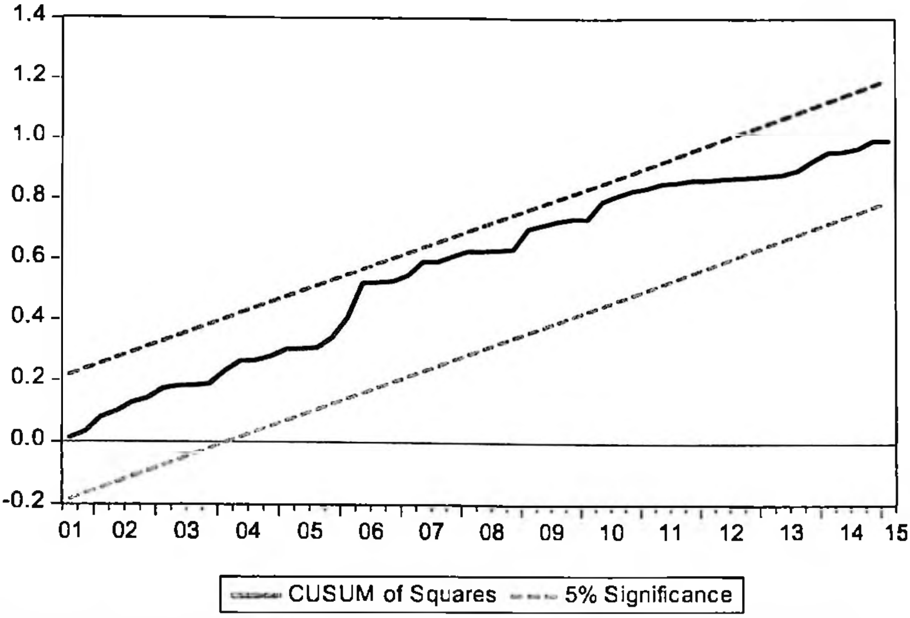

Figure B1b: Plot of Cumulative Sum of Squares of Recursive Residuals
Source: Author's Computation (2017)

Stability Test for model CA2

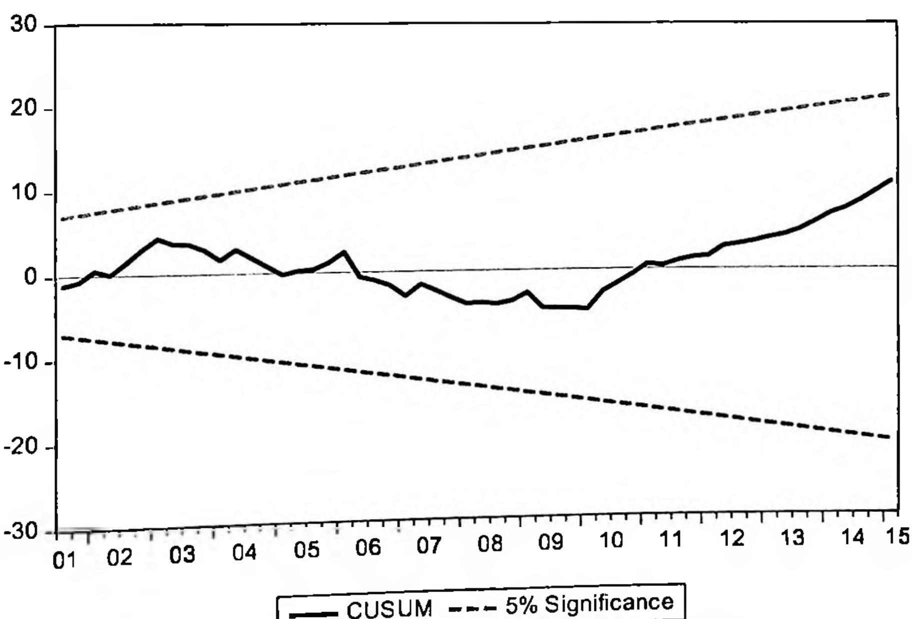

Figure B2a: Plot of Cumulative Sum of Recursive Residuals
Source: Author's Computation (2017)

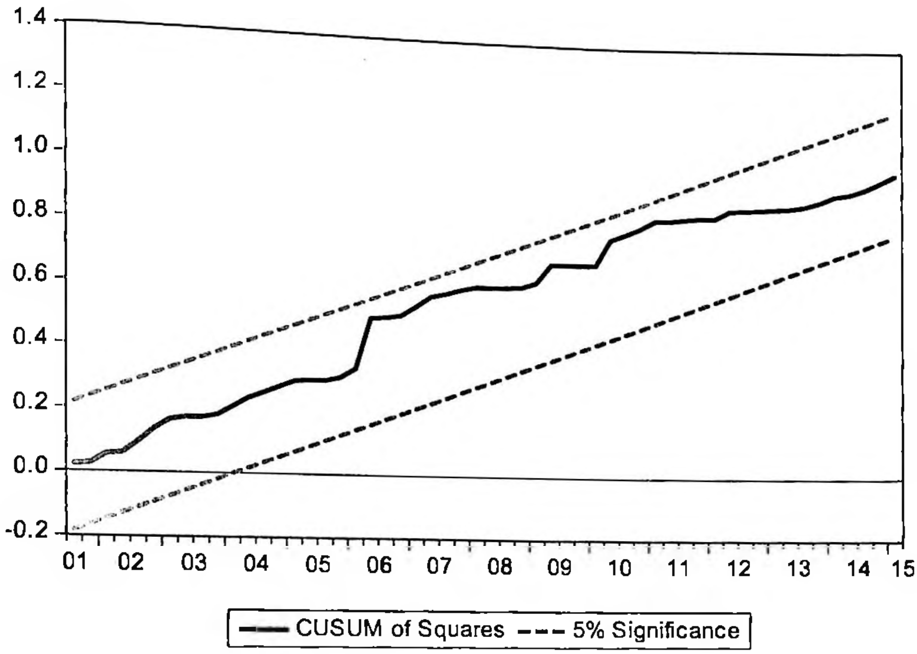

Figure B2b: Plot of Cumulative Sum of Squares of Recursive Residuals
Source: Author's Computation (2017)

Stability Test for model KA1

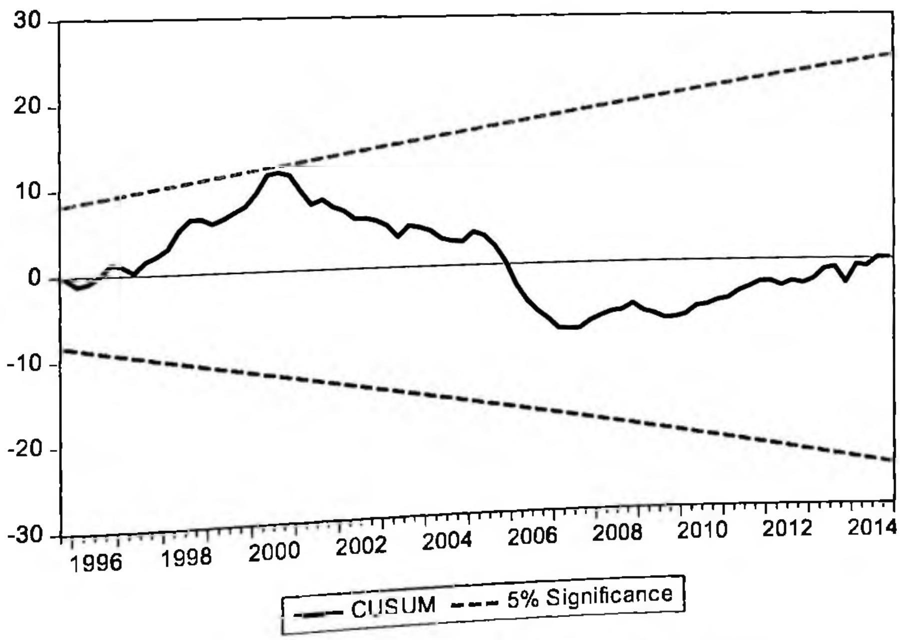

Figure B3a: Plot of Cumulative Sum of Recursive Residuals
Source: Author's Computation (2017)

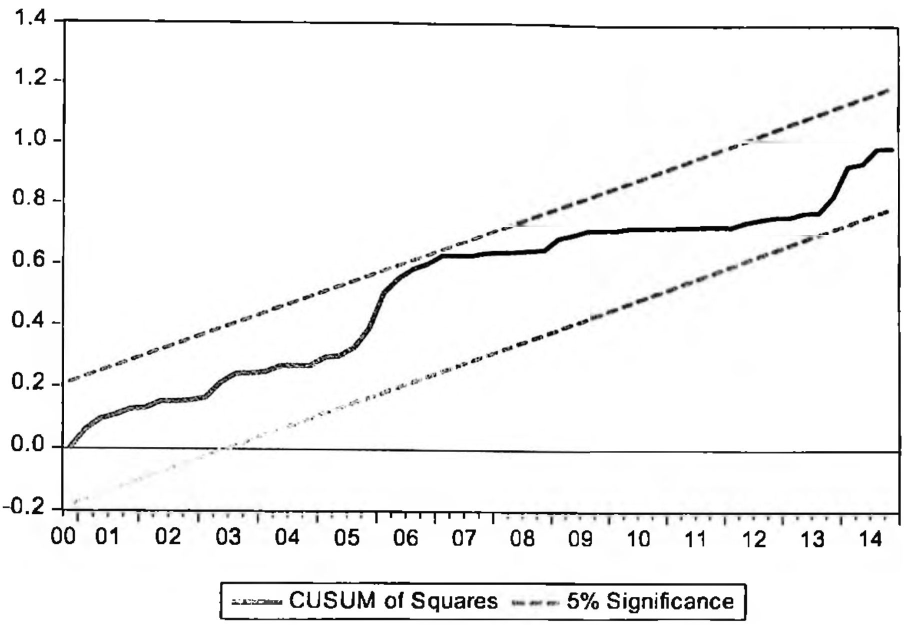

Figure B3b: Plot of Cumulative Sum of Squares of Recursive Residuals
Source: Author's Computation (2017)

Stability Test for model KA1

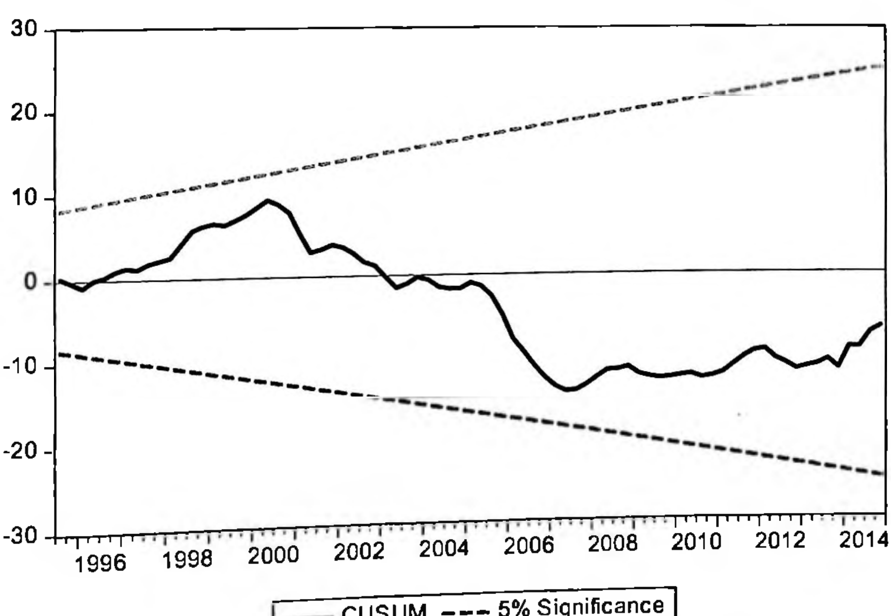

Figure B4a: Plot of Cumulative Sum of Recursive Residuals
Source: Author's Computation (2017)

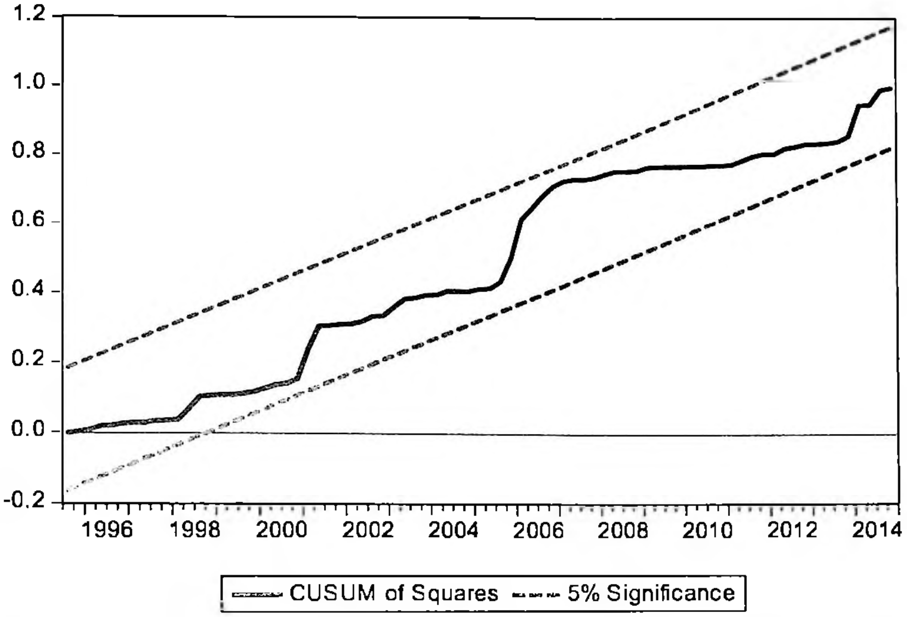

Figure B3b: Plot of Cumulative Sum of Squares of Recursive Residuals
Source: Author's Computation (2017)

Appendix C: Oil Price and stock Market Activities (Figures and Tables)

Table 1C: Stationarity Test

	ADF Test				PP Test				KPSS test			
Variable	Levels	Lag	Diff	Lag	Levels	BW	Diff	BW	Levels	BW	Diff	BW
P_t	-1.79	0	-11.71[a]	0	-1.86	3	-11.71[a]	2	0.34[a]	10	0.27	3
	(0.39)		(0.00)		(0.35)		(0.00)					
r_t	-2.61[c]	3	-9.48[a]	0	-2.12	7	-9.83[a]	6	0.19	10	0.13	7
	(0.09)		(0.00)		(0.24)		(0.00)					
$LCPI_t$	-1.86	0	-12.49[a]	0	-1.90	3	-12.49[a]	1	0.31	10	0.19	1
	(0.35)		(0.00)		(0.33)		(0.00)					
$LREER_t$	-1.04	2	-8.11[a]	1	-0.88	1	-7.50[a]	6	0.55[a]	10	0.25	0
	(0.74)		(0.00)		(0.00)		(0.00)					
LOP_t	-2.53	1	-9.62[a]	0	-2.51	3	-9.64[a]	4	1.08[a]	10	0.24	3
	(0.12)		(0.00)		(0.11)		(0.00)					
ODS_t	-11.65[a]	0	-10.60[a]	0	-11.67[a]	5	65.57[a]	38	0.07	5	0.14	32
	(0.00)		(0.00)		(0.00)		(0.00)					
$ODSS_t$	-11.88[a]	0	-11.59[a]	2	-11.88[a]	4	-58.36[a]	24	0.11	3	0.20	54
	(0.00)		(0.00)		(0.00)		(0.00)					
OSS_t	-11.59[a]	0	-10.69[a]	3	-11.60[a]	2	-119.64[a]	134	0.04	2	0.14	42
	(0.00)		(0.00)		(0.00)		(0.00)					

Note: Diff represents difference, [a], [b], and [c] denotes significance level at 1%, 5% and 10% respectively. Numbers in brackets are P-Values. *Lag* and BW are the lag length and Bandwidth respectively.

The respective critical values for the KPSS at 1%, 5% and 10% test are 0.739, 0.463 and 0.347.

Source: Author's Computation (2017)

Table 2C: VAR Lag Order Selection Criteria

Lag	LogL	LR	df	P	FPE	AIC	SC	HQ
0	-934.012	NA	16	0.00	2.83885	12.3949	12.4596	12.5541
1	-307.834	1252.4	16	0.00	0.00926	4.36624	4.5602*	4.84369*
2	-287.223	41.222	16	0.00	0.000872	4.30557	4.62883	5.10133
3	-265.402	43.643*	16	0.00	0.000808*	4.22897*	4.68154	5.34303
4	-260.249	10.305	16	0.85	0.000935	4.3717	4.95358	5.80406

Source: Author's Computation (2017)

Table 3C: LM Serial Correlation Test

Lags	LM-Stat	Prob.
1	21.7208	0.15244
2	23.3882	0.10374
3	6.2965	0.98456

Source: Author's Computation (2017)

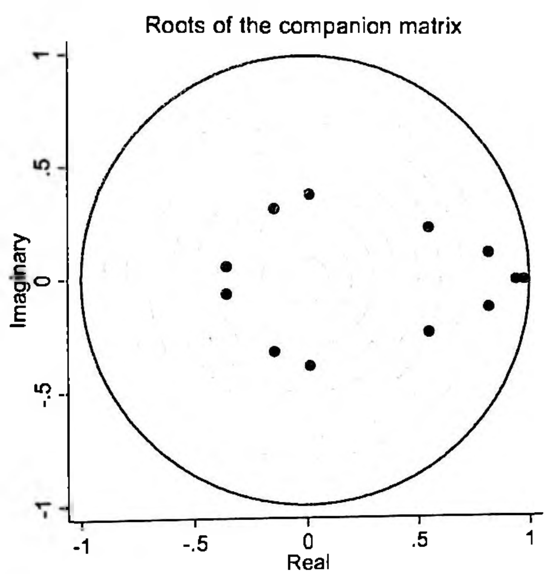

Figure 1C: Stability condition test with eigenvalues plot in the unit circle
Source: Author's Computation (2017)

Table 4C: Structural FEVD

Step	SFEVD (1)	SFEVD (2)	SFEVD (3)	SFEVD (4)
1	2.72	2.74	0.6	93.9457
2	3.33	4.98	2.02	89.6698
3	3.67	7.37	4.14	84.8206
4	3.62	9.45	5.14	81.7883
5	3.62	11.45	5.55	79.3824
6	3.74	13.42	5.55	77.2856
7	3.91	15.25	5.4	75.4358
8	4.09	16.93	5.19	73.7919
9	4.28	18.43	4.98	72.3188
10	4.46	19.76	4.78	70.999
11	4.63	20.93	4.61	69.8201
12	4.79	21.96	4.48	68.7698
13	4.94	22.85	4.37	67.8344
14	5.08	23.63	4.29	67.0006
15	5.21	24.3	4.24	66.2553
16	5.34	24.87	4.21	65.5862
17	5.45	25.37	4.2	64.9828
18	5.57	25.79	4.21	64.4358

Source: Author's Computation (2017)

Table 5C: BDS Test Results for Stock Prices

Dimension	BDS Statistic
2	0.198[a] (0.004)
3	0.334[a] (0.006)
4	0.426[a] (0.007)
5	0.485[a] (0.008)
6	0.522[a] (0.007)
7	0.542[a] (0.007)

Note: [a], [b] and [c] denotes significance at 1%, 5% and 10% respectively. Standard Error in parenthesis ()

Source: Author's Computation (2017)

Table 6C: Estimates of the effect of oil price shocks on Stock Market Activity

Independent Variables	OLS		Markov Switching Models			
			$lnP_t - Shocks$		$lnP_t - LOP$	
Independent Variables	$lnP_t - Shocks$	$lnP_t - LOP$	Regime 1	Regime 2	Regime 1	Regime 2
$ln\Delta P_{t-1}$	0.018	0.003	-0.293^{a}	0.470^{a}	0.543^{a}	-0.836^{a}
	(0.073)	(0.082)	(0.035)	(0.109)	(0.099)	(0.007)
r_t	-0.001	0.001	-0.001	-0.013^{b}	-0.0004	-0.038^{a}
	(0.001)	(0.002)	(0.001)	(0.005)	(0.0009)	(0.003)
$lnCPI_t$	-0.088^{c}	-0.085^{c}	-0.056	-0.026^{c}	-0.022	-0.147
	(0.049)	(0.036)	(0.090)	(0.015)	(0.015)	(0.131)
$ln\Delta REER_t$	0.889	0.649	0.228^{a}	0.297^{b}	0.188	0.327^{a}
	(0.734)	(0.486)	(0.006)	(0.130)	(0.115)	(0.012)
ΔLOP_t		-0.040			-0.022	-0.314^{a}
		(0.166)			(0.056)	(0.030)
ODS_t	4.965^{b}		0.072^{b}	0.0013^{b}		
	(1.910)		(0.002)	(0.0006)		
$ODSS_t$	0.211		-0.469^{a}	0.107^{c}		
	(0.135)		(0.040)	(0.060)		
OSS_t	0.001		-0.331	-0.403		
	(0.003)		(0.429)	(0.560)		
C	0.475^{b}	0.451^{b}	-0.059	0.163^{c}	0.135	0.492
	(0.238)	(0.208)	(0.574)	(0.094)	(0.093)	(0.755)
R-Squared	0.073	0.057				
Adjusted R-Squared	0.020	0.025				
F-Statistics (Prob.)	2.344(0.028)	2.549(0.03)				
Durbin Watson Stat	1.981	1.995	2.198		2.282	
			Markov Switching Common Parameters			
LOG(SIGMA)			-3.042^{a}		-3.020^{a}	
			(0.177)		(0.124)	
P11-C			-0.672		4.984^{a}	
			(1.454)		(1.059)	
P21-C			-4.021^{a}		0.038	
			(1.200)		(1.472)	
Transition Probabilities						
P11			0.338		0.993	
P12			0.662		0.0068	
P21			0.018		0.510	
P22			0.982		0.490	
RCM			0.054		0.020	
			Regime 1	Regime 2	Regime 1	Regime 2
Expected Duration			1.511	56.756	146.991	1.962

Note: ^{a}, ^{b} and ^{c} denotes significance at 1%, 5% and 10% respectively. Standard Error in parenthesis ()

Source: Author's Computation (2017)

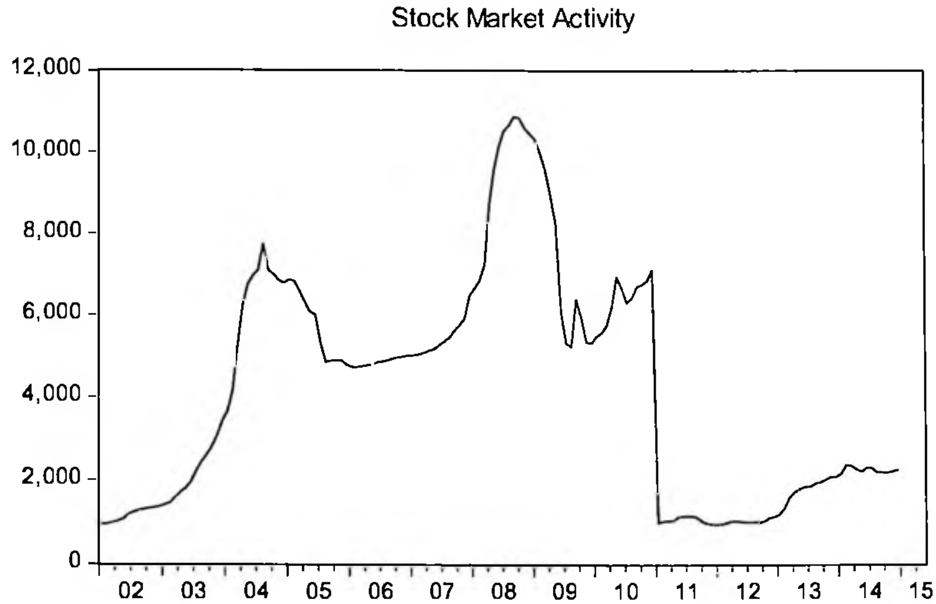

Figure 2C Plot of Stock Market Activity
Source: Author's Computation (2017)

Appendix D: Oil price shocks and Macroeconomy (Tables and Figures)

Table 1D: Stationarity Test

	ADF Test				PP Test				KPSS test			
Variable	**Levels**	**Lag**	**Diff**	**Lag**	**Levels**	**BW**	**Diff**	**BW**	**Levels**	**BW**	**Diff**	**BW**
O_t^{ss}	-1.30	0	-12.01[a]	1	-1.24	4	-13.66[a]	4	1.42[a]	10	0.10	4
	(0.63)		(0.00)		(0.66)		(0.00)					
Y_t^w	-4.85[a]	13	-3.30[b]	11	-5.20[a]	4	-20.49[a]	10	0.04	9	0.08	24
	(0.00)		(0.02)		(0.00)		(0.00)					
O_t^p	-2.54	1	-10.70[a]	0	-2.52	3	-10.69[a]	0	1.19[a]	10	0.26	3
	(0.11)		(0.00)		(0.11)		(0.00)					
$\mathcal{S}_t$	2.00	3	-4.11[a]	2	2.63	5	-13.38[a]	7	1.44[a]	10	0.06	7
	(0.99)		(0.00)		(1.00)		(0.00)					
Ω_t	-5.52[a]	1	-13.73	1	-7.65[a]	3	-33.73[a]	27	0.04	7	0.18	55
	(0.00)		(0.00)		(0.00)		(0.00)					
π_t	-1.86	0	-12.49[a]	0	-1.90	3	-12.49[a]	1	0.31	10	0.19	1
	(0.35)		(0.00)		(0.33)		(0.00)					
i_t	-1.46	2	-7.00[a]	1	-2.15	7	-13.09[a]	7	0.57[b]	10	0.05	7
	(0.55)		(0.00)		(0.23)		(0.00)					

Note: Diff represents difference, [a], [b], and [c] denotes significance level at 1%, 5% and 10% respectively. Numbers in brackets are P-Values. *Lag* and BW are the lag length and Bandwidth respectively. The respective critical values for the KPSS at 1%, 5% and 10% test are 0.739, 0.463 and 0.347.
Source: Author's Computation (2016)

Table 2D: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1074.022	NA	1.88e-15	-14.0398	-13.9005	-13.9832
1	1774.397	1327.025	3.58e-19	-22.6105	-21.49642*	-22.15791*
2	1823.491	88.49943	3.59e-19	-22.61173	-20.5229	-21.7632
3	1861.455	64.93696	4.19e-19	-22.4665	-19.4028	-21.2219
4	1890.271	46.63707	5.56e-19	-22.2009	-18.1625	-20.5604
5	1917.690	41.84996*	7.62e-19*	-21.917*	-16.9037	-19.8804
6	1953.491	51.34579	9.50e-19	-21.7433	-15.7552	-19.3107
7	1982.483	38.91144	1.32e-18	-21.4801	-14.5172	-18.6515
8	2015.906	41.77819	1.78e-18	-21.2751	-13.3374	-18.0505

Source: Author's Computation (2016)

Table 3D: LM Serial Correction Test

Lags	LM-Stat	Prob.
1	64.97931	0.0628
2	45.87748	0.6005
3	42.74837	0.7232
4	40.30094	0.8074
5	47.91687	0.517

Source: Author's Computation (2016)

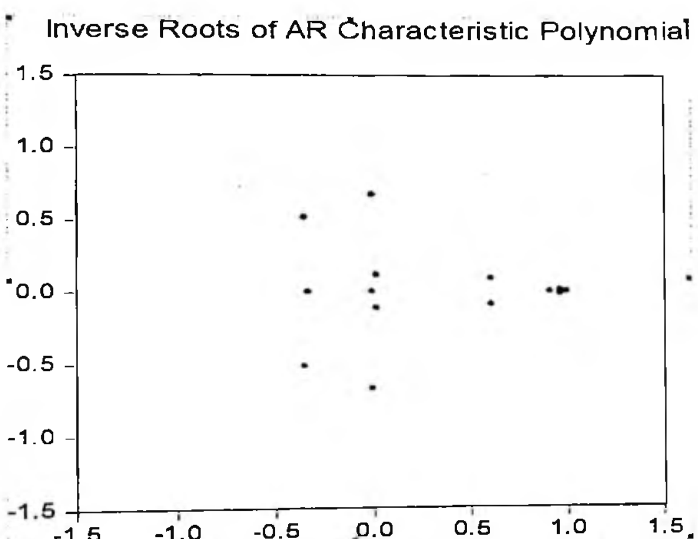

Figure 1D: Stability condition test with eigenvalues plot in the unit circle
Source: Author's Computation (2016)