UNIVERSITY OF CAPE COAST

EFFECT OF OIL PRICE CHANGES ON STOCK PRICES ON THE GHANA STOCK EXCHANGE

BY

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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.

Candidate's Signature: ……………………… Date …………………..

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Supervisors' Declaration

We hereby that the preparation an presentation of this thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature ………………… Date ……………………

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ABSTRACT

The study sought to examine the effect of oil prices on stock prices on the Stock Exchange in Ghana. To achieve this, the studies stet out to examine the short and long run effect of oil price on stock prices. The studies also examine the causality between the variables. Using monthly time series data January 2003 to December 2014, and controlling for inflation, money supply, interest rate and exchange, the study found that there is cointegrating relationship among the variables using Johansen co-integration approach. There was found to be a negative long run effect between oil price and stock prices. Also oil price and stock prices were found to be negatively related in the short run. Again, uni-causal relationship was found to flow from oil price to stock prices. Based on these, it is therefore recommended, governments, Ghana Stock Exchange and investors should take measures to mitigate against negative oil price shocks on the stock prices.

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DEDICATION

To my friends, Douglas, Solomon, Nancy and to my family, Abigail and Israel.

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LIST OF ACRONYMS

WTI: West Texas Intermediate.

DCF: Discount Cash Flow.

GSE: Ghana Stock Exchange.

EIA: Energy Information Administration.

UK: United Kingdom

VAR - VEC: Vector Auto Regression /Vector Error Correction

IMF: International Moneytary Fund.

SEC: Security and Exchange Commission

ASEA: African Securities and Exchange Association.

CPP: Convention Peoples's Party.

NLC: National Liberation Party.

PP: Progress Party

NRC: National Redemption Council

SMC: Supreme Military Council

AFRC: Armed Forces Revolutionary Council

PNP: Peoples National Party

GSE - CI: Ghana Stock Exchange-Composite Index

GSE-ASI: Ghana Stock Exchange- All Share Index

IPO: Initial Public Offering

ADF: Augmented Dickey Fuller

SBC: Schwartz Boyesian Criterion

FPE: Final Production Error

AIC: Akaike Information Criterion

SIC: Schwartz And Information Criterion.

HQ: Hannan-Quinn Information Criterion

ECT: Error Correction Term

OLS: Ordinary Least Squares

GTS: General To Specific

VECM: Vector Error Correction Model

CPI: Consumer Price Index

GDP: Gross Domestic Product

GIPC: Ghana Investment Promotion Council

OVB: Omitted Variable Bias

NPA: National Petroleum Authority

BIC: Bayesian Information Criteria

ARDL: Autoregressive Distributed Lag

FMOLS: Fully Modified Ordinary Least Squares

FRED: Federal Reserve Economic Data

RFO: Residual Fuel Oil

LPG: Liquefied Petroleum Gas

ATK: Aviation Turbine Kerosene

CHAPTER ONE

INTRODUCTION

This chapter presents the background to the study which looks at effect of oil price changes on stock prices on the Ghana Stock Exchange. It also highlights the statement of the problem, objectives of the study, research hypothesis, significance of the study, scope of the study, limitation of the study as well as the organisation of the study.

Background to the Study

Ghana's economic growth is vulnerable to fluctuations in the international prices of oil, especially when the country still depends solely on the international market to meet domestic demands for petroleum products. This results in the country experiencing poor growth rates during periods of crude oil hikes (Fosu & Aryeetey, 2008). Aryeetey and Harrigan (2000) had earlier confirmed that the crude oil price shocks of 1974, 1979 and 1981 partly blamed for this economic hardship.

Similarly, British Petrochemical Annual Report for 2012 indicated that crude oil prices during these periods quadrupled from the 1972 price of $2.48 to $ 11.58 per barrel by 1974. The authors further reiterated that the price of crude oil further increased to $36.83 per barrel by 1980. The shocks in the crude oil prices during that period might have influenced the country's economic misfortune. This makes it important for a study on the impact of oil price variation in Ghana.

The channels through which oil prices affect the Ghanaian economy has been identified to be directly related to government expenditure (Cantah, 2013) and indirectly through exchange rate (Tweneboah, 2009). This has resulted in a negative and non-linear effect of oil price volatility on private investment in Ghana (Wiafe, Barnor & Quaidoo, 2015). It is also argued that, there is an adverse effect on investment which is linked to inconsistent supply, demand and uncertainty that resulting from oil price shocks (Elder, 2009). There is similar uncertainty regarding reversible asset and irreversible asset and how oil price shock affects such manner of investments. The latter argument on investment risk and uncertainty brings to bear the importance oil price shocks could be to the performance of stock markets either in developing or developed economies (Eberly, 2013).

For many economies, importation of crude oil makes it very vulnerable to global market fluctuations. This is especially so for stock markets in such economies irrespective of how strong the stock marketing in professing. Nevertheless, the impact of the stability of oil prices on the stock market could equally be subject to the rise and fall of the country's economy (Roberado & Rivera-Castro, 2013). This notwithstanding, oil prices still depend on fundamentals of demand and supply. Thus, they change contemporaneously with business cycles.

Leiby and Paik (2004) noted that the stock values ideally reflect the market's best estimate of the future profitability of firms, so the effect of oil price shocks on the stock market is a meaningful and useful measure of their economic impact. Asset prices are the present discounted value of the future net earnings of firms hence both the current and the expected future impacts of oil price shocks should be absorbed fairly quickly into stock prices and returns. This could be done without having to wait for those impacts to actually occur. Apart from crude oil prices, the other factors that influence stock market returns are interest rates, exchange rate, inflation rates and industrial production.

Jones and Kaul (1996) stated that available data indicates a strong significant but inverse relationship between fluctuations in oil prices (oil price shocks) and the stock markets of emerging and developed economies. Nonetheless, Broadstock, Cao and Zhang (2012) shows that it could have a positive impact on the stock market. Evidence from Sadorsky's (2001) study on the effect of oil prices' volatility over stock returns shows that oil price itself exerted significantly negative influence on stock returns in the United States though the magnitude of the effect may have increased since the mid-1980s.

A research by Nandha and Faff (2008) shows that increase in oil price have a detrimental effect on stock in all sectors except mining and oil and gas industries. O' Neill (2008) also find that oil price increases lead to reduced stock returns in the United States, the United Kingdom and France. On the contrary, studies conducted by Huang, Hwang and Peng, (2005) did not find any significant association between daily price of oil futures and general stock returns in the United States. Nonetheless, Ciner (2001) also reports that a statistically significant non-liner association exist between real stock returns and oil price futures. Arourei, Jouim and Nguyen (2012) examined the extent of volatility transmission between oil and stock markets in Europe and the United States at the sector-level and concluded similarly to Ciner (2001).

In the recent past, the global energy economy has witnessed sporadic changes in crude oil prices with its attendant effects on many economic variables including the stock exchange indices. Undoubtedly, crude oil is one of the most valuable natural commodity in the world. It is assumed to be the perfect example of macroeconomic indicator which can affect the movements of stock market and the economy of any country. According to Wajdi (2014), rising crude oil prices have the tendency to affect the global economy through a variety of significant channels, including a rise in the cost of production of goods and services, transfer of wealth from oil consumers to oil producers, and impact on inflation, consumer confidence and financial markets. Thus consumers, governments and financial practitioners are greatly concerned about the oil price shocks and its negative economic effects on business cycles (Hamilton & Herrera, 2004). In addition to this, most researchers have moved their attention to the effect of oil price volatilities on the stock market. The authors reported on their findings that the spill over is usually unidirectional from oil markets to stock markets in Europe, but bidirectional in the United States.

Furthermore Arourei (2011) later examined the volatility spill over between oil and stock markets in Europe and found that there was a significant volatility spill over between oil price and sector stock returns and suggest that a better understanding of those links is crucial for portfolio management in the presence of oil price risk. In similar research, Oberndorfer (2009) examined the relationship between developments that had occurred in energy markets in Euro zone and prices of energy stocks in Europe and found that increases in oil prices negatively affected European stock returns and volatilities in coal prices also affected stock returns but did not have a considerable impact as compared to that of the oil price. However, Chang (2009) examined the volatility spills over between WTI (West Texas Intermediate) crude oil futures returns and stock returns of ten worldwide oil companies but their findings show no volatility spillover effects in any pairs of return series.

It is of interest to note that most of these empirical findings available in relation to the relationship between the oil price shocks and stock markets have been looked at in the developed stock markets in developed countries, however little has been said when it comes to most emerging stock market in developing countries like Ghana. Most of the financial literatures available in Ghana focus on the effect of macroeconomic variables on the stock markets (see Osinubi, 2004; Ushad, 2008). It is against this background that this study focuses on the relationship between the effect of oil price shocks and the stock markets of an emerging stock markets in a developing country like Ghana.

Although the rapidly expanding literature has investigated the relationship between oil prices and the stock markets in most developed countries, few studies have been conducted on the relationship between oil price movement and the stock markets in developing countries

In Sub-Saharan African countries especially Ghana, there are few number of related studies (Adam & Tweneboah, 2008; Lin, Wesseh & Appiah 2014), that forecasted the role of macroeconomic variables (such as exchange rate, interest rate and inflation) on stock markets and the economic output. However, this cannot be said for the effect of oil price shocks on the stock markets.

Moreover, the phenomenal role of Ghana stock exchange in the development of the Ghanaian economy is justified by the turnover. Bank of Ghana (BOG) Annual Report (2016) stated that, Crude oil prices increased steadily in the first half of the year, from US$31.9 per barrel in January 2016.

It became volatile between July and November .The price subsequently picked up in December to end 2016 at US$54.9 per barrel, indicating a year-on-year growth of 41.1 per cent. This resulted in high cost of production due to the steady rise in wages and crude oil prices. Stock market activities remained bearish in the review year. This was mainly as a result of investor preference for high yielding money market instruments. Market trading was therefore subdued and the Ghana Stock Exchange Composite Index (GSE-CI) remained in negative territory in the face of declining equity prices. At the end of 2016, the GSE-CI lost 15.3 per cent to close at 1,689.09 points, compared with a loss of 11.7 per cent in 2015. Total market capitalization declined to GH¢52,691.0 million in 2016, from GH¢57,116.8 million in 2015, down by 7.7 per cent, mainly due to decline in equity prices.

Narayan and Narayan (2010) postulated the theoretical underpinning between stock prices and oil prices to be equity prices as discounted returns of expected future cash flows. Systematic movements in expected cash flow and discount rate do have some bearing on stock prices, and an increase in oil prices leads to higher cost of production, reduces profits in the immediate thereby lowering stock prices.

Thus, in light of the above statistics, the implications of oil price fluctuations on the Ghana Stock Exchange in particular and the economy of Ghana in general is far reaching and would inevitably warrant a study of this nature.

Statement of the Problem

Oil is considered one of the most significant commodities necessary for the growth of every nation's economy and Ghana is no exception. The use of oil has not only been linked with just petroleum that is used in the transport sector; the use of oil goes beyond what one would presume in our modern civilization.

Theoretically, there are many ways through which the oil price movements could have an impact on the stock prices. According to Discounted Cash flows (DCF) technique, the value of a stock is equal to the sum of discounted expected future cash flows. These cash flows could directly or indirectly depend on the oil prices. For instance, if there is an unprecedented increase in the oil price, the energy cost for many companies would increase. As a consequence, the earnings could fall and so as the present cash flows. For example, due to the fact that oil is a crucial input in most firms' production, expected cash flows could be affected by oil price, which may subsequently lead to variations in costs. Such incidents would affect earnings and dividends which ultimately affect stock price (Rafailidis & Katrakilidis, 2014). Using the interest rate channel, higher oil prices may lead to overestimation of the expected inflation and thus higher nominal interest rates; and since discount rates are negatively related with stock prices, increases in interest rates depress stock prices (Rafailidis & Katrakilidis, 2014).

On the other hand, Kilian and Park (2007) demonstrated that the response of stock price to oil price variations can be either positive or negative depending on the source of the changes in oil price. Thus, a changes in oil price due to demand or supply side shock will have differing effect on the stock prices. Their analysis of the impact of oil price shocks on the US stock market, they find that the negative response of US stock returns to oil price changes can be attributed only to demand shocks resulting from the uncertainty about future crude oil supply shortfalls; while, higher oil prices, driven by an unanticipated global expansion, have positive effects on stock returns (Miller and Ratti (2009)). It is clearly established that oil prices movements affect the performance of oil-importing countries (Wiafe, Barnor & Quaidoo, 2015). Again, theoretical postulate suggests a relationship between oil price variation and effect on their stock markets. Yet, the theoretical argument suggest that the effect of oil price on stock markets could either be positive or negative. Thus, effect of oil price shocks on stock market has become an important concern for researchers in recent times, due to the vital role that stock market plays in the economic development of a country (Oberndorfer, 2009). Thus requiring empirical interrogation of the relationship between oil prices and stock market prices in Ghana

Despite this, studies on the stock market and oil price effect in Ghana is rare. The studies which have sought to examine oil price effect in Ghana concentrate on inflation (Wiafe & Ahiakpor, 2015), growth (Cantah, 2013) and macroeconomic performance (Tweneboah & Adam, 2009). The existing literature on oil price and stock markets are highly concentrated on develop economies (Arourei & Rault, 2011). The literature on Sub-Saharan region has centred on Nigeria (Asaolu & Ogunmuyiwa, 2010). Focusing on Nigeria as a source of generalisation makes the finding hard to apply to the Ghanaian economy, which is a net importer of crude oil.

This study, therefore seeks to examine empirically the relationship between oil price variation and stock market prices on the Ghana stock exchange. Such a study is necessary because, oil price movements affect investment risk and uncertainty. Also, oil price shocks affect corporate cash flow directly or indirectly. Such effect on the corporate may affect their performance and eventual value of their share. Yet the magnitude of such effect on the performance of share prices is not known.

It is worth mentioning that an energetic stock markets offer great prospects for economic development of a country. However, a review reports from researchers have indicated that a large body of literature exist investigating the association between oil prices and emerging market stock prices. Despite vast amount of literature on this issue, much has not been done on African economies including Ghana. This leave a clear need for a study of the effect of oil prices on the stock market price of Ghana. Again, this study uses current data from the Ghana Stock Exchange which also captures the periods where Ghana became oil exporter. Another innovation which is not found in studies on Sub-Saharan African economies is the use of ex-pump oil prices. This is important because, most countries offer subsidies on fuel prices therefore, the actual effect of crude prices may not have the actual effect on stock market. Therefore, this study use the ex-pump fuel price as a proxy for oil price. This will reveal the actual effect of oil prices on the stock prices in Ghana.

Objectives of the Study

The main objective of this study is to examine the effect of oil prices changes on the stock prices of the Ghana stock exchange. To be more specific, the study seeks to;

1. Investigate the long-term (co-integrating) relation between oil prices and stock prices on the Ghana Stock Exchange.

2. Examine the short run dynamics of oil prices changes on stock prices of the Ghana Stock Exchange.
3. Examine the Granger causality between oil price and stock prices.

Research Hypothesis

The study will attempt to prove that:

1. H_0: there is no short-term relationship between oil price and stock prices

   H_1: there is short term relationship between oil price and stock prices.

2. H_0: there is no long-term relationship between oil price and stock price

   H_1: there is long-term relationship between oil price and stock price

3. H_0: there is no Granger causality between oil price and stock prices in Ghana.

   H_1: there is Granger causality between oil price and stock prices in Ghana.

Significance of the Study

The findings from this study have added to knowledge of the relationship between oil prices and the stock prices on the Ghana Stock Exchange. The outcome of this study has also been of interest to researchers, policy makers, investors and regulators alike. Thus, the findings will inform and educate investors on how best to manage their portfolio of stocks or shares to maximize returns during period of oil price shocks. This will also provide empirical literature on the relationship between oil price and stock market from a developing economy perspective.

Scope of the Study

This study focuses on investigating the monthly stock prices of the Ghana Stock Exchange covering January 2003-December 2014 represented by the GSE-Composite Index of the Ghana stock exchange and the monthly Ex-pump prices from National Petroleum Authority (NPA). The study also uses other variables such as interest rate, money supply, inflation and exchange rate. The study focuses on using VAR-VEC models by employing the Hendrick approach to estimate the long run and short run dynamics of stock prices as results of oil price variations.

Limitation of the study

Oil prices in this study was proxied by ex-pump fuel prices (Gasoline Premium) which is not the only product of crude oil. This presupposes that other equally important products of Crude oil which includes, Diesel, LPG, Kerosene, Gasoline Premix, RFO and ATK were not considered in this study. The study was also limited to data of GSE Composite Index. This means that there is a possibility that specific issues regarding ex-pump fuel price relating to a particular company might have not come up.

Organisation of the Study

The study is organised into five chapters. The chapter one presents the introduction of the study. The chapter also provides the background to the study, the statement of the problem, the objectives, hypotheses, the scope and the significance of the study. The chapter two focuses on review of related literature. The review is presented in two sections; the theoretical review and empirical review of related literature. The methodology used for this study is presented in Chapter three. The chapter four gives the results and discussion of the study. The final chapter provides the summary, conclusions and recommendation of the study.

Chapter Summary

The chapter one of the study looked at the introduction, which include the background of the study, statement of the problem, objectives of the study, research hypothesis, significance of the study, scope of the study, limitation of the study and the organization of the study.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter is divided into two sections. The first section deals with the trends in stock market performance in Ghana. The second section of this chapter focuses on theoretical review and empirical review of stock market prices and returns.

Background Information on the Ghana Stock Exchange

The Ghana stock market albeit small, is one of the premier and vibrant stock markets in Africa. Until 1990, there was very little active secondary trading in stocks in Ghana due to the non-existence of a stock exchange. The implementation of economic reforms under the auspices of the International Monetary Fund (IMF) beginning in the 1980s with emphasis on economic liberalization and private enterprise, however, sowed the seeds for the development of an active stock market.

The Ghana Stock Exchange (GSE) commenced operations in November 1990 and has since posted a remarkable long-term performance largely as a result of foreign portfolio inflows generated by optimism in the economic reforms and also because of relatively low political risk. In 1994 and 1998, the market was named as the best performing stock market in emerging markets when weighted capital gains topped 116% and 124%, respectively. External shocks to the economy in 1999-2001 resulted in weak performances in those years but the market had recovered strongly in 2002 and 2003 following an improved macroeconomic environment.

There were 35 companies and 5 corporate bonds listed on the market. The dominant sectors on the market were banking, brewery and manufacturing. Most of the companies listed were multinational. Recent years, have however, seen some increased interest by indigenous entrepreneurs in the market. Trading takes place every day Monday - Friday. Until 2001 when the continuous auction system of trading was introduced, the call-over system operated.

Local investor participation is being boosted by a new legislation that has birthed the emergence of mutual funds, and market indices in recent years have been driven mostly by local investors in contrast to foreign portfolio interest in the earlier formative years. Notwithstanding, foreign institutional investors still do control a majority of the shares on the market which currently has a market capitalization of US$1.2 billion, equivalent to 20% of Ghana's GDP. There are 13 licensed dealing members or brokerage firms. The highest regulatory body is the Securities and Exchange Commission (SEC). The SEC ensures that participants on the market adhere to the rules and regulations set out in the Securities Industry Law and the Companies Code in order to protect and boost investor confidence in the market. The Ghana Stock Exchange also has its own listing and membership regulations that stakeholders must adhere to.

In order to encourage the development of the market and thereby boost capital mobilization, the law applies zero tax on capital gains. However, a withholding tax of 10% is charged on dividends. The law also applies a tax discount of 2.5% on the income tax that listed companies are liable to pay. This is intended to encourage companies to list on the market.

Non-resident foreign investors are allowed to own up to 100% of shares in listed companies where local interests are non-existent. Non-resident foreign ownership is, however, restricted to 74% where local interests exist. The exchange control and investment promotion laws also allow foreign investors to repatriate 100% of their profits. The GSE's biggest shortcoming has been its inability to attract a large number of companies to list on the market due to several possible reasons. Firstly, it was expected that most of the state enterprises will be divested via the mechanism of public floatation and listing on the GSE but this did not happen due to parochial interests. Secondly, the need for listed companies to satisfy stringent disclosure requirements may have deterred indigenous Ghanaian entrepreneurs who due to cultural factors are unwilling to be subject to public scrutiny.

Thirdly, economic instability has undermined the potentials of developing a large capital market. Finally, the regulatory environment has created an uneven playing field for the growth of private fund management industry that could support large debt and equity floatation. Nevertheless, an improving regulatory environment, political stability and the introduction of a central electronic depository and automated trading facilities are expected to provide a big boost for the market's development in the years ahead.

There are twenty-nine exchanges in Africa, which represent thirty-eight nations' capital markets. Out of this twenty-nine stock exchanges, twenty-one are members of the African Securities Exchanges Association (ASEA) of which Ghana Stock Exchange is a member. The Ghana stock exchange (GSE) is the principal stock exchange of the country. The idea of operating a stock exchange in Ghana came up as far back as 1961 when the

Convention People's Party (CPP) called for the assistance of the British expect, Professor Lawrence C.B. Gower in the preparation of the Companies Code. Professor Gower stated in the Companies Code 1963 (Act 179) the need to establish a stock exchange, but the concept was deferred. Some years later, governments from the CPP, National Liberation Council (NLC), Progress Party (PP), National Redemption Council (NRC), Supreme Military Council (SMC), Armed Forces Revolutionary Council (AFRC) to the People's National Party (PNP) made successful attempts to establish a stock exchange. These efforts were based on the fact that all the succeeding governments got to understand the importance of a stock exchange.

The exchange was finally incorporated in July 1989 as a private company limited by guarantee under Ghana companies' code, 1963 (Act 179) with trading commencing at Accra in the year 1990. The Ghana Stock status was later changed to a public company limited by guarantee in April 1994. The Ghana Stock Exchange (GSE) is modelled along the British style and as a result, the GSE has many of the characteristics of that of the British Stock Exchange. Buying shares on the stock exchange means investing a considerable amount of capital in a company, which the stock exchange has approved for that purpose. The securities traded on the exchange include equities and both corporate and government bonds. Currently, there are 35 companies listed and 2 (two on the GSE with 1 preference shares, 1 corporate bond and 3 government bonds as of September 2013. The listed companies include mining, brewery, banking, oil and manufacturing firms, all of which represent the key sectors of the economy. The criteria for listing include capital adequacy, profitability, spread of shares, years of existence and management efficiency. In the early stage of its operation, among the approved companies for which interested investors could buy shares were Fan Milk, Accra Brewery Ltd., Guinness Ghana Ltd., CFAO, Enterprise Insurance Ltd., Kumasi Brewery Ltd., Metalloplastica Ltd., Mobil Oil., SOQA, PZ, Supper Paper Product Ltd., Unilever, UTC, Ashanti Goldfields Ltd., and the Ghana Commercial Bank Ltd. However, its membership has increased to thirty –five as of September 2013 and currently the manufacturing brewing sectors dominate the exchange. A distant third is the banking sector while other listed companies fall into the insurance, mining and petroleum sectors. Most of the listed companies on the GSE are Ghanaian but there are some multinationals.

Analysis of this study is based on the Ghana Stock Exchange Composite Index (GSE-CI) which is the principal index of the Ghana Stock Exchange. It comprises of all listed stocks on the GSE and measured the general performance of the stock exchange and it is calculated from the values of each of the market's listings. The Ghana Stock Exchange Composite Index (GSE-CI) includes all ordinary shares listed on the GSE with the exception of those companies whose shares are listed on other exchanges. (Example. ETI, TLW). The base index is 1000 and the index is a market capitalization weighted index. There are other indices on the Ghana Stock Exchange (GSE), Namely, Ghana Stock Exchange All-Share Index (GSE-ASI), CBL All-Share Index (CBL-ASI) and GSE Financial Stocks Index (GSE-FSI). For the past two decades Ghana’s stock market has surged, though its performance is of a trajectory consisting of both ups and downs. In 1991, the GSE annual reports stated that the exchange turnover of stocks increased from 1.8 million shares to a volume of 125.63 million shares in 1997. This proofs beyond reasonable doubt that the Exchange market has been one of the best performing stock markets among all emerging markets. Concurrently, the Exchange emerged as the 6th best performing emerging stock market posting an impressive return of 114% in 1993.

The GSE was later voted best performing market amongst all emerging markets by Birinyi Associates, a research Group in USA with gains of 124% in 1994. The volume of trade on the Exchange in 2001, which edged up to 55.3 million however, reduced to 44.12 million in 2002 and increased to 96.33 million in 2003 and 104.35 million in 2004. The closure of 2003 trading year saw the Ghana Stock Exchange being adjudged the best stock market in the world in terms of performance, posting a yield of 154.7% (GSE Fact Book, 2005).

In the year 2002-2003, the Ghana Stock Exchange was again ranked top in the world with a compounded index return of 256%. Amidst the world monetary turn in oil in 2008, GSE compared to other stock exchanges in Sub-Saharan Africa was the best performing exchange on the continent with an index return of 58.06% followed by Malawi and Tanzania yielding returns of 26.69% and 3.54% respectively. Indeed, among the exchanges in Africa, just these three posted positive returns.

In any case, 2009 was an especially difficult year for the stock market of Ghana and this was due to the fact that the year 2008 was one of the best years of the market. As indicated by the Ghana Stock Exchange, the GSE All-Share index dropped by 46.58%, making the year 2009 as the minimum performing market in Africa and one of the most noticeably worst in the world. This worse performance was as a result of the global financial crisis the market felt in the fourth quarter of 2008 as well as the way the Exchange in 2009 began its move from paper certification to electronic book entry securities under a new automated Trading System. The process naturally obliges time since investors needed to be convinced to get on board. Additionally, the rise in local interest rate, making the money market alluring instruments was also a contributory factor.

The exchanging volumes and values of 419.79 shares and GH¢446.56m respectively recorded over the time of January-December 2011 were significantly higher than the volume of 330.13 million shares and value of GH¢151.13 million recorded over the same period in 2010 (GSE Fact Book, 2011). The volume of shares traded went up 27% while the value of shares traded in 2011 represented 295% over the volume and values achieved in 2010 respectively. Market Capitalization went up by 136.59% from the December 2010 value of GH¢20.12 billion to GH¢47.35 billion by 2011. The increment was mainly due to the listing of Tullow Oil PLC and some extra listings. In terms of primary issues, Tullow Oil PLC was the only Initial Public Offering (IPO) to be listed on the Exchange during the year 2011. The company sold 3.53 million shares at the IPO and raised GH¢ 109.48million (GSE, 2011).

Theoretical Review

There are several theories and models that attempt to explain the behaviour of stock market variables. These include the efficient market hypothesis, capital asset pricing models, portfolio theories and arbitrage theory. These models attempt to link stock returns and risk levels in the stock markets by attempting to explain how stock prices reflect economic environments. For the purpose of this study, the Arbitrage Pricing Theory (APT) was adopted to underpin the study.

Efficient Market Hypothesis

The efficient market hypothesis by Fama (1967) acquiesce that stock prices reflect all available information in an efficient capital market. The theory suggests three main form of efficiency i.e. the strong-form, semi-strong and the weak form efficiency. In general, an efficient stock market is a market where stock prices reflect all information about companies. In such a case, the market value of the company changes in a way very similar to that of the intrinsic value of a company. These changes are not consistent with the value and do not restrain from trading financial assets. The differences in investor awareness and uneven transaction costs prevent fundamental changes in value to be completely and immediately reflected in market prices (Goedhart, Koller, & Wessels, 2010).

However, if markets are efficient, changes in asset prices cannot be reflected in algorithms, while excess return is gained as a success rather than an outcome of a correct prediction. Allen, Breadley and Myers (2011) defined a market as efficient when it was not possible to earn a return higher than the market return. In other words, the value of shares reflects the fair value of the company and is equal to the future cash flows discounted by an alternative cost of capital. Eakins and Mishkin (2012) argued that an efficient market is a market where asset prices fully reflected all information available. Generally, the essence of an efficient market is built on two pillars:

1) In efficient markets, available information is already incorporated in stock prices;

2) In efficient markets, investors cannot earn a risk-weighted excess return.

The theory of EMH argues for three levels of efficiency. These are the weak form, semi-strong form and the strong form efficiency. And as a matter of necessity, a stock market which is having a strong form must have weak form and semi-strong form efficiencies. In this regard, the weak form efficiency is considered as the lowest form of efficiency. Fama (1967) argued that for weak form efficiency to exist, prices of financial asset reflect all available information contained in the past prices. The implication is that no trader can consistently gain from observing the trends in the past prices. Thus, future price movements could not be predicted base on (Fama, 1967). The implication is that an investor can make abnormal returns using fundamental analysis but not always the case. This means that variables like oil prices can influence the performance of the stock prices when we think of market analysis from fundamental and technical perspective. This is because, the efficient market hypothesis allows for other macroeconomic variables to influence asset prices.

Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model is a simple linear model that is expressed in terms of expected return and expected risk. The model states that the equilibrium returns on all risky assets are a function of their covariance with the market portfolio. Capital Asset Pricing Model was developed by Sharpe (1964), Lintner (1965) and Mossin (1966) to investigate the effects risk had on the expected return of an investment relative to the market portfolio. The capital asset pricing model relates the expected return of an asset to its riskiness measured by the variance of the asset's historical rate of return relative to its asset class. The model decomposes a portfolio's risk into systematic and specific risk. Systematic risk is the risk of holding the market portfolio. To the extent that any asset participates in such general market moves, that asset entails systematic risk. Specific risk is the risk which is unique to an individual asset. It represents the component of an asset's return which is uncorrelated with general market moves.

In their recent study to validate the model, (Fama & French, 2004), fronts the portfolio theory that investors choose portfolios that are said to be mean-variance-efficient, and found along the efficient frontier for portfolios. The CAPM assumes that any portfolio that is mean-variance-efficient and lies on the efficient frontier is also equal to the market portfolio. The implication of these, according to the authors, is that the relation between risk and expected return for any efficient portfolio must also hold for the market portfolio, if equilibrium is to be maintained in the asset market. The model is presented in the following linear form;

$$R_t = \alpha + \beta X_t + \varepsilon_t \qquad 1$$

Where R_t represents the return to an asset, X represents the return of an underlying portfolio of assets (often measured as a domestic market index), and ε_t represents the asset-specific return, all at time. The key term in the model is ß (i.e. beta), which indicates the statistical relationship between the asset's return and the return on the total portfolio of the assets.

According to the capital asset pricing model (CAPM), the marketplace compensates investors for taking systematic risk but not for taking specific risk. This is because specific risk can be diversified away. When an investor holds the market portfolio, each individual asset in that portfolio entails specific risk, but through diversification, the investor's net exposure is just the systematic risk of the market portfolio. Another theory to the CAPM is the arbitrage pricing theory (APT) by (Ross, 1976) in which the return on an asset is specified as a function of a number of risk factors common to that asset class. The model assumes that investors take advantage of arbitrage opportunities in the broader market; thus, an asset's rate of return is a function of the return on alternative investments and other risk factors. The APT in contrast to CAPM acknowledges several sources of risk that may affect an asset's expected return. The model attributes the expected return of a capital asset to multiple risk factors, and in the process, measures the risk premiums associated with each of these risk factors. An arbitrage model takes the following form:

$$R_{t} = \alpha + \hat{a}_1 X_{1t} + \hat{a}_2 X_{2t} + \hat{a}_n X_n + \varepsilon_t \qquad 2$$

The model is similar in form to equation 1, except that the X's represent a set of risk factors common to a class of assets, and the betas represent the sensitivity of the asset's return to each factor. Arbitrage Pricing Theory addresses the question of whether the risk associated with the particular macroeconomic variable is reflected in the expected market returns. According to (Chen, Roll & Ross, 1986), economic variables have a systematic consequence on stock market returns because economic forces affect discount rates, the ability of the firm to generate cash and future oil expenses payments.

The core idea of APT is that only a small number of systematic influences affect the long-term average returns of securities.

The Market Portfolio

This refers to the portfolio that comprises all securities where the amount invested in each security corresponds to its relative market value. Under the CAPM each investor holds an optimal portfolio and the aggregate of all investors is the market portfolio, which is defined as the portfolio of all risky assets, where the weight on each asset is simply the market value of that asset divided by the market value of all risky assets.

Moreover, the CAPM requires that in the equilibrium the market portfolio must be an efficient portfolio. One way to establish its efficiency is to argue that if investors have homogenous expectations, the set of optimal portfolios they would face would be using the same values of expected returns, variances and co variances. Therefore, the efficiency of the market portfolio and the CAPM are joint hypothesis and it is not possible to test the validity of one without the other (Roll, 2007). If a market is weak from efficiency, then it is impossible to earn abnormal returns by developing a forecasting model based on past returns. In the context of the capital asset pricing model, an abnormal return in excess of what was expected according to the CAPM equation.

Arbitrage Pricing Theory (APT)

The Arbitrage Pricing Theory (APT) is another model of asset pricing based on the idea that equilibrium market prices should be perfect, in such a way that prices will move to eliminate buying and selling without risks (arbitrage opportunities). The APT analyses how investors construct efficient portfolios. Thus, it offers a new approach to explaining the asset prices and also states that the return on any risky asset is a linear combination of various macroeconomic factors that are not explained by CAPM. Therefore, unlike CAPM model this theory specifies a simple linear relationship between assets, returns and the associated number factors.

Across the world, APT model has always been a center of attraction to determine different factors in the respective economies. Significant researches have been done on APT ever since it was introduced by Ross (1976). Ingersoll (1984) stated that the one key advantage of APT is that it derives a simple linear pricing relationship with the factors affecting the asset prices, as opposed to some of the CAPM's assumptions that are questionable. Lehmann and Modest (1985) examined the different strategies for forming portfolios, which significantly affect the unique factors affecting the risk premiums of the portfolios. The results were very beneficial as this research proved that increasing the number of securities in the analysis can increase the performance of portfolios. Also, another conclusion they drew through this research was that 750 securities in a portfolio provided more markedly high performance as compared to a portfolio with 250 securities.

Arthur, Carter and Abizadeh (1988) also examined the relation between risk and returns for mineral assets and concluded that APT is more efficient in explaining the returns for mineral assets than CAPM. Linn (1993) tested APT when insufficient information is available on asset returns. The results indicated that factor betas found out through normality distribution methods underestimated the inadequate information available for the respective securities and overestimated for securities which give higher information which meant that the return residuals were correlated with absent information. They also came to light that by adding new securities in a sequence and estimating through linear factor model, additional priced factors come into light when they don't even exist but are significantly important.

Using APT, Philippatos (1993) examined the spot foreign exchange risk premium. They tested that the deviations in the returns of currency depend on measuring systematic risk. Numerous tests proved that the exchange returns can be explained by APT using a single-factor. Theodosius (1993) tested the conditional heteroscedasticity with some factors using APT. The results were that heteroscedasticity can produce erroneous estimates of betas and these betas can lead to wrong conclusions. Yet, another conclusion they drew was that by putting together individual securities into a portfolio and forming their group as a portfolio does not completely erode the conditional heteroscedasticity present in it.

Isako (2002) performed a research on Swiss market which is particularly famous for having an effect from foreign economic conditions on it. Using APT, they examined the monthly returns on 19 industrial sector portfolios from 1986 to 2002 using both statistical and macroeconomic models. The results revealed that statistically determined factors give us a better picture of the determinants of stock returns other than the macroeconomic variables. Also, they concluded that the stock returns are affected both by the local and the foreign economic conditions. Jamin (2003) conducted a research for the determination of exposure to and pricing of exchange rate risk using APT modeling in the dollar and the German stock market. Another significant study was carried out on APT in Istanbul in which

13 macroeconomic variables were used including money supply, industrial production, crude oil prices, consumer price index etc. The Istanbul Stock Exchange's stocks were built on these factors which were drawn on 11 portfolios from the industry sector. The results were that there exists no relationship between the actual returns on the stock and the macroeconomic variables used in the research. Sarvolia (2010) did research on portfolio management in an Investment Company in Tehran stock exchange (TSE) using CAPM, APT, Systematic and Unsystematic Risk indicators. The results suggested when examining systematic and unsystematic risk, CAPM and APT should be used all together in performing evaluation of investment performances of companies.

Jecheche (2006), argues that Multi-factor models allow an asset to have not just one, but many measures of systematic risk. Each measure captures the sensitivity of the asset to the corresponding pervasive factor. The author further contends that, the intuition for the result when assets have no specific risk, is that all asset prices move in lockstep with one another and are therefore just leveraged copies of one other. The result becomes more difficult when assets luck specific risk. In such a case, it is possible to form portfolios with a diversifiable specific risk. In order to achieve full diversification of residual risk, however, a portfolio needs to include an infinite number of securities. With a finite set of securities, each of which has specific risk, the APT pricing restriction will only hold only approximately.

Chen, Roll and Ross (1986) in their first empirical investigation of the APT postulated that the most basic level of some fundamental valuation model is to determine the prices of assets. That is, the price of a stock will be the correctly discounted expected future oil expenses. Therefore, the choice of factors should include any systematic influences that impact future oil expenses, the way traders and investors form expectations and the rate at which investors discount future cash flows. It is through this mechanism that macroeconomic variables become part of risk factor in the equity market. The authors further concede that stock returns are exposed to systematic economic news, that they are priced in accordance with their exposures, and that the news can be measured as innovations in state variables whose identification can be accomplished through simple and intuitive financial theory.

Capital Asset Pricing Model and Arbitrage Pricing Theory

Zhang (2001) applied APT and CAPM both to examine the financial performance on eight forestry-related investments. Although CAPM provided significant results as compared to the previous research done on timberland investments, they found that the results concluded by APT were more robust and beneficial. APT has constantly been tested globally to test its validity in the stock markets of the world. Atlay (2003) employed various economic variables which consider the basic indicator of an economy; from those economic variables, he derived the factor analysis process and factor realizations of principle economic phenomena for two countries Germany and Turkey. The idea behind employing macroeconomic variables is described to be just quantitative indicators of basic economic phenomena. He tested the period of January 1988 to June 2002 and January 1993 to 2002 for Turkey and Germany respectively. The tested macroeconomic variables are; consumer price index, wholesale price index, imports, exports, foreign exchange rate, average yield of public bonds, industrial production index, money market interest rate. He found evidence which turn to support APT for the German market but could not establish same for the Turkey market.

Chen et al. (1986) examined the validity of the APT in the US securities market. They used US macroeconomic variables for the underlying risk factors driving stock returns. The results showed that many of the macroeconomic variables used for the study were important and helpful in explaining the expected return derived from stock, especially in industrial production, variations in risk premium, and the shifts in the yield curve. Equilibrium versions of APT were also given as the equilibrium APT models of Connor (1984). Another study by Abizadeh (1988) examined the relation between risk and returns for mineral assets and concluded that APT is more efficient in explaining the returns for mineral assets than CAPM.

Dhankar and Rohini (2005) conducted a research to estimate the factors that influence stock returns in India. Through the analysis of the Indian stock market using monthly and weekly returns for 1991-2002, they concluded that APT with multiple factors provides a better indication of asset risk and estimates of required rate of return than CAPM which uses beta as the single measure of risk. Another study was conducted in Australia (Wang, 2008) in which he studied that whether the macroeconomic variables defined through Arbitrage Pricing Theory (APT) can explain the returns on the stock indexes in Australia. This research was based on the returns of stocks listed on the Australian Stock Exchange (ASX) during the period from 31 March 2000 to 31 December 2007. The research concluded that industry indices' returns can only be explained by three to five of the thirteen macroeconomic variables selected in the research. Empirical results suggest that macroeconomic variables, used in an APT framework, can explain consumer discretionary behavour, energy, financial, IT, and materials, price index returns, but cannot explain other index returns. Therefore, APT is a desirable model in examining the Australia Stock Exchange (ASX), as it explains half of the industry indices' returns.

Again, a significant study was conducted by Turgut (2008) in which they tested APT in the Istanbul Stock Exchange (ISE) from February 2001 to September 2005 monthly. They took 13 macroeconomic variables against 11 industry portfolios to analyze the effect of these variables on the returns of stocks. By virtue of the results they concluded that APT failed to explain relationship between macroeconomic variables and stock's returns.

Again, another important study was conducted in Indonesia (Herwany, 2010) in which the researchers wanted to investigate the ability of CAPM and APT in explaining the additional returns of portfolio of stocks traded in Jakarta Stock Exchange (JKSE). They used data from three important economic eras i.e. pre-crisis period (1992-1997), crisis period (1997-2001), and post-crisis period (2001-2007).

Consequently, the results were in the favour of APT as it proved that Beta is not the only factor that can explain the portfolio's additional returns. APT has proven to be right in explaining the portfolio excess returns in the periods in which they observed i.e. they found out that excess return averages are found to be consistently negative. They also found out that risk-premiums vary over the observation periods in which the study was conducted. Unfortunately, no such research has been done until now to test the APT model on stocks here. On the other hand, the first tests of CAPM on individual stock in the excess return form have been conducted by Lintner (1965) and Douglas (1968). They have found that the intercept has value much larger than *R*, the coefficient of beta is statistically significant but has a lower value and residual risk has effect on security returns. Their results seem to be a contradiction to the CAPM model. But both the Douglas and Lintner studies appear to suffer from various statistical weaknesses that might explain their anomalies results. The measurement error has incurred in estimating individual stock betas, the fact that estimated betas and unsystematic risk are highly correlated and also due to skewness present in the distribution of observed stock returns. Thus, Lintner's results have seemed to be in contradiction to the CAPM.

With reference to the test of CAPM on portfolios, one classic test was performed by MacBeth (1973). They have combined the time series and cross-sectional steps to investigate whether the risk premier of the factors in the second pass regression are non-zero. Forming twenty portfolios of assets, they have estimated beta from time series regression methodology, they then performed across sectional regression for each month over the period 1935–68 in the second pass regression. Their results have shown that the coefficient of beta was statistically insignificant and its value has remained small for many sub-periods. But in contrast to Lintner, they have found residual risk has no effect on security returns. However, their intercept is much greater than risk free rate and the results indicate that CAPM might not hold.

Scholes (1972) have tested CAPM by using time series regression analysis. The results have shown that the intercept term is different from zero and in fact is time varying. They have found when $\beta f 1$ the intercept is negative and that it is positive when β p 1. Thus, the findings of Black et al violate the CAPM.

Ferson and Harvey (1998) however, contend that the CAPM and APT have advantages and disadvantages as models of asset returns. The CAPM is seen as parsimonious and commonly employed by equity analysts, but requires a precious identification of the portfolio against which the asset is compared. On the other hand, Mosley and Singer (2007) contends that, APT accommodates multiple sources of risk and alternative investment, the model suffers from a similar challenge of identification since many factors, both international and domestic could influence an assets performance. The model, as with the CAPM, is subject to certain assumptions; the first of these being that investors may borrow and lend at the risk-free rate, there are no taxes and short selling of securities is unrestricted. The second assumption assumes that a wide variety of securities exist, thus risk unique to those securities may be diversified away, and lastly, investors are risk averse who aim to maximize their wealth.

The criticisms of the model have centered on the generality of the APT itself. The APT sets no theoretical foundations for the factors that should be included in ascertaining the risk-adjusted return of the capital asset, and furthermore does not state the number of risk factors that should be included. The APT also presents certain methodological issues relating to the estimation of the model. Cheng (1996) points out that the model may be sensitive to the number of independent variables included in the linear regression. Evidence of this was found by Günsel & Çukur (2007). However, in both cases it was found that the applicability of the APT in establishing asset returns may still be valid.

Empirical Review

Naik (2013) investigated the relationships between the Indian stock market index (BSE Sensex) and five macroeconomic variables namely, Industrial Production Index, Wholesale Price Index, Money Supply, Treasury Bills rates and Exchange rates. The study used monthly data for these variables over the period 1994:04–2011:06. The author employed Johansen's co-integration and vector error correction model (VECM) for their analysis. The result observed that in the long-run, the stock prices are positively related to money supply (M3). The study established that money supply causes stock prices only in the long-run but no causality from stock price to money supply as found either in the long run or in the short run. One possible explanation may be the fact that money supply changes have an indirect effect through their effect on real output which in turn impact the stock prices.

Osamuonyi and Evbayiro-Osagie (2012) also arrived at the same finding when they attempted to determine the relationship between macroeconomic variables and the Nigerian capital market index. The study used yearly data of interest rates, inflation rates, exchange rates, fiscal deficit, GDP and money supply from 1975 to 2005 employing Vector Error Correction Model (VECM) to study the short-run dynamics as well as long-run relationship between the stock market index and the six selected macroeconomic variables from the Nigerian economy. Money supply (M2) was found to have a significant but negative relationship with Stock Market Index in both the short- run and long run.

Sharpe (2002) examined stock valuation and inflation for the time period of 1965-2001 to check this he collects monthly historical annual operating income for S & P 500 from I/B/E/S International. The negative relation between equity valuations and expected inflation was found to be the result of two effects: a rise in expected inflation coincides with both lower expected real earnings growth and higher required real returns. The earnings channel mostly reflects a negative relation between expected long-term earnings growth and expected inflation. The effect of expected inflation on required (long-run) real stock returns is also substantial. He run the simple regression and concluded that there is strong negative relationship between stock returns and inflation.

The relationship between stock prices and interest rates has received considerable attention in the literature, though with mixed results. Using VECM model and yearly time series data for the period 19852008, Onasanya and Ayoola (2012) found that the stock macroeconomic variables do not significantly influence the return at the stock market. Interest rates, specifically was found to be negatively related and insignificant to stock market returns in Nigeria. Owusu-Nantwi and Kuwornu (2011) study of the impact of interest rates on stock market returns indicated that the variable is not significant for the stock market in Ghana. Interest rate as captured by 91-Treasury bill rate indicated a negative relationship with the stock market return when the authors employed Ordinary Linear Squares method with monthly data of 1992-2008. The results of the study were however in agreement with several studies under review in this study.

Uddin and Alam (2007) examined the linear relationship between share price and interest rate as well as share price and changes of interest rate. Also, they explored the association between changes of share price and interest rate and lastly changes of share price and changes of interest rate in Bangladesh. They found for all of the cases that Interest Rate has significant negative relationship with Share Price and Changes of Interest Rate has significant negative relationship with Changes of Share Price.

Adarmola (2012) having found an author studying the exchange rate volatility and stock market behavior in Nigeria, applied Johansen's Co-integration Technique and Error correction mechanism using quarterly data for the period of 1985 to 2009 and found that Exchange rate exerts significant impact on Nigerian stock market both in the short and in the long run. The study showed that in the short run, exchange rate had a positive significant impact on stock market performance; however, the results also showed that in the long run, the relationship is significantly negative. Jamil and Ullah (2013) found similar findings when they examined the impact of foreign exchange rates on stock prices for Pakistan by employing Co-integration Technique and Vector Error Correction Mechanism (VECM). Using monthly data from 1998 to 2009, they found that relationship exists between exchange rates and stock market returns, both in the short run and long run. The short run period was found to have a positive but significant relationship, while the long run relationship is not significant. The short run sensitivity of stock market returns to exchange rates indicates that the investments in the stock market are short term and most investors liquidate their stock within one year.

Aurangzeb (2012) arrived at the same conclusion when the author examined the factors affecting performance of stock markets of South Asian countries using monthly data for the period of 1997 to 2010 of 3 South Asian countries namely, Pakistan, India and Sri Lanka. The result showed that exchange rate has positive impact on the performance of stock markets of the three markets of South Asia.

The results of Maysami (2004), indicated a positive relationship between interest rates and stock market returns in Malaysia. The authors employed monthly data for the period of 1989 to 2001 with a Vector Error Correction Model. The disparities in these studies present an opportunity to collect Kenyan data and find out the relationship as per Kenyan situation, this further informs the current study of the role of interest rates on returns in the NSE.

From this literature review, several key conclusions can be drawn. First, while existing theories conjecture a link between macroeconomic variables and stock markets, they do not specify the type or the number of macroeconomic factors that should be incorporated. Thus, the existing empirical studies, reviewed in this chapter, have shown the use of a vast range of macroeconomic variables to examine their influence on stock prices (returns). Subsequently, while previous studies have significantly improved our understanding of the relationships between financial markets and real economic activity, the findings from the literature are mixed given that they were sensitive to the choice of countries, variable selection, and the time period studied. It is difficult to generalize the results because each market is unique in terms of its own rules, regulations, and type of investors.

The VAR framework, VECM method, co-integration tests, Granger causality tests, and GARCH models were commonly used to examine the relationships between stock prices and real economic activity. However, there is no definitive guideline for choosing an appropriate model. Finally, it is obvious that there is a shortage of literature concerning emerging stock markets, but it is particularly lacking in regards to the Kenyan Market. Indeed, of the empirical studies reviewed in this study, only two studies included the Kenyan market and examined the effect of the macroeconomic variables on its behavior. Still on Kenyan markets, of the reviewed literature, no specific one has attempted to examine the short run and long run dynamics of these variables on stock returns. Therefore, this study, to the best of our knowledge, will be among the first empirical studies to consider the relationships between the Kenyan stock market returns and a set of macroeconomic variables from 2003 to 2013.

Underlying CAPM and APT the assumption is that the return generating process is stationary. But researchers have found evidence that the expected market risk premium is positively related to predicted volatility of stock returns (French, Schwert & Stambaugh, 1987). Thus, inspire of a number of anomalies in hand, the CAPM has done the job as expected of a good model. In rejecting it, our understanding of asset pricing has enhanced. These anomalies are now stylized facts to be explained by other asset pricing models such as multifactor asset pricing models Ross (1976). These models are rich and more flexible than their competitor. Based on existing evidence, they have shown some promise to fill the empirical void left by rejecting the CAPM.

There are serious problems in empirically testing APT as well. Dhrymes, Friend and Gultekin (1984) have provided evidence that the number of common factors in test increases as the number of assets in sample increases or length of time period sampled increases. But Roll and Ross (1994) have responded that this would be expected. As additional securities or returns are collected, additional common factors might emerge. For example, as sample size increases, firms from a number of new industries might be included that share a common factor. Roll and Ross have pointed out that it is the number of priced factor which are important not the total number of factors. Shanken (1992) has also criticized the testing of APT. He has argued that by altering the portfolios construction changes risk premium and the returns that are examined on securities can mask or exacerbate the underlying factor risks in the economy. But this problem is less severe in individual stocks. In case of portfolios even the firms are not constantly changing the nature of their assets portfolio, as in the case of mutual fund. The major criticism is that APT is silent regarding the particular systematic factors effecting a security risk and return. Investors must fend for themselves in determining these factors.

Oil Price Movement and Stock Market

The International Monetary Fund (2000) argues that changes in the oil price affects economic activity, corporate earnings, inflation and monetary policy which also have implications for asset prices of a company and thereby also the financial markets. In the following, there will be given a short introduction to the efficient market hypothesis and the link between oil price movements and the stock market.

Bjørnland (2008) argues that current and future information about the economic conditions facing the firm determines the asset prices on the stock market. There is extensive literature that study how efficient stock markets are to process new information. The most famous studies are made by Fama (1970) which suggests that a market is efficient when the asset price fully reflect all the information available of current and future returns (Fama, 1970). Based on this hypothesis of efficient markets, it would be reasonable to expect that in companies where oil is either an input or an output, the stock market would quickly absorb new information of an oil price change, and incorporate it into the stock price. Further, it is also assumed that the asset prices are calculated by taking the present discounted value of future net earnings of the firm. In these cash flows the current and future impacts of oil price changes are incorporated, and thereby also incorporated into the stock prices (Bjørnland, 2008).

In this study, oil price are incorporated in the stock prices. There are different channels in which oil price shock may affect the stock price. Seen from a microeconomic perspective, the most obvious is the fact that for a lot of companies, oil is an important resource and essential input in the production of goods.

In this way, a change in the oil price will certainly have an impact on the costs, as any other input variable, and changes in expected costs further impacts the stock price (Huang, 1996). A study by Nandha and Faff (2008) analyses 35 global industry indices for the period between 1983 and 2005. Their findings show that oil prices have a negative impact on equity returns for all the industries except mining, and oil and gas industries. Faff and

Brailsford (1999) obtained the same negative impact of oil price shock on industries like paper and packaging, banks and transport. Furthermore, there are some industries that are in a better position to pass on the extra costs inflicted by an increasing oil price, and thereby minimizing the negative impact on their profitability. In addition, the financial markets offer great opportunities for hedging against a higher oil price (Nandha & Faff, 2008).

Although the above literature suggest that higher oil prices are generally bad news for stock price in most oil input industries, the same is not true for industry in which oil is an output of the production. Assumed that a company is able to uphold the same level of sales as before an increase in the oil price, the revenue of the company would be expected to rise. Therefore, it would make a large difference whether oil is an output instead of an input in a company. A paper by El-Sharif et al. (2005) examines the relationship between the price of crude oil and the equity prices in the oil and gas industry in the UK. Their evidence shows that there exists a positive relationship between the two factors, and that it is often significant and reflects a direct impact of volatility in the price of oil on equity prices. Similarly, other studies made by Huang (1996), Faff and Brailsford (1999), Nandha and Faff (2008), reached the same conclusion on the relationship between the price of oil and the oil and gas industry for several different countries.

Arguing from a macroeconomic perspective Basher and Sadorsky (2006) argue that as a consequence to an oil price hike, importers of oil will have less disposable income to spend on other goods and services and for this reason needs to search for alternative energies. Furthermore, they argue that the non-oil producing countries will face higher costs and risks because of the uncertainty that follows with a volatile oil price, which also will affect the stock prices and reduce wealth and investment. On the other hand, Le and Chang (2011) argue that for oil exporting countries an oil price increase will have a positive impact in the form of higher incomes and wealth effects. Bjørnland (2009) also argues that "higher oil prices represent an immediate transfer of wealth from oil importers to oil exporters". Furthermore, she argues that if governments use the additional income to purchase goods and services domestically, this would result in an improving economy which would also have a positive effect on the stock markets.

A more indirect channel in which a change in the expected oil price may have an effect on stock returns, is via the discount rate (Anoruo and Mustafa 2007). The expected discount rate is composed by taking the expected inflation rate and the expected real interest rate. Further, both of these may also depend on the expected oil price. Huang (1996) suggest that by considering a country that is a net importer of oil, a higher oil price will have a negative effect on the trade balance. This will in turn put a downward pressure on the foreign exchange rate, and an upward pressure on the inflation rate. Consequently, an increase in the inflation rate, results in a higher discount rate and hence lower stock returns. Further, Huang (1996) suggest that since the oil is a commodity, the oil price can be used as a proxy for the inflation rate. Cologni & Manera (2008) confirms the results of Huang, Masulis & stoll (1996) arguing that unexpected oil price shocks are followed by an increase in inflation rates.

Furthermore, Huang (1996) suggest that the oil price has an influence on the real interest rate. This assertion is based on that a higher oil price, relative to the general price level, cause an increase in the real interest rate. This in turn increases the hurdle rate on corporate investments, and thereby causes a decline in the stock prices. Hence, it can be assumed that a higher oil price by itself can put an upward pressure on the real interest rate (Huang, 1996). This connection between the oil price and the interest rate is also found in the paper by Park and Ratti (2008). They find that an increase in the real world, oil price significantly raises the short-term interest rate in the US and eight European countries. This is also consistent with the result in the paper by Sadorsky (2001) and Papapetrou (2001). They argue that a higher oil price increases the costs of production and puts inflationary pressure on the economy, which in turn bring an upward pressure on interest rate. Based on the discussion in this section it is expected that fluctuations in the oil price have an impact on stock returns.

Huang (1996) cited in study the relationship between oil futures returns and stock returns in the U.S. during the 1980s. By using a multivariate vector auto regression, they examine the linkages between oil prices and the stock market on three different levels; first for the stock price index S&P 500, second, for 12 stock price indices, and third for 3 different oil companies. They do not find the oil future returns to have much impact on the S&P 500, but find that oil futures do lead some individual oil company stock returns.

Salisu and Isah (2017) re-examine the relationship between oil price and stock prices in oil exporting and oil importing countries in the following distinct ways. First, we account for possible nonlinearities in the relationship in order to quantify the asymmetric response of stock prices of these two categories to positive and negative oil price changes. Secondly, in order to capture within group differences, we allow for heterogeneity effect in the cross-sections by formulating a nonlinear Panel ARDL model which is the panel data representation of the Shin et al. (2014) model and also analogous to the non-stationary heterogenous panel data model. Thirdly, we evaluate the relative predictability of the linear (symmetric) and nonlinear (asymmetric)

Panel ARDL models using the Campbell and Thompson (2008) test. Our results depict that stock prices for oil exporting and oil importing countries responded asymmetrically to variations in oil price. Even though the response in the latter is stronger than the former. This finding is further supported by the out-of-sample forecast results which suggested that the inclusion of positive and negative oil price changes in the predictive model for stock prices produces better forecast results only for the oil importing countries. In all, the irreconcilable difference between oil exporting and oil importing countries has implications on oil price-stock nexus.

An earlier work which followed the path of Sadorsky (2001) is Salisu and Isah (2017). Though their finding are somewhat the same, the methodology used in the two studies are different investigates the relationship between oil price and stock returns using an unrestricted VAR for the U.S. The analysis is made by using monthly data between 1947 and 1996, and the variables included in the model are industry production, interest rate, stock returns and oil price. Sadorsky run three different tests to study the relationship between the oil price and stock returns. First, he studies the impact of oil price shocks on stock returns. Second, he tests for asymmetric oil price shocks. Third, he examines if there is asymmetric oil price volatility shocks. The evidence shows that the oil price shocks have a statistically significant negative impact on stock returns. Further the results suggest that positive oil price shocks have a large impact on the stock returns than the negative stock returns. Finally, he finds asymmetric effects between oil price volatility shocks and the stock return.

Similarly, Ciner (2001) is testing for both linear and nonlinear linkages between the stock return in the U.S. and oil futures return. The test is made by conducting a Granger causality test within the context of a VAR model. Results from the 1980s and the 1990s do not indicate a linear Granger causality between oil futures and stock returns. On the other hand, the results provide evidence of a nonlinear relationship between the U.S. stock return and the oil future returns.

Papaetrou (2001) use a multivariate VAR model to investigate the dynamic relationship between oil prices, economic activity and employment in Greece. The empirical analysis is conducted with monthly data for the period 1989-1999. The variables employed in the VAR models are real oil price, interest rate, real stock return, industrial production and industrial employment. The empirical results show that, oil price shocks have an immediate negative impact on the stock market. Therefore, a positive oil shock will have a negative impact on stock returns. In contrast to the majority of the other papers Maghyereh (2004) examines the relationship between oil price shocks and stock markets in 22 merging economies. He employs a VAR model, but instead of monthly data he uses daily data in the analysis for the period between 1 of January 1998 to 31 of April 2004. The empirical results suggest that oil price shocks do not have a significant impact on stock markets. Furthermore, he finds that oil price shocks explain very little of the forecast error variance.

Park and Ratti (2008) use a multivariate VAR analysis to study the effects of oil price shocks and oil price volatility on the stock returns of the US and 13 European countries from 1986 to 2005. As in the paper made by Cunado and de Gracia (2003), they also use three different proxies for oil price change: the linear oil price shock, and two nonlinear oil price variables given by a scaled real oil price change, and a net oil price increase. Park & Ratti use four different variables in their VAR analysis: stock prices, short-term interest rates, industrial production, and the oil price. Their findings show that for the majority of the countries the linear oil price shock have a statistically significant negative impact on stock returns. One of the exceptions is the stock return of Norway which is positively impacted by a oil price shock. The same results are also true when the scaled oil price is used as the oil price variable. When the net oil price variable is used as oil price variable, the results are only statistically significant negative for a minority of the countries. Further they find that in all the countries but the US an increase in the oil price volatility significantly depress the stock returns. Finally, despite the findings for the US and Norway, there is little evidence that suggests an asymmetric effect on real stock returns of positive and negative oil price shocks for oil importing countries.

Cong (2008) investigate the relationship between oil price shocks and the Chinese stock market. They implement a multivariate VAR model for the period 1996-2007. In the VAR model, they include 5 different variables: short term interest rate, industrial production, real oil price, consumer price index and real stock returns. As opposed to some of the earlier studies they do not find a statistically significant impact on the stock returns. Neither do they find any statistically significant asymmetric effects on stock return, or any significant impacts from increased oil volatility.

Bjørnsland (2008) studied the effect of an oil price shock on the stock return in Norway in the period 1993-2005. She uses a structural VAR model that includes seven variables, and defines four different proxies for oil price change. The evidence shows that an increase in the oil price of 10%, immediately increase the stock returns by 2-3%. The maximum effect is reached after 14-15 months where it has increased by 4-5%, after this it eventually dies out. The results are also robust for transformations into different linear and nonlinear oil prices.

Odusami (2009) employ an asymmetric GARCH-jump model to analyse the relationship between crude oil price and the U.S. stock market. He uses daily data from January 1996 to December 2005, and finds a significant nonlinear negative relationship between oil price shocks. Finally, Ono (2011) examines the impact of oil prices on real stock returns for Brazil, Russia, India and China (BRIC). He utilizes a VAR model with data from January 1999 through September 2010 to test the responses to linear, non-linear and asymmetric oil price shocks. The results suggest that the real stock returns of China, India and Russia responded statistical significant positively to some of the oil price indicators, while the results were not statistical significant for Brazil. Furthermore, the paper found a statistically significant asymmetric effect for India, while in the cases of Brazil, China and Russia no asymmetric effects were found.

Chapter Summary

This chapter summarizes the literature on stock market prices. The chapter however started with the stylized fact of the stock market development in Ghana. Afterward, the chapter presented the review on capital pricing theories starting from efficient market hypothesis to Capital Asset pricing models. The review suggests that the works on oil price and stock market prices are limited to developing economies. The few papers on developing economies are scanty. This reveals the need for the current study on Ghana which is a net oil import economy. The theoretical literature reveals that for this study, the APT is the appropriate theory. This is because, it allows for the inclusion of several factors and allows us to model stock price in a multifactor frame work.

Also, it is clear that this study present current information in the form of data. And provide literature on developing economy like Ghana. This will add to the empirical literature on stock price. More so, all the studies uses crude oil prices however, this study uses fuel prices as a proxy for oil price which is a novelty in the literature on developing economies.

CHAPTER THREE

RESEARCH METHODS

Introduction

This chapter presents the methodology of the study. The chapter is divided into various sections. The chapter first presents the research design for the study. The design follows by theoretical model from which the empirical model was presented. The justification for inclusion of variables and their a priori expected signs are presented. This is followed by Data and sources of data. The chapter then gives the estimation techniques for the study.

Research Design

Babbie (2005) posits that research design involves a set of decisions regarding what topic is to be studied, among what population, with what research methods and for what purpose. In other words, it is the overall plan for obtaining answers to questions or testing research hypotheses. It outlines the various stages involved in the research. This study therefore applies a quantitative research design using time series approach. As espoused by Kothari (2004) quantitative research approach involves the generation of data in quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion. This allows for test of causality and relationship in and test for association between variables which this study seeks to do.

Data Source(s)

Time series data was used in the empirical work. The data covered the period January, 2003 to December, 2014. For stock prices, the study proxied it with GSE All share index which was obtained from the Ghana Stock Exchange in monthly form. The monthly oil prices were obtained from the

National Petroleum Authority (NPA). Other variables which were included in the model were obtained from Bank of Ghana and World Development Indicators data set.

The monthly data was used due to the fact that other controlled variables were available in monthly data form not weekly. Lin (2014), explained further that the use of daily data often induces potential biases arising from, among others, the bid-ask bounce, non-synchronous trading days and the effects of illiquidity on asset prices, while monthly data may mask some volatility transmission mechanisms due to time aggregation and compensation effects.

However, due to un-availability of data on daily and weekly observation on all the variables used, the study employed monthly frequency data for the study. It must be said that, this does not affect the quality and the recommendation that emanate from the study.

Model Specification

This study aims to estimate the effects of oil prices on stock performances in the Ghanaian economy. Variables such as Cedi-US Dollar Exchange rate, Interest rate, Inflation rate and Money Supply are added as control variables to this relationship as cited by Sadorsky (1999). Therefore the following mathematical function can be proposed in this research study.

$$S_t = \text{f}\,((O_t, E_t, IR_t, CPI_t, MS_t) \qquad 1$$

Where ‘’S” is the stock prices in period t, “E” represent Exchange rate in period t, “IR” for Interest Rate in period t, “CPI” for Consumer Price Index, (inflation rate) in period t ‘MS” for Money supply in period t and “O” for oil prices in period t.

The Mathematical function in equation (1) can be written in linear and double logarithmic system in order to estimate elasticity coefficients of each explanatory variable. This also helps to estimate the growth effects as also suggested by Katircioglu (2010):

$$\ln S_t = \beta_0 + \beta_1 lnO_t + \beta_2 ln\, E_t + \beta_3 ln\, IR_t + \beta_4 ln\, CPI_t + \text{â}_5 ln\, MS_t + \text{å}_t$$

2

In equation (2), the terms **"*ln*"** stands for the natural logarithm of each variable while å_t stands for white noise error term of this long run model.

Definition and Justification of Inclusion of Variables

The purpose of this research is to examine the effect of oil prices changes on the stock prices of the Ghana Stock Exchange. However, modelling the stock prices of the Ghana Stock Exchange against merely oil price would tend to generate serious estimation complications due to Omitted Variable Bias (OVB). Barreto and Howland (2006) observed that the OVB arises when the relationship between two variables is explained, but important variables that correlate and, or have a significant relationship with the dependent variable are excluded. It is therefore imperative to include other important variables that are argued to affect the relationship to avoid such a bias. Following previous empirical studies on oil price changes and stock returns, this study therefore includes other explanatory variables in the analysis such as Cedi-US dollar Exchange rate, Interest rate, and Inflation rates (See Sadorsky, 1999; Basher & Haug (2008) among others).

Interest Rate

The inclusion of interest rate is based on Bernanke (1997). Following the direct channel of oil price changes on economic activity, Bernanke (1997) also took into account an indirect effect of oil price shocks on real economic activity due to central bank's response to higher oil prices. Sadorsky (1999), Trung 2009, Park and Ratti (2008) among others, also include interest rates when they analyse the impact of oil price changes on stocks. Interest rate is argued to be an important variable that affect stock market indicators (Adam & Tweneboah, 2008; Acheampong & Wiafe, 2013). It serves as a discounting factor on future cash flow streams. Due to the discounting effect, it is expected that if interest rates are high in an economy, investment in stocks are likely to fall leading to a fall in price of stocks. It is therefore expect interest rate to be negatively related to stock prices. Therefore, with the inclusion of interest rate. The variable interest rate is measured by the prime rate of the central bank. This is due to the fact that data on savings rate or deposit rates are hard to come by.

Inflation Rate

Economic theory states that inflation reduces the purchasing power of business cash flow thereby changes in inflation is expected to affect the purchasing power of businesses, thus it is expected that inflation will correlate negatively with stock returns and inflation rate by Consumer Price Index (CPI). Empirically, Adu (2012), Tabale (2006) and Abugri (2008) have given evidence on its explanatory power of stock returns. Higher inflation rate is expected to lead to a fall in stock prices since it indicates a measure of instability thus, investor would see investment in GSE as highly risky. Earlier studies like Ayadi, (1991) and Ekpenyong and Obieke, (1994) also found inflation to be an important variables in explaining stock prices. Chen (1986) records a negative association while Beenstock and Chan (1988), report a positive relationship with stock returns.

Exchange Rate *(E)*

Due to the use of monthly data, this study uses the bilateral exchange rate between the Ghana Cedi and US dollar exchange rate is translated into the cost for importing raw materials and other inputs. The exchange rate therefore affects business cash flow and hence the amount of oil expenses paid. Hypothetically, exchange rate will inversely relate stock returns. Empirical literature available such as Adu (2012), Tabak (2006) and Abugri (2008), have given evidence on its explanatory power of stock returns.

Oil Prices (O)

Killian and Park (2009), Rafailidis and Katrakilidis, (2014) and Salifu and Isah (2017) among others provide evidence that oil prices affect stock returns. Butt et al., (2009) conclude that while increases in oil prices negatively affect industrial production and stock returns, the effect on stock returns is stronger than that on industrial production. Ghana is a net oil importing country. Changes in the price of oil will therefore affect corporate profitability and, in turn, oil expenses payments through their effect on industry operational costs. Hence, it is expected that oil price increases will be negatively correlated with stock price. Oil prices were measured by domestic petroleum prices.

Money Supply

Increase in money supply increases the liquidity in an economy. High liquidity affects the risk free interest rate in an economy and thereby affecting the cost of capital and expected returns on investment in a country. It is therefore expected that money supply could affect the performance of stock either negatively or positively. Mishkin (2004) argues that expansionary monetary policy leads to increase in asset prices through the price channel. This is due to the fact that spending capacity is increase during expansionary monetary policy regimes. Part of this capacity may be directed at stock markets leading to higher demand and eventual rise in prices.

Estimation Technique

This thesis examined the effect of oil price changes on stock performances of the Ghana's Stock Exchange, therefore this study made use of econometric procedures such as Vector Autoregressive (VAR) and Vector Error Correction (VAR/VEC) Model, Granger causality in addition to co-integration test were also employed to examine the impact of oil price changes on the stock prices of Ghana Stock Exchange Composite Index. The relationship between oil prices and stock sectors has also been recently examined by several studies which mostly apply the standard VAR/VEC model (see Miller & Ratti, 2009 and many others). The following empirical analysis will be conducted:

- The study employed the Augmented Dickey-Fuller (ADF) test to verify the time series properties of the data and the Phillip-Perron (PP) test will also be used to confirm the estimates of the ADF test. The order of integration of the variables will be ascertained through the unit root test.
- In the second step, the study did test for the number of co-integrating vectors in the system in the bid to verify the existence or otherwise of

long run co-movement between the variables using Johansen co-integration test.

- The study estimated and tested for the co-integrating relationship in the framework of a vector error correction model (VECM); h o w the key variables respond to exogenous shocks using the variance decomposition analysis.
- In the fourth step, the study incorporated the long-run information present in the co-integration vector along with short –run directional information contained in the error correction model to obtain a forecast of stock prices
- In the final step, Granger-causality to test is done to ascertain causality. Our causality test is preceded by co-integration testing since the presence of co-integrated relationships have implications for the way in which causality testing is carried out.

Unit Root Tests

Nelson and Plosser (1982) observed that majority of the time series macro-economic data are either non-stationary or have a unit. Harvey (1990) described non-stationary as one where the moments (mean, variance and covariance) of the distribution from which series observations were drawn are time-variant; they depend on the point in time at which the observations were realized. A combination of variables that is non- stationary may lead to spurious regression results (Granger & Newbold, 1974). Therefore, embarking on studies involving time series data necessitates that stationary test is conducted to establish the underlying process of the data series.

Stationary test is expected to be the first step in the time series regression analysis. This is due to the fact that there is the need to distinguish between stationary and non-stationary variables in order to come up with statistically reliable results. Granger and Newbold (1974) and Stock & Watson (1988) have shown that running regression on non-stationary data using OLS estimation produces spurious results. One way to remedy non-stationarity is by differencing the variables to make them stationary in order to obtain consistent parameter estimates, though this may lead to a loss of long-run properties of the data (Gujarati, 2001).

Various tests have been developed to test for the stationarity of macro-economic time series data. These include the Dickey-Fuller (1979) test, Augmented Dickey-Fuller (1981) test and Phillips-Perron (1988) test. The Augmented Dickey-Fuller (ADF) test which is widely used due to its simplicity and thoroughness was employed to test forth the presence of unit roots in all the variables. To check for the robustness of the ADF unit root test, Phillips-Perron (PP) test was also carried out.

The ADF and PP unit root tests were employed in order to ensure reliable results of the test for stationarity due the weaknesses in each method. These tests are similar except that they differ with respect to the way they correct for autocorrelation in the residuals. The null hypothesis to be tested is that the variable under investigation has a unit root (is not stationary). In each case, the lag-length is chosen using the Akaike Information Criteria (AIC) and Schwartz Information Criterion (SIC) for both the ADF and PP test but priority was given to AIC since Adam and Tweneboah, (2008) maintains that the SIC has the tendency of underestimating the lag order. The sensitivity of

ADF tests to lag selection renders the PP test an important additional tool for making inferences about unit roots. The basic formulation of the ADF is specified as shown in equation 3.

In general terms, we specify economic models based on the assumption that the variables are stationary. After the model has been specified, the variables are then tested for unit root (stationarity) using the Augmented Dickey-Fuller (ADF) tests. The simplest form of the unit root test or stationarity follows a simple random walk. We estimate an Autoregression *AR (1)* which is given below.

X_t = áX_{t-1} + å$_t$ å$_t$ ~ *iid(O,*ó$^2_{\text{å}}$*)* *3*

From the stated equation, the assumption is that the underlining data generating process is $AR(1)$. Thus, it is assumed that the variable X is influence by the past observation and an innovation (shock), ε_t is a white noise process. The variable is pure random walk, thus $\alpha = 1$. Since the X_t is a random walk, it follows that, the variable is not integrated at the level hence there is the need to difference it to induce stationarity and find the order of integration (Koop, 2003 & Ender, 2005). By taking the differential of X_t gives:

ΔX_t = (1 − á)ΔX_{t-1} + å$_t$ 4

It must be noted that the above regression is an example of what is sometimes called an unbalanced regression since, under the null hypothesis, the regression is I(0) and the sole repressor is I(1). Under the alternative hypothesis, both variables are I(0), and the regression becomes balanced again (Davison and Mackinnon, 1999). To test for stationarity among variables, the test follows an Ordinary Least Squares approach by estimating the above equation (Green, 2012). The Dickey-Fuller equation following the above equation can be given as.

$$\Delta X_t = \text{ñ}\Delta X_{t-1} + \text{å}_t \qquad 5$$

It follows that if

$\rho = (1-\alpha)$,

and $\rho = 0$ then $\alpha = 1$

and if $\rho < 0$ then $\alpha < 1$.

Therefore, the Dickey-Fuller test the hypothesis for stationary / unit root on the behaviour of the ρ. It must be said that the DF test is a negative tail test (Enders, 2005: Hamilton, 1993; Hayashi, 2000). The hypothesis for the unit root test is given as:

$H_o : \rho = 0$ (There is unit root-non-stationarity)

Against the alternative

$H_a : \rho < 0$ (There is no unit root-stationarity)

The DF test uses three basic underlining equations in testing for the presence of unit root of any time series data. The first formulation is the basic AR (1) with no constant (drift) term or deterministic trend. The second formulation includes a drift and the third formulation includes a drift and a deterministic trend term in the model. These variants are expressed in the following equations.

$$\Delta X_t = \text{ñ}X_{t-1} + \text{å}_t \qquad 6$$

$$\Delta X_t = c + \text{ñ}X_{t-1} + \text{å}_t \qquad 7$$

$$\Delta X_t = c + \text{ä}t + \text{ñ}X_{t-1} + \text{å}_t \qquad 8$$

The variables c and t are constant and trend terms respectively. Equation (8) is however very restrictive in the underlining assumptions.

The augmented Dickey–Fuller (ADF) unit root test is used to determine whether the variables are of stationary status by examining controls for higher-order correlation. This is accomplished by adding lagged differences of the dependent variable of the regression model. The Augmented Dickey-Fuller test (Dickey and Fuller, 1979) involves running a regression on first difference on the time series itself, lagged difference terms, a constant and a time trend.

$$\Delta Y_t = c_1 + c_2 t + c_3 X_{t-1} + \ldots + c_ñ \Delta X_{t-ñ} + å_t \qquad 9$$

Where

Y denotes the variable in question, Δ is the first difference operator, and $c_1, c_2, c_3, \ldots, c_p$ are parameters to be estimated, and ε_t is the stochastic random disturbance term.

It would seem natural to assess the significance of the ADF statistic using the normal table. However, under H_0, X_t *is* non-stationary, so conventional normal asymptotic are invalid. An alternative asymptotic framework has been developed to deal with non-stationary data. The limit distributions DF_p and DF_t are non-normal (see Lukephol, 2005 for extensive derivation of the asymptotic distribution on unit root). They are skewed to the left, and have negative means. The first result states that *p* converges to its true value (of zero) at rate *T*, rather than the conventional rate of $T^{1/2}$. This is called a "super-consistent" rate of convergence. The second result states that the t-statistic for *p* converges to a limit distribution which is non-normal, but does not depend on the parameters α. This distribution has been extensively tabulated, and may be used for testing the hypothesis H_0. The standard error $s\ (\hat{\rho})$ is the conventional ("homoscedastic") standard error. But the theorem does not require an assumption of homoscedasticity. Thus, the Dickey-Fuller test is robust to heteroscedasticity (Hansen, 2006).

The ADF calculated (tau statistic) is compared with the critical value. If the tau value is more negative than the critical values, we reject the null. The conclusion drawn in such case is the series are stationary. Conversely, if the tau statistic is less negative than the critical values, we fail to reject the null hypothesis and conclude that the series is non-stationary. This is because, the alternative hypothesis is one-sided, the ADF test rejects H_0 in favour of H_1 when ADF $< \varsigma$, where ς is the critical value from the ADF table. If the test does not reject H_0, a common conclusion is that the data suggests that X_t is non-stationary. This is not really a correct conclusion however; it could be said that there is insufficient evidence to conclude whether the data are stationary or not. Yet, in the implied sense, we can say that the variables are not stationary.

If the variables are not stationary, linear regression techniques could result in highly correlated result among the variables. In such series, the value of any given data would be determined largely by the value of the preceding data point in the series. This autocorrelation must be controlled before inferences may be made about the correlation with other variables. If not controlled, this would lead to spurious results (Yule cited in Gujarati, 2001).

Enders (2005) mentioned that the selection of an appropriate lag length is as important as determining which variables to be included in a VAR system. Though one possible means of achieving this is to allow for different lag length for all equations, it is common to use the same lag length for all equations since this preserves the symmetry of the system. One of the main challenges of the VAR, however, is to choose the optimal lag length. If it is too small, then the model may be mis-specified due to omission of relevant variables. If it is too large the degrees of freedom is wasted. In other words, a model with a relatively large number of lags is most likely to produce residuals that approach a white noise process but might not be parsimonious.

On the other hand, a model with small value of the lag length is more likely to be parsimonious but might not produce residuals that are random enough to approach a white noise process. The above problem implies that there is the need to select an optimal lag length for the VAR. The F-statistics approach to selecting the optimal lag length is considered inappropriate for this study on the basis that it is tedious to use and as well has the tendency to produce too large a model, at least some of the time (Stock & Watson, 2003). The study employs the information-based criteria for selection the optimal lag length for the model. These have the advantage of selecting an optimal lag length that ensures a parsimonious model, while at the same time ensuring that the errors approach a white noise process.

Both the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) or Schwarz Information Criterion (SIC) have the common objective of selecting a model that produces errors that approach a white noise process as much as possible, subject to the constraint that the smallest possible number of lag terms or estimated parameters is included to ensure parsimony as well. When this objective is achieved, the number of lags that minimizes the BIC is consistent estimator of the true lag length. On the other hand, the constraint in the AIC formula is not large enough to ensure that the correct lag length is chosen, even in large samples so that the AIC estimator of the true optimal lag length is not consistent.

Nevertheless, as suggested by Stock and Watson (2003), AIC provide a reasonable alternative to BIC if one is concerned that the BIC might yield a model with too few lags. Based on this, the study will use the two criteria to select a value for the optimal lag length. Because time series is auto correlated, the ADF test is usually used to take into account the white noise process based on the introduction of the lagged difference term. If the t-statistics from the stationary equation is greater than the critical values, we reject the assumption of non-stationarity (unit root) and otherwise.

Co-integration

In the face of non-stationary series with a unit roots, first differencing appears to provide the appropriate solution to the problems. However, first differencing has eliminated all the long-run information which economists are invariably interested in. Later, Granger (1986) identified a link between non-stationary processes and preserved the concept of a long-run equilibrium. Two or more variables are said to be co-integrated (there is a long-run equilibrium relationship), if they share common trend. Co-integration exists when a linear combination of two or more non-stationary variables is stationary.

Johansen and Juselius Approach to Co-integration

Once pre-testing has demonstrated that the variables are integrated of the same order, OLS is used to estimate the parameters of a co-integrating relationship. It has been shown that the application of OLS to I (1) series yields super-consistent estimates. That is estimates converge on to their true values at a faster rate than the case if I (0) or stationary variables are used in estimation. Then, these parameter values are used to compute the residuals. Co-integration tests are the test for stationarity of the residuals by using DF and ADF tests. If the residuals are stationary, there exists one co-integrating relationship among variables and it will rule out the possibility of the estimated relationship being "spurious". Since the residuals are estimated by OLS, by construction the residual variance is made as small as possible, the test is prejudiced towards finding a stationary error process. The test is also sensitive to how the equation is presented (i.e. whether x is regressed on y or vice versa). Finally, if there are more than two variables, the Engel and Granger (hereafter, EG) procedure will not allow discrimination between different co-integrating vectors.

Given these limitations of the EG procedure, several methods have been developed for testing co-integration. One of the most popular is the Johansen and Juselius cointegrating (JJ) procedure. They include the Fully Modified Ordinary Least Squares (FMOLS) procedures of Phillips and Hansen (1990), the Johansen (1988, 1991) or the Johansen and Juselius (1990, 1992) and the Autoregressive Distributed Lag (ARDL) approach by Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001) to determine the long-run relationship in bivariate and multivariate frameworks.

Johansen (1988) and Johansen and Juselius (1992) particularly developed multivariate method that explicitly used the vector autoregressive (VAR) and the vector error correction (VECM) framework for the testing of the presence of co-integration and estimation of long-run and short-run relationships among non-stationary macroeconomic time series. The VAR and VECM provide a useful framework to study the impact of unanticipated shocks (individual and system) on the endogenous variables (impulse response functions). Additionally, we can identify the relative importance of each variable in explaining the variations of endogenous variables (variance decomposition analysis). Moreover, both long-run (co-integration) relationships and short-run dynamics of the variables in the system can be established. The relationship between VAR and VECM is expressed as follows. Assume an unrestricted reduced form VAR (p):

$$X_t = \text{ä} + \text{ö}_1 X_{t-1} + \ldots + \text{ö}_{\text{ñ}} X_{t-k} + e_t \qquad 10$$

Where

$[X]_t$, X_{t-1}... $[X]_{t-k}$ are 1x7 vector of integrated series of order one (where $[X]_t$ is made up of logs of “S” is the stock prices in period t, “E” represent Exchange rate in period t, “IR” for Interest Rate in period t, “CPI” for Consumer Price Index (inflation rate) in period t and “O” for oil prices in period and money supply), $[\varphi_1]$... $[\varphi_p]$ are a vector of coefficients to be estimated, $[\delta]$ is a vector intercepts. while $[e]_t$ is a vector of error terms and k denotes the lag length of the series.

Since there are only lagged values of the endogenous appearing on the right-hand side of the equations, simultaneity is not an issue and OLS yields consistent estimates. Estimation of equation (14) requires that $[e]_t \sim ID(0,\Omega)$ where Ω is non-diagonal covariance matrix that remains constant overtime. Following Johansen (1991) and provided that the variables are integrated of order one and co-integrated, using Δ to represent the first differences, equation 10 is transformed into an equilibrium error correction model of the form:

$$X_t = \text{ä} + \sum_{i=1}^{k-1} \text{Ö}_i \, \Delta X_{t-1} + \prod X_{t-k} + \text{å}_t \qquad 11$$

Where

$$\Phi_i = -(\varphi_{i+1} + \ldots + \varphi_k),\ i = 1, \ldots, k-1,\ \text{And}\ \prod_i = -(I - \varphi_1 - \ldots - \varphi_k)$$

Φ_i: represents a 5x5 matrix of coefficients of the first difference variables that capture the short-run dynamics.

The coefficients of the lagged dependent variable indicate inertia as well as the formation of expectations. The coefficients of the other lagged endogenous variables provide estimates for impact assessment.

For the long run information, matrix $\prod$ coefficients provide information about the long-run relationships among the variables used in the model. Again, if the rank condition of $\prod$ satisfied, then decomposed to obtain $\prod = \theta\beta'$.

The error correction representation is:

$$\Delta X_t = \text{ä} + \text{Ö}_1 X_{t-1} + \text{Ö}_2 X_{1-2} + \ldots + \text{Ö}_{\text{ñ}-1}\Delta X_{t-p+1} + \text{è}(\text{â}X_{t-p}) + \text{å}_t \qquad 12$$

Where the columns of β are interpreted as distinct co-integration vectors providing the long-run relationships $(\beta' X_t)$ among the variables, and $\theta's$ are the adjustment or error correction coefficients indicating the adjustment to long-run equilibrium. β contains the coefficients of the r distinct co-integrating vectors giving $\beta' X_t$ stationary (X_t may not be stationary).

One major problem in the estimation of VAR and VEC models is the selection of an appropriate lag length. Thus, strictly speaking, in an m-variable VAR model, all the m variables should be stationary. The lag length plays a crucial role in diagnostic tests as well as in the estimation of VECM and VAR models (Bhasin, 2004). As a result, appropriate lag length (p) will be chosen using standard model selection criteria (AIC and SBC) that ensure normally distributed white noise errors with no serial correlation.

Johansen (1988) co-integration techniques allow us to test and determine the number of co-integrating relationships between the non-stationary variables in the system using a maximum likelihood procedure. There are two tests to determine the number of co-integrating vectors namely, the trace test and the maximum Eigen value test. They are defined as follows:

$$\ddot{e}_{trace}(r) = -\hat{O}\sum_{i=r+1}^{n} \ln(1-\ddot{e}_i) \qquad 13$$

$$\ddot{e}_{max}(r,r+1) = -\hat{O}\ln(1-\ddot{e}_{r+1}) \qquad 14$$

Where λ_i the estimated value of the characteristic roots, T is the number of usable observations, and *r* is the number of distinct co-integrating vectors.

In the trace test, the null hypothesis (H_0) is there is at most r co-integrating vectors (r=0, 1, 2...) is tested against a general alternative. Alternatively, in the maximum eigenvalue test, the null hypothesis $(H_0 : r = 0)$ is tested against an alternative $(H_0 : r = 1)$. This is followed by $(H_0 : r = 1)$ against $(H_0 : r = 2)$, and so on. The trace and maximum Eigen value statistics are compared with the critical values tabulated in Osterwald-Lenum (1992). The distribution of the statistics depends on the number of non-stationary components under the null hypothesis and whether or not a constant is included in the co-integrating vector.

Variance Decomposition

The variance decomposition provides complementary information for a better understanding of the relationships between the variables of a VAR model. Enders (2005) contends that the variance decomposition tells us the proportion of the movements in a sequence due to its own shock, and other identified shocks. While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Therefore, variance decomposition provides information about the relative importance of each variable in explaining the variations in the endogenous variables in the VAR

The recursive VARs is used for this study due to its simplicity and it has the ability to allow for any number of parameters (Daniels & Park, 2007). This approach to identifying the VAR, originally proposed by Sims (1980), uses the so-called Choleski factorization of the variance-covariance matrix Σ_{ε^*}. The Choleski factorization imposes n normalization restrictions (diagonal elements of B0 are equal to 1) and restricts additional n (n-1)/2 elements of B_0 to zero. Thus, it imposes a total of n (n+1)/2 restrictions on the system, which just identifies the structural form. The Choleski factorization implies that the first variable in the VAR system is assumed to be contemporaneously exogenous to all the remaining variables, and the second variable is contemporaneously exogenous to all except the first variable, and so on (Sims, 1980). This implies that only one residual is included in the first equation (and *n-1* zero restrictions), two residuals in the second (and *n-2* zero restrictions) and so on. This is reflected in the composition of the reduced-form error terms ε_t^*

Granger Causality Tests

In the final stage, Granger causality tests was implemented in this work in order to observe the direction of causality among variables both in long and short runs. This test was firstly proposed by Granger (1969). Later, it has been developed and extended by the other authors. In this work, Granger causality techniques was carried out again under distributed lag system and error correction mechanism as advised in the econometrics literature (Enders, 1995). Therefore, equation (14) will be estimated in this thesis with that respect in parallel to the work of Katircioglu (2007):

$$\ln Y_t = \text{á}_0 + \sum_{i=1}^{n} \text{á}_{1i} \Delta \ln Y_{t-1} + \sum_{j=1}^{\tilde{n}} \text{á}_{2j} \Delta \ln X_{t-1} + \text{á}_3\text{è} + \text{á}_4 ECT_{t-1} + \text{å}_{ti} \quad 14$$

$$\ln X_t = \text{â}_0 + \sum_{j=1}^{n} \text{â}_{1j} \Delta \ln X_{t-1} + \sum_{i=1}^{\tilde{n}} \text{â}_{2i} \Delta \ln Y_{t-1} + \text{â}_3\text{ø} + \text{â}_4 ECT_{t-1} + \text{å}_{ti} \quad 15$$

Econometrics methodology reveals that having significant *t ratios* for ECT_{t-1} in equation would be enough to validate long-run causations and significant F-ratios would be enough for short term causations among the series (Katircioglu, 2007). The term "L" denotes distributed lag structures in the model to be determined by standard lag length criteria such as Akaike and Schwartz approaches. In this thesis, optimum lag structure will be determined based on Schwartz criterion.

Data Processing and Analysis

Both descriptive statistics and inferential statistics were employed in the analysis of this study. Charts such as graphs and tables were employed to aid in the descriptive analysis. The data were analysed using Microsoft Excel and Econometric Statistical Software Eviews 7.0.

Chapter Summary

The aim of this chapter was to present the methodology and set of data that would be used by this study to achieve the study objective of (1) estimating the long co-integration among macroeconomic variables and stock market performance, (2) testing the causality between stock market asset prices and macroeconomic variables used in the model for Ghana. This study has used multivariate Vector autoregressive (VAR) framework in order to identify the relationship and causality between financial development and economic growth. As argued by Xu (2000) the advantages of using multivariate Vector autoregressive (VAR) framework.

First, it allows for different economic and Institutional arrangements in the economy. Second, it deals with simultaneous problem between dependent variable and other variables in the mode, thus avoiding the problem of simultaneous equation bias. Third, It help in identifying both short run and long run cumulative effect of financial development on domestic variables by allowing the interaction among the variables.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the analysis and discussion of the regression results of the specified model used in the study. This was done in line with the objectives of the study (to investigate the relationship between oil price and stock performance) and findings of the literature review. The chapter is divided into sections. In the first section is a descriptive statistics of the variables of interest, the second deals with investigation of the time series properties of the variables where the results of the Augmented Dickey-Fuller unit root test is presented. The results of Johansen's approach to co-integration are presented in the third section. Section four presents and discusses the results of the estimated long-run stock price equation using vector autoregressive approach. The final section presents and discusses variance decomposition analysis, and granger causality test.

Descriptive Statistics

In this section, the study conducted descriptive statistics of the variables involved. The descriptive statistics include the mean, median, maximum, minimum, standard deviation, and number of observations. Table 1 illustrates extensively these statistics. It can be observed from Table 1 that all the variables have positive mean and median. Also, with the exception of interest rate, the minimal deviation of the variables from their means as shown by the standard deviation gives indication of low fluctuation of these variables over the period under consideration. In terms of skewness, all of the variables are negatively skewed with the exception of interest rate, which is positively skewed.

Table 1: Summary Statistics of Variables

	LS	LE	LMS	LO	LCPI	IR
Mean	8.076	-0.123	7.500	3.657	5.024	22.947
Median	8.493	-0.099	7.616	3.705	5.094	23.600
Maximum	9.296	0.397	8.932	4.965	5.760	46.745
Minimum	6.606	-1.012	5.974	2.216	4.078	9.550
Std Dev.	0.885	0.248	0.860	0.678	0.473	10.945
Skewness	-0.438	-0.538	-0.160	-0.010	-0.306	0.564
Kurtosis	1.627	5.233	1.889	1.923	1.996	2.327
Obs	120	120	120	120	120	120

Source: Author's construct, Nyarko (2017)

Correlation

The correlation matrix for the variables were presented for the data. This is to test by inspection whether there is the possibility of muliticollinear variables in the study. The Correlation matrix suggest that variables are not strongly correlated. It is only in the case of money supply and log of stock prices the correlation between them strong correlation. However, the correlation observed is not near perfect correlation and hence good for the estimation of the model.

Table 2: Correlation Matrix of Variables in the Model

	IR	LE	LS	LO	LMS	CPI
IR	1					
lnE	-0.3000	1				
	(0.0004)					
lnS	-0.01267	0.4690	1			
	(0.8831)	(0.0000)				
lnO	-0.5310	-0.4804	-0.3514	1		
	(0.0000)	(0.0000)	(0.0000)			
lnMS	-0.2244	-0.7377	-0.4589	0.5109	1.00000	
	(0.0084)	(0.0000)	(0.0000)	(0.0000)		
lnCPI	-0.3806	-0.0771	-0.2018	0.5095	0.3479	1.000000
	(0.0000)	(0.3703)	(0.0180)	(0.0000)	(0.0000)	

Source: Field Survey, Nyarko (2017) **Note:** probability values are in parenthesis

Discussion of Time Series Properties of the Variables

Results of Unit Root Tests

Unit root test was conducted in order to investigate the stationarity properties of the variables before proceeding to apply the Johansen's approach to co-integration. The graphical approach was used. The graphs suggest that, all the variable used exhibit stationarity properties after the variables were difference. This is an indicative of integrated variables with a degree one. The graphs are presented in Appendix A and B.

In order to verify the order of integration from the graphical approach, the Augmented Dickey-Fuller (ADF) was applied to all variables in levels and in first difference. The Schwartz-Bayesian Criterion (SBC) was used to determine the optimal number of lags included in the test. The p-values were used for making the unit root decision which arrived at similar conclusion with. Table 3 and 4 presented the results of both tests for unit root for all the variables at their levels with intercept and their first difference.

The results of unit root test in Table 3 show that the null hypothesis of unit root for all the variables cannot be rejected at levels. This means that all the variables are not stationary at levels since their p-values are not significant.

Table 3: Unit Root Test for the Order of Integration (Augmented Dickey-Fuller): At Levels (with Intercept)

Variables	ADF Stats	P-Value	[LAG]
LS	-1.8716	0.3446	4
LO	-1.3427	0.6079	1
LE	-2.3279	0.1650	1
IR	-1.6485	0.4547	1
LCPI	-1.7671	0.3952	1
LMS	-1.6019	0.4781	12

Source: Field Survey, Nyarko (2017)

The result from Table 4 shows that, at first difference all the variables are stationary and we reject the null hypothesis of the existence of unit root. The null hypothesis of the existence of unit root is rejected at one percent level of significance for all the variables with the exception of stock returns which is rejected at10 percent. It can therefore be concluded that all the variables are integrated of order one *I*(1). The first difference of all the variables are employed in the estimation of the short run equation in order to avoid spurious regression

Table 4: Unit Root Test for the Order of Integration (Augmented Dickey-Fuller): At First Difference (with Intercept)

Variables	ADF STATS	P-VALUE	*OI*	LAG
DLS	-2.5914	(0.0977)*	*I*(1)	3
DLO	-8.7198	(0.0000)***	*I*(1)	0
DLE	-4.5896	(0.0002)***	*I*(1)	0
DIR	-6.2255	(0.0000)***	*I*(1)	0
DLCPI	-8.1707	(0.0000)***	*I*(1)	0
DLMS	-2.3581	(0.0000)***	*I*(1)	0

Note: *OI* represents order of integration and D denotes first difference. ***, ** and * represent significance at the 1%, 5% and 10% levels respectively.

Source: Author's computation, Nyarko (2017)

Long-run relationship between oil price and stock market prices

Johansen co-integration analysis results are presented in this section. First differencing appears to provide the appropriate solution to the problems considering non-stationary series with a unit root. Therefore, o-integration can be used to establish whether there exists a linear long-term economic relationship among variables according to Johansen (1991). Again, Pesaran and Smith (1995) added that co-integration enables researchers to determine whether there exists disequilibrium in various markets. In this regard, Johansen (1991) asserts that co-integration allows us to specify a process of dynamic adjustment among the cointegrated variables and in dis-equilibrated markets. Given that the series are *I* (1), the co-integration of the series is a necessary condition for the existence of a long run relationship. The results of both the trace and maximum-Eigen value statistic of the Johansen co-integration test are presented in Tables 5 and 6.

Table 5: Johansen's co-integration test (trace) Results

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical value	Probability
None *	0.399533	121.4495	95.75366	0.0003
At most 1	0.210147	63.30411	69.81889	0.1482
At most 2	0.109647	36.41050	47.85613	0.3760
At most 3	0.104742	23.17083	29.79707	0.2378
At most 4	0.077293	10.55755	15.49471	0.2402
At most 5	0.012093	1.387027	3.841466	0.2389

Source: Author's Construct, Nyarko (2017)

Trace test indicates 1 co-integrating equation(s) at 5% level of significance

*Note: * denotes rejection of the hypothesis at the 5% significance level*

Table 6: Johansen's Co-integration Test (Maximum Eigen Value) Results

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical value	Prob
None *	0.399533	58.14542	40.07757	0.0002
At most 1	0.210147	26.89360	33.87687	0.2691
At most 2	0.109647	13.23967	27.58434	0.8713
At most 3	0.104742	12.61328	21.13162	0.4884
At most 4	0.077293	9.170519	14.26460	0.2722
At most 5	0.012093	1.387027	3.841466	0.2389

Source: Author's Construct, Nyarko (2017)

Trace test indicates 1 co-integrating equation(s) at 5% level of significance
*Note: * denotes rejection of the hypothesis at the 5% significance level*

Results from Tables 5 and 6 shows that both the trace statistic and the maximum-Eigen value statistic indicate the presence of co-integration among the variables. The null hypothesis of no co-integrating relationship or vector (r = 0) is rejected since the computed values of the maximum-Eigen value for both the trace statistic and the maximum-Eigen value statistic are greater than the critical values at 5 percent level of significance. This implies the existence of a stable long-run relationship among stock price, oil price, exchange rate, interest rate, inflation and money supply.

Based on the indication of one co-integrating vector among the variables, the estimated long-run equilibrium relationship for stock returns was taken from the first normalized vector in the co-integration result. The choice of this vector is based on sign expectations about the long-run relationships. The long run relationship is given below.

$$\underset{}{LS} = \underset{(0.85741)}{-2.9893LO} + \underset{(2.51565)}{10.3614LE} - \underset{(0.02934)}{0.1521\mathrm{IR}} - \underset{(4.25671)}{24.6536LCPI} - \underset{(2.05257)}{6.9158LMS}$$

Note: That standard errors are parenthesis,

The coefficients are log coefficients

Where *LS* is stock price, *O* is oil price, *E* is exchange rate, *IR* is interest rate, *CPI* is consumer price index and *MS* is money supply. The error correction term can be expressed as:

$$ECM = LS + 2.9893LO - 10.3614LE + 0.1521\mathrm{IR} + 24.6536LCPI + 6.9158LMS$$

Error Correction Term Expression of Long Run Effect on Stock Price

The model above represents the long run effects on stock price. Firstly, oil price exerts a negative and significant effect on stock price. The coefficient of -2.9893 implies that in the long run, a 1 percent increase in oil price will lead to 2.9893 percent decrease in stock price. There are different channels in which oil price shock may affect the stock price.

From a microeconomic perspective, the most obvious is the fact that for a lot of companies, oil is an essential input in the production of goods. In this way, a change in the price of oil will certainly have an impact on the cost of production, as any other input variable, and changes in expected costs further impacts the stock price. Specifically, oil price changes are inversely related to stock price for most companies which use oil as input. This is consistent with Jones and Kaul (1996) who found a significantly negative impact of oil price shocks on the performance of the U.S. and Canadian stock market. Sadorsky (2001) also built further on this research and found that an oil price shock has a negative and statistically significant impact on stock returns of companies with oil-related production costs. Other studies by Butt (2009) and Huang, Masulis and Stoll, (1996) have also provided evidence of the inverse relationship between oil price and stock returns.

However, this finding contradicts the studies by El-Sharif et al. (2005) who provided evidence that there exists a positive relationship between the two variables. Similarly, other studies made by Faff and Brailsford (1999), Nandha and Faff (2008) and Mohanty, Nandha and Bota (2010) reached the same conclusion on the relationship between the price of oil and stock price for several different countries.

Exchange rate is statistically significant in the long run and it has a positive effect on stock price. The coefficient of 10.3614 implies that in the long run, a 1 percent increase (or depreciation) in exchange rate will lead to approximately 10 percent increase in stock returns. The positive relationship is justified in that changes in exchange rates affect the competitiveness of a firm, which in turn influences the firm's cost of funds, earnings and hence its stock price. In this case, a depreciation of the cedi for example makes exports companies in Ghana more competitive. This will cause an increase in their earnings and hence the rise in stock prices. This finding is consistent with the study by Maysami (2004) who showed that there is a positive relationship between exchange rate and stock returns for Singapore while the results of Adam and Tweneboah (2008) support the hypothesis of a negative relationship between Ghana stock market and exchange rate.

Interest rate was found to exert a negative impact on stock prices in Ghana. The coefficient of -0.1521 implies that 1 percent increase in interest rate in the long-run would lead to 0.1521 percent decrease in stock prices. Thus, the negative and significant effect of interest rate on stock prices is an indication that interest rate is one of the key channels through which stock performance can be affected. Interest rate has impact on a company's operations. Therefore, any increase in the interest rates, ceteris paribus, will raise the cost of capital. The inflated interest rate will reduce its profits. The lower the profits, the lower cash inflows which translates into a fall in stock price. Moreover, the increase in interest rate also raises the required rate of return higher thereby leading to a drop-in stock price. The negative effect of interest rate on stock prices is in conformity with the findings of Humpe and Macmillan (2007) which indicated that both US and Japan stock prices are negatively related to the interest rate.

In addition, consumer price index with a coefficient of -24.6536 has a negative and significant impact on stock price. Specifically, a one percent increase in CPI will decrease stock price by approximately 25 percent. A higher level of CPI represents distortion in an economy. CPI is used to capture macroeconomic instability (Asiedu, 2006). It shows that stability of a country is an important element for improving stock prices. An increase in inflation increases the cost of production of companies. This reduces the profitability of the firms and hence the oil expenses paid to investors and thus resulting in a drop in stock price. In addition, high inflation also increases interest rate which results in an increase in the required rate of return thereby leading to a fall in stock price. The negative relationship is in line with the results of the study carried out by Adu (2012), Tabale (2006) and Abugri (2008). He provided evidence that inflation has a negative relationship with stock prices. However, it contradicts the results of Beenstock and Chan (1988) and Clare and Thomas (1994) who reported a positive relationship between inflation and stock price.

The coefficient of money supply of -6.9158 shows that a 1% increase in money supply would result in a -6.9158 percent decrease in stock price, holding all other factors constant. The sign of the money supply variable supports the theoretical conclusion that money supply contributes negatively to stock prices. An increase in monetary supply indicates excess liquidity available for buying stocks, eventually resulting in higher stock prices due to an increase in demand for stocks. Additionally, expansionary monetary policy would lower interest rate which would in turn lead to a lower required rate of return and thus, resulting in a higher stock price. This finding is in line with that of Humpe and Macmillan (2007) who reported that Japan stock prices are influenced negatively by money supply.

It has been argued by Engle and Granger (1991) that when variables are co-integrated, their dynamic relationship can be specified by an error correction representation. An error correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships. The ECT is expected to be statistically significant with a negative sign. The negative sign implies that any shock that occurs in the short-run will be corrected in the long-run. If the absolute value of the error correction term is greater, the rate of convergence to equilibrium will be faster and vice versa.

Since the variables are non-stationary but co-integrated, the estimation of the VECM, which included a first differenced VAR with one period, lagged error correction term yielded an over-parameterized model as presented in Appendix A. As the values of the variables are stationary, the model was estimated using the ordinary least squares (OLS). The approach of general-to-specific (GTS) modelling was employed to arrive at a more parsimonious model. This involves deleting insignificant lagged variables using the p-values. According to Rutayisire (2010), the process of moving from the general to the specific brings about a simplification of the model which makes estimations more reliable and increases the power of the tests. The result from the vector error correction model is shown in Table 7. The short run result indicates that with the exception of interest rate, all the variables have at least one lag to be significant.

Table 7: Results of Error-Correction Model (VECM)

Variable	Coefficient	Std error	t- statistic	Probability
ECT(-1)	-0.588428	0.270587	-2.174635	0.0432
D(LS(-1))	0.511516	0.093875	5.448913	0.0000
D(LS(-4))	0.245285	0.098461	2.491185	0.0146
D(LO(-1))	-0.092325	0.053286	-1.732636	0.0866
D(LO(-3))	-0.092127	0.053169	-1.732717	0.0866
D(LO(-5))	-0.132816	0.056493	-2.351017	0.0209
D(LE(-4))	0.857431	0.458952	1.868236	0.0650
D(LCPI(-4))	-0.576082	0.341713	-1.685864	0.0953
D(LMS(-3))	-0.370015	0.139688	-2.648859	0.0095
D(LMS(-4))	-0.453188	0.153752	-2.947520	0.0041
CONSTANT	-0.032711	0.013240	-2.470613	0.0154

Source: Author's Construct, Nyarko (2017)

R-squared= 0.567183DW=2.044622, F-Statistics=5.127820, Prob=0.0000, Adjusted R-Squared= 0.506574

The result in Table 7 shows that the estimated coefficient of the error correction term (ECT) has the expected sign and it is also significant. This is an indication of joint significance of the long-run coefficients. According to Kremers et al. (1992) and Bahmani-Oskooee (2001), a relatively more efficient way of establishing co-integration is through the error correction term. The estimated coefficient of the error correction term of -0.588428 which implies that the speed of adjustment is approximately 59 percent per month. This negative and significant coefficient is an indication that co-integrating relationship exists among the variables. The result implies that about 59 percent of the disequilibrium in the stock market caused by previous months' shocks converges back to the long-run equilibrium in the current month. The variables in the model show evidence of quick response to equilibrium when shocked in the short-run. The rule of thumb is that, the larger the error correction coefficient the faster the variables equilibrate in the long-run when shocked (Acheampong, 2007). In this study, the size of the coefficient suggests that the speed of adjustment to changes is fast.

The current value of stock price is affected by the past months values of stock price. Specifically, stock price at lag one and four are significant with a coefficient of 0.511516 and 0.245285 respectively. It shows that the past one and four months stock prices exert positive effect on current stock price. This is expected because an increase in stock price in the previous months will attract more investment due to the capital gains associated with the rise in stock prices. The increase in demand will cause the price of stocks to rise further.

Oil price is also significant at lag one, three and five in the short run where it exerts a negative effect on stock price. The coefficients of -0.092325, -0.092127and -0.132816 implies that in the first, third and fifth month a 1 percent increase in oil price would lead to 0.092325 percent, 0.092127 percent and 0.132816 percent decrease in stock price respectively. The negative effect is justified by the fact that an increase in the price of oil will have an impact on the cost of production, since it is an input variable for most companies. The increase in the cost of production will reduce profits of companies and hence their oil expenses. The reduction in oil expenses reduces demand for stocks which causes a fall in the stock price. This is consistent with the findings of Jones and Kaul (1996) and Sadorsky (1999) who found a negative and significant effect of oil price on stock price in the short-run. However, this finding contradicts the results of Faff and Brailsford (1999) and Nandha and Faff (2008) where a positive relationship between these variables was found.

Table 7 result shows that exchange rate is significant at lag four in the short run where it exerts a positive effect on stock price with a coefficient of 0.857431. Thus, in the previous fourth month a 1 percent increase (depreciation) in exchange rate would lead to a 0.857431 percent increase in current stock price. The positive relationship between these two variables conforms to the finding of Maysami *et al*. (2004) who argued that exchange has a positive short-run effect on stock price Whiles it contradicts that of Adam and Tweneboah (2008) who found an inverse relationship between the two variables for Ghana.

Moreover, consumer price index (CPI) which represents macroeconomic instability has a negative and significant impact on stock price at the fourth lag. This implies that a 1 percent increase in CPI will cause a fall in stock price by 0.576082 percent. The negative relationship is in line with the results of the study carried out by Chen et al., (1986) who showed that inflation has a negative relationship with stock price in the short run. However, it contradicts the results of Beenstock and Chan (1988) who reported a positive short-run relationship between inflation and stock prices.

Money supply is negative and significant at lags three and four. Thus, 1 percent increase in money supply in the previous third and fourth month will cause a drop in stock price by 0.370015 and 0.45318 percent respectively. Thus, a change in money supply in the short-run exerts a negative and statistically significant impact on stock price. This means that there exists a negative relationship between money supply and stock price. This finding is in line with that of Humpe and Macmillan (2007) who reported that Japan stock prices are influenced negatively by the money supply in the short run.

To determine the direction of causality between oil price and stock market price, the study conducts a pair wise Granger causality test using lag 5. The results are presented in Table 8.

The results of the granger causality test in Table 8 show that there is a unidirectional causality between oil prices and stock price. The null hypothesis that oil price does not granger-cause stock price is rejected at 5 percent level of significance. Thus, oil price changes predict stock price but not the other way around. In the empirical literature, the result is consistent with the findings of Fatima and Bashir (2014) who found uni-directional causality between oil price and stock price for China. However, it contradicts the finding of Anoruo (2011) who found a bi-directional causality between oil price and stock price for United States.

From the results in Table 8 it can be seen that there is a bi-causality between exchange rate and stock returns. This implies that there is causality running from exchange rate to stock returns and vice versa.

Table 8: Granger Causality Test

Null Hypothesis	F-Statistic	Prob
LO does not Granger Cause LS	2.73304	0.0476**
LS does not Granger Cause LO	1.54592	0.1821
LE does not Granger Cause LS	2.63587	0.0492**
LS does not Granger Cause LE	2.16462	0.0636*
IR does not Granger Cause LS	2.98690	0.0272**
LS does not Granger Cause IR	0.56740	0.7248
LCPI does not Granger Cause LS	3.45609	0.0039***
LS does not Granger Cause LCPI	0.11453	0.9889
LMS does not Granger Cause LS	2.17809	0.0621*
LS does not Granger Cause LMS	0.44259	0.8178

Source: Author's Construct, Nyarko (2017)

*Note: *, ** and *** denote rejection of null hypothesis at 10%, 5% and 1% level of significance.*

This result is consistent with that of Aydemir and Demirhan (2009) who also found bidirectional causality between stock price and exchange rate for Turkey. However, it contradicts that of Ozturk (2008) who found a unidirectional relationship running from stock prices to exchange rate. Karamustafa and Kucukkale (2003) found no causality between these two variables.

The results show a unidirectional causality between interest rate and stock price at 5 percent level of significance. Specifically, interest rate is found to granger cause stock price. This implies that keeping interest rate at the right level is a real booster for stock performance in Ghana. This finding is consistent with that of Adam and Tweneboah (2008) who found a unidirectional relationship running from interest rate to stock price for Ghana. It is also consistent with the result of Humpe and Macmillan (2007) for US and Japan.

The Granger causality test results also suggests that the null hypothesis of CPI does not granger cause stock price is rejected at 1 percent level of significance, implying CPI granger causes stock price. However, the null hypothesis that stock price does not granger causes CPI is not rejected; implying that stock price does not granger causes inflation. Thus, a unidirectional causality has been found running from inflation to stock price. It is consistent with Fama and Schwert (1977), Saunders and Tress (1981), and Nishat and Shaheen (2004) who found unidirectional causality running from inflation to stock price.

A unidirectional causality has been identified from money supply to stock price at 5 percent significance level. The Granger-causality test result suggests that the null hypothesis of money supply does not granger causes stock price is rejected at 10 percent level of significance. Thus, money supply predicts stock price and not the other way around. In the empirical literature, the result is consistent with the findings of Errunza and Hogan (1998) who found uni-directional causality running from money supply to stock price for Germany and France. Similarly, Nishat and Shaheen (2004) finding also indicate that money supply does granger cause stock price. However, the finding contradicts that of Karamustafa and Kucukkale (2003) for Turkey.

Evaluation of the Models

The stability of the models were tested over the estimation period. The Ramsey reset test was done to check for the model specification errors. The test suggested that the model was correctly specified. The model that was estimated was also free from serial correlation problems. This is because the Lagrangean multiplier test for serial correlation based on the Bruasch-Pagan test showed that there is no serial correlation. The model also passed the residual normality test.

Even though time series models hardly suffer from heteroskedasticity problems, this study also went ahead to verify whether the residuals generated from the model are homoscedastic. The result from the ARCH test suggest that there is no problem of hetereskedasticity. This thereby leads to a higher level of confidence in the presented model and the result.

Table 9: Diagnostic Test for Stock Price Mode

Diagnostic	Statistic	Conclusion
Ramsey Reset Test: F-statistic	= 0.426708 (0.6541)	correctly specified
Log likelihood ratio	= 1.209677 (0.5462)	
ARCH Test: F-statistic	0.29603(0.9260)	no effect of arch
Breusch-Godfrey Serial	0.645816(0.6654)	No serial correlation
Multivariate Normality	1.4283 p-value = 0.5604	Residuals are normal

Source: Author’s Construct, Nyarko (2017)

Variance Decomposition Analysis

The forecast error variance was decomposed by employing Sim‘s Recursive Cholesky decomposition method. The forecast error variance decomposition provides complementary information for a better understanding of the relationships between the variables of a VAR model. Variance decomposition shows the proportion of the movements in a variable due to own shocks and those due to shocks in other variables (Enders, 2004). Thus, the variance decomposition analysis will enable us identify the most effective instrument for each targeted variable based on the share of the variables to the forecast error variance of a targeted variable. The results of the forecast error variance decomposition of the endogenous variables at various months are shown in Table 10.

Table 10 shows that the largest source of variations in stock price forecast error is attributed to its own shocks. The innovations of oil price, exchange rate, interest rate, inflation and money supply are important sources of the forecast error variance of stock price. This suggests that all the variables play important part in the forecast error variance of stock price with the most effective instruments being interest rate and oil price. Thus, interest rate and oil price are the most important sources of variations besides own shocks. The least important source of the forecast error variance of stock price is the innovations of CPI throughout the 10-month horizon.

Table 10: Result of Variance Decomposition of Stock Price

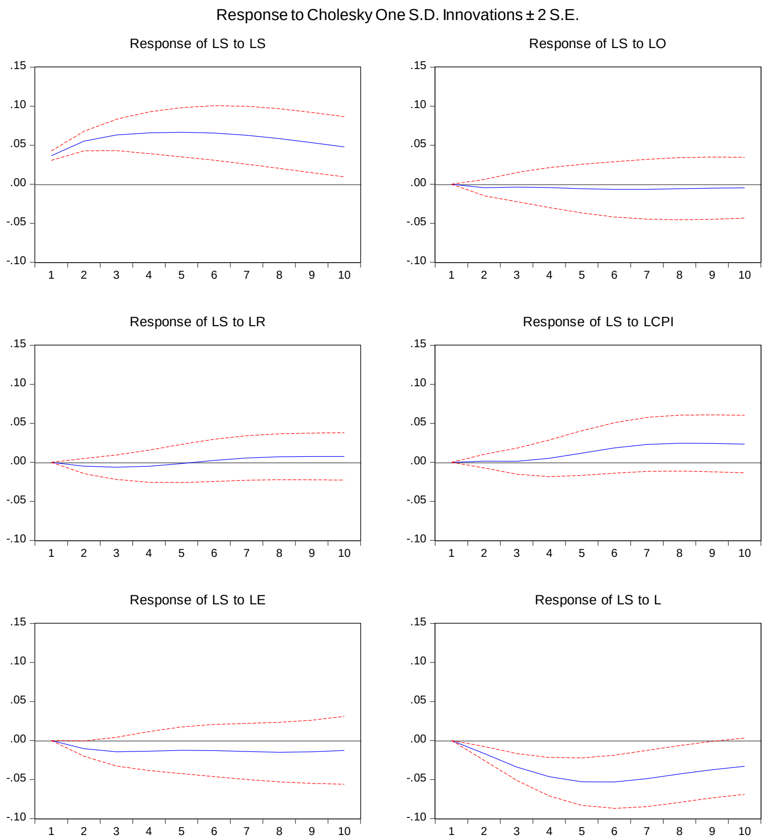
Period	S.E.	LS	LO	LR	LCPI	LE	LMS
1	0.0364	100.000	0.00000	0.0000	0.0000	0.0000	0.0000
2	0.0692	90.8779	0.42468	0.4892	0.0463	2.3259	5.8357
3	0.1009	81.7587	0.34028	0.6274	0.0393	3.1565	14.077
4	0.1301	74.7414	0.31939	0.5293	0.1748	3.0104	21.224
5	0.1565	69.7250	0.35963	0.3770	0.6811	2.7394	26.117
6	0.1793	66.4401	0.41295	0.3057	1.5684	2.6137	28.658
7	0.1982	64.4164	0.44899	0.3279	2.6108	2.6554	29.540
8	0.2132	63.1790	0.46490	0.3928	3.5783	2.7944	29.590
9	0.2248	62.3823	0.47039	0.4624	4.3787	2.9345	29.371
10	0.2339	61.8175	0.47393	0.5285	5.0371	3.0084	29.134

Source: Field Survey, Nyarko (2017)

Impulse Response

The impulse response was also examined. This was done to also have a fair idea about the impact of oil prices on the stock market performance in Ghana. The results are presented in Panel 1 below. The impulse response function reveals that the shock to the innovations of stock market to is quite responsive when the shock emanates from the stock prices itself. Thus, a positive shock will lead to a bullish stock prices for about five periods and peak and begin to experience a fall in prices of the stock prices (bearish). This is somewhat in line with the results depicted in the variance decomposition. It stands to reason that, previous performance in the stock prices are a key factor in determining the stock prices in the future. This affirms the postulates of the asset pricing models like the CAPM which was used as a theoretical framework for this study.

Figure 1: Impulse response graph of LS to LS, LO, LR, LCPI, LE and LMS respectively



Source: Author's Construct, Nyarko (2017)

However, oil prices as proxied by the ex-pump fuel prices does little to the stock prices on the GSE. The results from the impulse response suggest that stock prices response to the shock in oil prices very marginally. As it can be observed the shock lead to a slight decrease in stock prices but remains constant. It must be noted, when trading on highly volatile assets, it is the marginal changes that matters not the magnitude of the change. The shock in exchange rate and money supply leads to the bearish behaviour of the stock prices. Surprisingly, inflation lead to an increase in asset prices as could be observed from the impulse response.

Chapter Summary

This chapter examined the time series properties of the data used for estimation and also presented and discussed the results. Unit root test was conducted by employing the ADF technique which showed that all the series had to be differenced once to achieve stationarity. The implication is that all the series are integrated of order one, $I(1)$. The presence of non-stationary variables implies the possibility of the presence of a long-run relationship, which the study verified using Johansen's co-integration test. Granger-causality test suggested uni-directional causality between oil price and stock price.

The oil price-stock price nexus was estimated in a single equation and the results indicated the presence of one co-integrating relationship between oil price and stock price. All the variables were found to have negative relationship with stock price except the exchange rate which was positively related to stock price.

The results of the VECM showed that the error correction term for stock price carry a negative sign and is also less than one as expected. The findings from variance decomposition showed that, the predominant source of variations in stock price forecast errors is attributable to its own shocks with the most effective instruments being interest rate and oil price and the least forecast error variance of stock price was the innovations to consumer price index.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents summary, conclusions and recommendations of the study. The first section of the chapter presents the summary which offers the general overview of the work giving the findings of the study. The conclusions drawn from the study are based on the outcome of the study, and the last section gives the recommendations of the study.

Summary

The study aimed at examining the role of oil price on stock prices. The study examined these following specific objectives. The first objective was to investigate long-run between oil prices and stock prices of the Ghana Stock Exchange. Also, the study sought to examine the short run dynamics oil prices changes on stock prices of the Ghana Stock Exchange. After finding the long and short run correlates, the causal relationship between crude oil price and stock prices were examine. Then lastly, the importance of oil price in explaining stock variation was examine.

To achieve these specific objectives, a time series data on money supply, inflation which was captured by CPI, exchange rate, interest rate, oil prices and GSE All-Share-Index were used for the study. The time series properties of these variables were examined. The study employed the ADF and PP test for stationarity. The Johansen multivariate co-integration test which falls in the class of Maximum Likelihood estimation technique was employed. The choice of the Johansen was informed in part because of the possible endogeneity that may be inherent in the variables used for the estimation. The unit root test also proved that the choice of the methodology and the estimation technique were appropriate. The unit root test suggested that the variables were integrated of order one.

After the unit root test and the test for co-integration, the long run and the short run coefficient were estimated. Afterward, the causality test was done. The causality test was done to examine the direction of causality. As again suggest in Rajie (2012), the causality test also could be used as a test of exogeneity. The next estimation done was to estimate the given contribution of oil prices in explaining the variations in stock prices. The variance decomposition was used. This approach follows the Cholesky decomposition.

From the estimated results, it was found that there was co-integrating relationship among stock prices and oil price with other control variables. The co-integrating relation suggested that there is a long run relationship between oil price and stock prices in Ghana. The estimated long run equation suggests that there is a negative long run effect of oil price on stock market. This indicative of the fact that stock prices are likely to experience a bubble when there is increase in oil price. This may be because of oil price is an input for most listed companies on the stock market. Therefore, increase oil prices affect the cash flow and the net present value of the expected cash flow of the firm. Hence the value of the firm is likely to fall reflecting in the share prices.

Again, in the long run, it was found that exchange rate depreciation has a positive relationship with stock prices in Ghana. This implies that, as increase in exchange rate results in an increase in stock prices in the long run. Similarly, interest rate and inflation were found to have a negative effect on the stock market prices. On the other hand, money supply was found to have a positive effect on stock market in the long run.

The short run dynamics revealed that of the stock market and its relationship with the variables used in the study. It further showed that, the past prices of the stock prices influence the current stock prices in the first and fourth months of the stock market. Previous stock prices serve as a sign for a positive performance in stock prices.

Secondly, oil prices were found to have a consistently negative effect on the stock market prices. It was found that the coefficient of the oil price changes on stock market prices were same in the first and the 3rd months. However, it increased in the fifth month by 0.04 percentage points. Indicating that oil price effect on stock prices follows an increasing and cumulative effect. Inflation and exchange rate had a negative short run effect on stock prices in the short run.

It was found that there is Granger causal relationship between oil price and stock prices. Thus, there is a uni-causal relationship which flows from oil price to stock prices but the reverse is not true.

Conclusions

Based on the findings of the study, the following conclusions were drawn from the findings:

Firstly, there is a long run co-movement between oil price index and stock exchange prices and an indication that the stock market index pull back to equilibrium given distortions originating from the exchange.

Secondly, there is short run dynamic relationship between oil price and stock prices. That is in the short run, oil prices leads to variations in stock prices in an inverse manner. Other control variables were important in explaining the changes in oil prices.

Thirdly, oil prices granger causes stock prices. Thus is there exist a causal relationship between oil prices and stock prices. The findings from variance decomposition showed that, the predominant source of variations in stock price forecast errors is attributable to its own shocks with the most effective instruments being interest rate and oil price and the least forecast error variance of stock price was the innovations to consumer price index. An increase in monetary supply indicates excess liquidity available for buying stocks, eventually resulting in higher stock prices due to an increase in demand for stocks. Additionally, expansionary monetary policy would lower interest rate which would in turn lead to a lower required rate of return and thus, resulting in a higher stock price.

Recommendations

From the conclusions, the following recommendations were made:

First, evidence from the variance decomposition showed that oil prices as key variable in explaining variations in the stock price index and as such investor, fund managers and stock player should concentrate on the variation in real sector activities in trying to predict variations in equity price.

Again, with evidence of bidirectional causality between the oil price and stock prices, money supply and interest rates, stakeholder should ensure sound monetary policy in order to increase the price of the stock market. More specifically, government in an attempt to stimulate stock prices in the face of high oil price, could embark on expansionary monetary policy to boast the performance of stock price indexes.

Also, government and other policy makers should work out to subsidies oil price for listed firms on the stock market to reduce the cost component and increase their earnings and dividend. This in effect will transformed into high stock prices and boast confidence in the performance of the Ghana Stock Exchange.

Recommendation for Future Studies

One limitation of this study is the data coverage. It is recommended that data on industrial clusters would provide a better understanding on oil prices on stock market performance.

Also, this study used gasoline premium as a proxy for oil prices, it is recommended that future studies could find a composite indexes of all the fuel prices based on the structure of firms listed on the stock market. This in so doing will reveal the pattern and the most used fuel by stock market listed firm and help government and stake holder to have more targeted policy on fuel prices that affect the stock performance of the economy.

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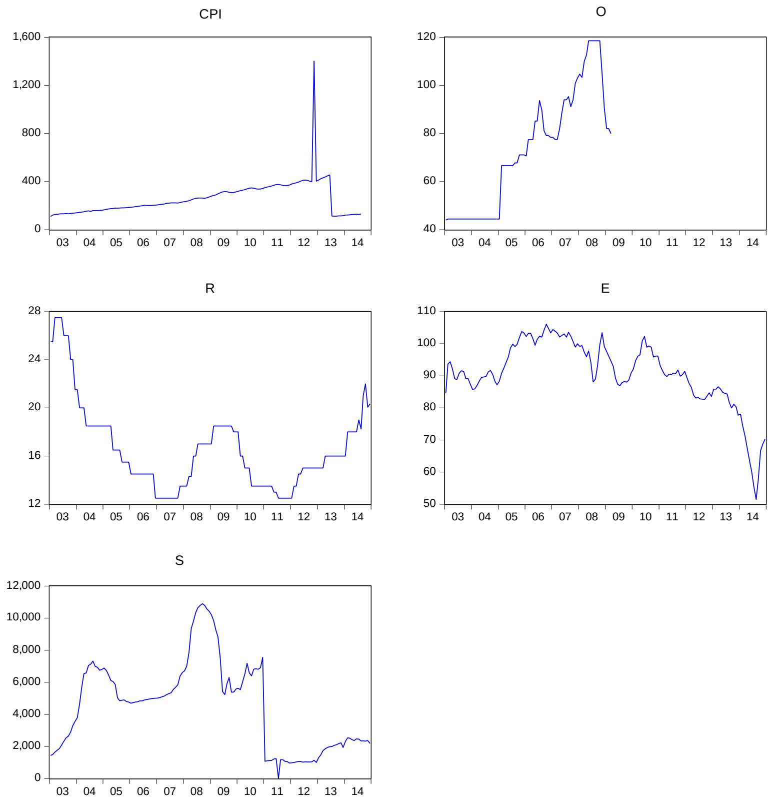
APPENDICES

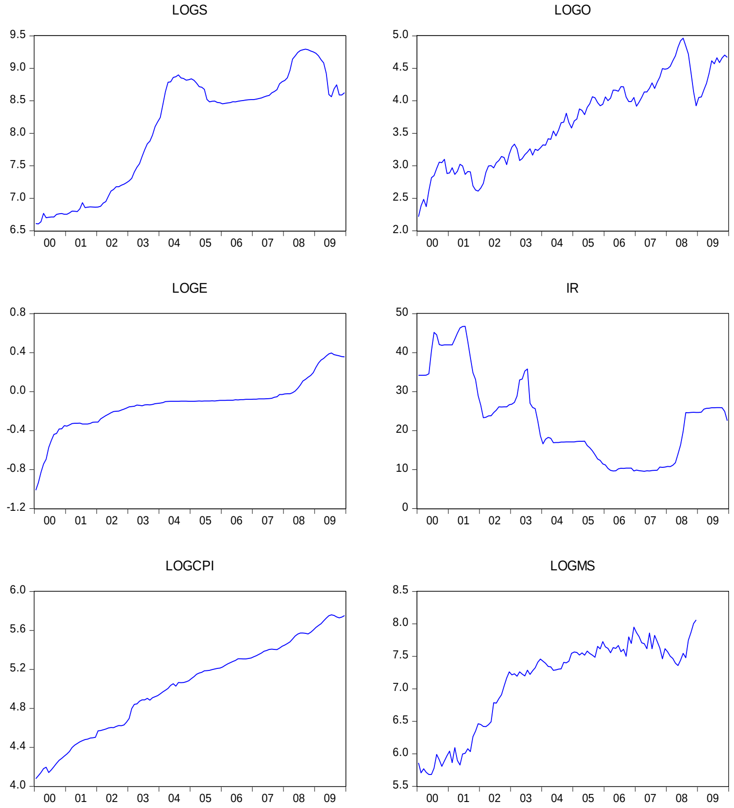
APPENDIX A

Graph of Level variable



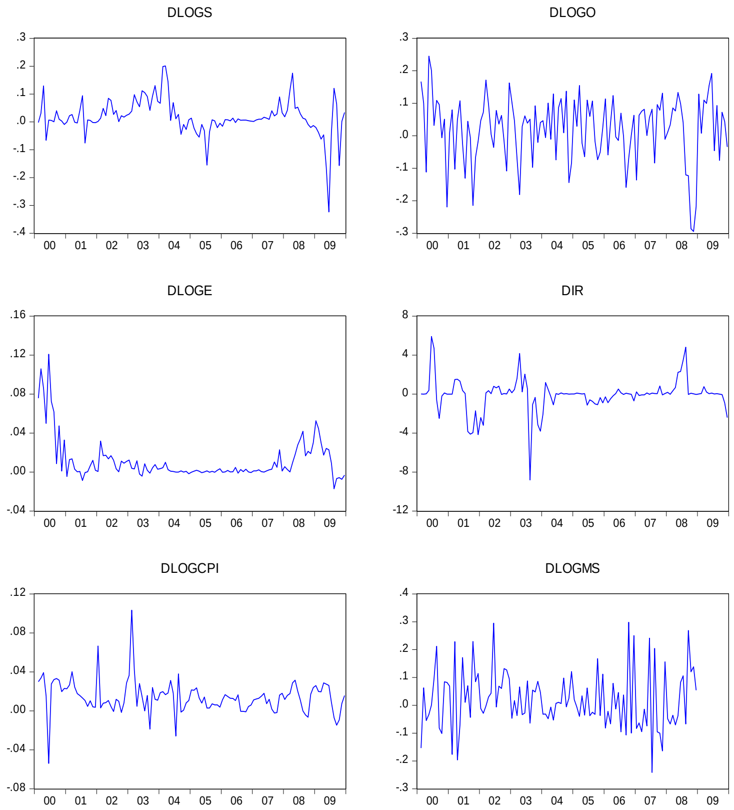
APPENDIX B

Graph of log of level variable



APPENDIX C

Log of Difference of Variable



APPENDIX D:

OLS Estimation of Short Run Dynamics (Non-parsimonious results)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECT	-1.000000	0.962130	-1.039361	0.3017
D(LS(-1))	0.535414	0.108188	4.948905	0.0000
D(LS(-2))	-0.202541	0.112685	-1.797403	0.0760
D(LS(-3))	0.131356	0.118975	1.104065	0.2728
D(LS(-4))	0.277791	0.117546	2.363263	0.0205
D(LS(-5))	-0.056820	0.110037	-0.516373	0.6070
D(LE(-1))	-0.479935	0.631544	-0.759940	0.4495
D(LE(-2))	0.545204	0.578697	0.942122	0.3489
D(LE(-3))	0.511430	0.613783	0.833242	0.4071
D(LE(-4))	-0.827126	0.515695	-1.603904	0.1126
D(LE(-5))	-0.138761	0.449340	-0.308812	0.7582
D(LMS(-1))	0.242588	0.158036	1.535020	0.1286
D(LMS(-2))	0.156623	0.155381	1.007990	0.3164
D(LMS(-3))	0.365303	0.157624	2.317557	0.0230
D(LMS(-4))	0.430012	0.164396	2.615708	0.0106
D(LMS(-5))	0.150607	0.169770	0.887125	0.3776
D(LO(-1))	0.095489	0.058675	1.627429	0.1075
D(LO(-2))	-0.013296	0.059437	-0.223707	0.8235
D(LO(-3))	0.099520	0.058704	1.695303	0.0938
D(LO(-4))	0.013466	0.063564	0.211848	0.8328
D(LO(-5))	0.130986	0.061716	2.122382	0.0368

D(LO(-1))	-0.419131	0.382780	-1.094965	0.2767
D(LO(-2))	0.325602	0.370441	0.878957	0.3820
D(LCPI(-3))	-0.346260	0.377269	-0.917806	0.3614
D(LCPI(-4))	0.605911	0.391485	1.547727	0.1255
D(LCPI(-5))	-0.199949	0.440606	-0.453805	0.6512
D(IR(-1))	0.001245	0.004240	0.293611	0.7698
D(IR(-2))	-0.001007	0.004169	-0.241544	0.8097
D(IR(-3))	-0.003453	0.004394	-0.785792	0.4343
D(IR(-4))	0.005007	0.004362	1.147820	0.2544
D(IR(-5))	-0.000804	0.003890	-0.206716	0.8367
C	-0.029148	0.016881	-1.726675	0.0880

APPENDIX E

Commented [Office1]: Very clumsily presented. Do a neater presentation.

Companies listed on the Ghana Stock Exchange as at 1st Jan. 2015

Listed Companies

African Champion Industries

Aluworks

AngloGold Ashanti

Ayrton Drug Manufacturing

Benso Oil Palm Plantation

CAL Bank

Camelot Ghana

Clydestone Ghana

Cocoa processing company

Ecobank Ghana

Ecobank Transnational Incorporated

Enterprise Group

Fan Milk

GCB

Ghana Oil Company

Golden Star Resources

Golden Web

Guinness Ghana Breweries

HFC Bank (Ghana)

Mechanical Lloyd Company

Mega African Capital

Pioneer Kitchenware

PBC

PZ Cussons Ghana

Sam-Woode

Societe Generale Ghana

SIC Insurance Company

Standard Chartered Bank Ghana

Starwin Products

Total Petroleum Ghana

Transaction Solutions Ghana

Trust Bank (The Gambia)

Tullow Oil

Unilever Ghana

UT Bank

APPENDIX F

Petroleum Products Supplied to the Economy (kilo tonnes)

Energy Commission of Ghana

National Energy Statistics 2000 -2013 (April 2014)

Year	2007	2008	2009	2010	2011	2012	2013
LPG	93.3	117.6	220.6	178.4	214.4	268.5	251.8
Premium Gasoline	544.2	545.0	701.4	787.8	807.0	992.7	1080.6
Premix	41.0	50.7	55.1	32.4	45.6	58.9	53.4
Kerosene	63.3	34.6	89.3	49.3	62.4	45.6	27.8
ATK	122.8	119.2	124.7	108.4	135.3	141.3	131.9
Diesel/Gas oil	1147.0	1092.1	1280.0	1271.9	1431.2	1665.0	1722.6
RFO	51.3	47.9	40.3	30.9	37.5	33.5	39.3

Source: National Petroleum Authority / Energy Commission of Ghana / National Energy Statistics 2000 – 2013 (April 2014)

APPENDIX G

Comparison of Major Petroleum Products Consumption in Ghana in 2014 / 2015

ENERGY COMMISSION GHANA, 2016 ENERGY (SUPPLY AND DEMAND) OUTLOOK FOR GHANA (APRIL 2016)

Products	2014 consumption 1000 tones			2015 consumption 1000 Tones		
	Forecast	Actual	Net short fall	Forecast	Actual	Net/sort fall
Gasoline	1,150-1200	1158.5	8-14.5	1150-1200	1210.4	10.4
Diesel	1760-1850	1713.3	46.7-136.7	1760-1850	1902.7	52.7
Kerosene /ATK	240-250	123.2	116.8-126.8	240-250	118.9	121.1-131.1
LPG	300-350	241.5	58.5-108.5	300-350	279	21-71
Total	345-3650	3,263.5	198-405.5	3450-3650	3511	71-139

NB: Total diesel consumption include sales to the mining companies and bunkering. Total gasoline consumption includes premix and other petroleum formulation.

Commented [Office2]: clumsy