INSTITUTE OF SOCIAL SCIENCE

DEPARTMENT OF BANKING AND FINANCE

ANALYZING THE RELATIONSHIP BETWEEN STOCK MARKET AND OIL/GOLD PRICES IN SOUTH AFRICA.

IN ACCORDANCE WITH THE REGULATIONS OF THE GRADUATE SCHOOL OF SOCIAL SCIENCES

CHIRISWELL DAITONE

NICOSIA (2015)

INSTITUTE OF SOCIAL SCIENCE

DEPARTMENT OF BANKING AND FINANCE

ANALYZING THE RELATIONSHIP BETWEEN STOCK MARKET AND OIL/GOLD PRICES IN SOUTH AFRICA.

IN ACCORDANCE WITH THE REGULATIONS OF THE GRADUATE SCHOOL OF SOCIAL SCIENCES

CHIRISWELL DAITONE

SUPERVISED BY

ASSIST.PROF .DR. TURGUT TURSOY

NICOSIA (2015)

DECLARATION

I hereby declare that:

This master thesis is the final product of my own work and has not been submitted before for any degree, examination or any related qualifications at any university or institution and ALL the sources I have used or quoted , have received due acknowledgments as complete references.

Name; Surname

Chriswell Daitone

Signature……..

Date……..

DEDICATION

This study is dedicated to all my ever loving mother's (Mrs. Rosemary, Miss Getrude, Miss Agnes, Miss Tambudzai and Mrs. J.Nyachuru). Especially I would like to thank the best father in the world Mr. Kaitano,who supports my choices by all means necessary and has been a pillar of strength and inspirational to me during my whole life. I would like to express my deep feelings of gratitude towards my siblings and to the rest of the family for ever supportive of my academic endeavors. This is a glimmer of gratefulness for everything every member of my family have done for me. My mother's prayers are powerful and I owe all love, appreciation and gratitude to her.

ACKNOWLEGMENTS

The Author would like to heartily thank the supervisor Asst. Professor .Dr. Turgot Tursoy for his time, effort and constructive contributions during the thesis work process. His encouragement, support and guidance enabled me to develop an understanding of the subject. Another round of applause goes to all the staff at Near East University especially Banking and Finance department for their endless assistance and conducive environment from the beginning to the end of this programme.To Faisal PhD student Banking and Finance department, your contributions and criticisms towards this thesis where amazing. With God ALL things are possible and in God I believe.

"Loyalty is a two way street. If I am asking for it from you, then you're getting it from me."

ABSTRACT

The significant macroeconomic episode of mid 2014 saw a dramatic plunge in international oil prices. This present study is an attempt to conduct empirical investigation on the relationship between the Johannesburg stock exchange and international oil/gold prices. All these variables have behold significant changes over time and hence it is undoubtedly relevant to verify their alliance periodically. The study takes monthly time series data from the 1st of January 2004 to 31st December 2014.The Vector Autoregressive model was estimated for the presents of unit root by employing the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. The long run relationship between the stock market and two strategic commodity indicators were identified by applying the Johansen cointegration approach while the Granger causality test was used to examine the casual relations. Moreover, the short run feedback to exposure from external shocks on each variable was determined by innovation accounting techniques of impulse responds function and variance decomposition. The Johansen cointegration results imply the existence of long term relationship between the analyzed variables. The Granger causality test results show that there must be either a unidirectional or no causality among the variables. The magnitude of response was mainly due to own innovations as implied by the impulse response and variance decomposition results. The findings imply that South Africa can enhance its economic activity through sound financial systems and make proper terms with the global commodity market volatility.

Keywords: Johannesburg, oil, gold, cointergration, Vector autoregressive, granger causality, innovation accounting

ÖZET

2014 ortalarının önemli makro ekonomik bölümü petrol fiyatlarında çarpıcı bir dalgalanmaya sahne oldu. Bu çalışma uluslararası petrol/altın fiyatları ile Johannesburg menkul kıymetler borsası arasındaki ilişki üzerine deneysel bir araştırma yürütme amacındadır. Bütün bu değişkenler zaman içinde önemli değişiklikler görmüş , bu yüzden de şüpheye yer bırakmayacak şekilde aralarındaki uyumu dönemsel olarak doğrulamaya uygun niteliktedirler.

Çalışma 1 Ocak 2004 'ten 31 Aralık 2014 'e kadar olan aylık zaman dizimi içerisindeki verileri kullanır. Çoğaltılmış Dickey Fuller (ADF) ve Phillips-Perron (PP) testleri kullanılarak ünite kaynak sunumları için Vektör Otoregresive model ölçümlenmiştir. Günlük ilişkileri değerlendirmek için Granger neden sonuç ilişkisi testi,menkul kıymetler ve iki stratejik öneme sahip ticari gösterge arasındaki uzun vadeli ilişkiyi tanımlamak içinse Johansson eş bütünleşme yaklaşımı kullanılmıştır. Ayrıca her değişken üzerindeki şiddetli dış etkileri açığa çıkarma için kısa vadeli geri dönüt , anında tepki işlevinin yenilikçi muhasebe yöntemleri ve sapma çözünmesi ile belirlenmiştir. Johansson eş bütünleşme sonuçları analiz edilmiş değişkenler arasındaki uzun vadeli ilişki varlığına işaret eder. Granger neden sonuç ilişkisi test sonuçları değişkenler arasında ya tek yönlü ya da hiç bir nedensellik olmama zorunluluğunu göstermektedir. Tepkinin büyüklüğü temelde, anında tepki ve değişken çözünme sonuçlarında belirtilen yeniliklere değinmekten dolayı idi. Bulgular gösteriyor ki Güney Afrika ekonomik büyüklüğünü doğru finansal sistemlerle ve küresel ticari pazar dalgalanmasında yapacağı doğru zaman planlaması ile genişletebilir.

Anahtar kelimeler. : Johannesburg menkul kıymetler , petrol fiyatları , altın fiyatları, eş bütünleşme, neden sonuç ilişkisi, Yenilikçi muhasebe

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBRIVIATIONS

ADF: Augmented Dickey-Fuller

APT: Arbitrage Pricing Theory

BRICs: Brazil, Russia, India and China

CAPM: Capital Asset Pricing Model

DCC-GARCH: Dynamic Conditional Correlation- Gernalarised Autoregressive Conditional Heteroskedasticity

DDM: Dividend Discount Model

GARCH: Gernalarised Autoregressive Conditional Heteroskedasticity

HSBC: Hongkong and Shanghai Banking Corporation

IRF: Impulse Responds Function

JSE/ALL SHARE INDEX: Johannesburg All Share Index

OECD: Organization of Economic Co-operation and Development

OPEC-Organization of Petroleum Exporting Countries

PP: Phillips - Perron

SIC: Schwarz Information Criterion

USA: United States of America

VECM: Vector Error Correction Model

VAR: Vector Autoregressive

CHAPTER ONE

THE PROBLEM AND ITS SETTING

1.0 Introduction

This chapter focused on the background of study, statement of the problem, research objectives, research questions, significance of study, scope of variables under study and the limitations. The study concentrated on the analyses of the relationship between the stock market and the international oil/gold prices.

1.1 Background of study

The trauma of 2008! The global economic and financial meltdown is still spooking most investors. This prompted current and potential investors to shun the stock markets and placed faith on the yellow metal. In general since gold is a substitute of stock market it witnessed a high increase in price as compared to stock markets during the crisis. At the same time the oil prices were also galloping. For the past decade it can be announced that the oil/gold prices were having an upward trend movements. The price of crude oil was $115 per barrel in June 2014 and as at January 2015 it had slumped by more than half down to $49 per barrel. This was supposed to be a boom respond. With lower oil prices, shrink production costs (energy consumes bulk of operational costs); consumers will have more savings resulting in more spending and fat pockets. Oil is a core production input in most sectors of the economy and most governments place close attention on the oil prices. The drop in oil prices resulted in odd reaction. In general economics, the basic fundamentals of demand and supply are always culprits of this drop. The nightmare of the global financial crisis swallowed all the prospects of the global economic growth rate. Most international investors are still nervous and skeptical about the prospects of the United States economy as such the stock markets followed the oil price downward trend. Low spending power and risk fear impulse by most people have resulted in low prices in the ‘safe haven asset’ gold. For decades the South African economy has been under siege. The global crisis did not spear its local currency Rand(ZAR) from depereciating,inflation rate increasing, political instability, high

unemployment rate, low investments to mention a few, affected the stock market and South African economy adversely.

The World Bank (2015) noted that the current oil fall in prices takes place against the backdrop of both cyclical and structural developments that might affect growth impact in 2015-2016. The sources and implications of the sharp decline in oil prices have led to intensive debate (World Bank 2014). A 10% decline in oil prices would raise growth in oil importing economies by some 0.1% -0.5% points, depending on the share of oil imports in Gross Domestic Product (World Bank,2014). In South Africa the oil price movements are viewed with sentiments. The Reserve Bank Governor of South Africa, Lesetja Kganyago was quoted by Bloomberg business, 'The benefit from the lower oil costs for South Africa's economy will probably be temporary as the drop hasn't passed through to the wider prices and crude should increase further.' In 2014, South Africa imported 425,000 bbl/d of crude oil mainly from Saudi Arabia (38%), Nigeria (31%) and Angola (12%) according to the South African Revenue Service. The concentration of the losers (energy companies like British Petroleum (BP), Shell, Sasol,) compared to scatted winners is narrow. The drop in prices give some relief to the government as the import bill of oil is a major virus and notorious economic weak spot which adversely constrain the current account. The current account deficit narrowed somewhat to 6.0% of Gross Domestic Product in the third quarter according to latest Reserve Bank data (VERITAS wealth, 2015). A US$10 fall in a barrel of oil would reduce South African annual import bill by US$ 2 billion or 0.5% Gross domestic product, as the country imported on average of 196 million barrels of petroleum/year, this was noted by analysts at HSBC South Africa (Barnato, 2013).

At the same time the nemesis is being brewed. South Africa is one of the leading gold producers in the world. Gold have been a major contributor on Gross Domestic Product to this economy. Currently the international gold prices are hovering in the US$1300 range. Major companies are battling with high production costs and some are shelving new explorations as they make terms with break even. The prominent importance used to be injected in gold over the last two decades is vanishing daily as the production falls 20% between 2007 and 2011. Another new generation of minerals has taken over South

Africa by storm namely iron ore, platinum, and diamonds and these minerals are contributing immensely towards exports. Cost competitiveness, ideal or depletion of ore, lack of investment and labor unrests (demanding higher wages) are major drivers of gold production drop. All this drama is taking place at a time when the South African government is embarking on ambitious structural reforms to position Johannesburg as one of the best economies in the world. With the mixed operations on its commodity market, the equity market will be determined to surge and carry the national economic activity to the next level.

South Africa as one of the emerging markets from less developed continent, need to have a strong stock market that is well aligned with strategic commodity market as this market on the international platform is well debated. This is because these commodity indicators namely oil/gold have cultivated their way to the top of international markets. Although other macroeconomic fundamentals should always be taken into great consideration. The Johannesburg Stock Exchange (JSE) is the best stock market in Africa and one of the viable markets in the word. The stock market is at the top as most investors are in 'cloud nine' due to healthy returns. With the gold given the safe haven status, crude oil stressing the fiscal and the Johannesburg stock market emerging as the hub market it is of supreme to note that the relationship between these variables have been exhausted through enduring economic debates and still get contemporary close attention by multitudinous researchers. Gold is real money, oil drives the economy and the world sees the stock market and comment.

1.2 Problem Statement

The dramatic collapse of the oil price during the final quarter of the year was probably the most important macro-economic event of 2014 (Accauntancysa.org, 2015). Efficiency in the economy is derived by numerous macroeconomic variables. Oil and gold have earned strategic commodities and their economic use is empirical. South Africa is an emerging market which is directly/indirectly sustaining from developed economies (European Union and USA). The economic calamity of 2008 resulted in stock markets crush (bankruptcy), low spending, shrunk GDP growth rates, bailouts in

other countries. South Africa is under reforms to have sustainable economy. The key is to increase economic activity. Oil imports are not declining any moment soon as the economy is taking upward trend. The stock market is trading in flat phases as it remains sensitive to volatility on international markets. The importance of gold is shrinking in the economy and at the same time other central banks are making their gold reserves up. As such the emerging market, South Africa should be well abreast on the connections between its stock market and oil/gold prices as the crude oil and gold have a directly/indirectly significantly influence on the stock market. Security markets reflect what is expected to go on in an economy because the value of an investment is determined by its expected cash flows and its future required rate of return and both are influenced by its expected aggregate economic environment (Reilly and Brown 2003, 408). As both the commodity and financial markets are volatile, a vigorous assessment and portfolio maximization is key. Deficiency in terms of theoretical and empirical studies on elucidating the relationship between oil/gold prices and the stock market in South Africa is driving this present study. It attempts to dispense to investors, policy makers the empirical results about the association between these markets and its implications on the economy in general. In developed world the tracking and analyzing the trends of these variables has become crucial in their economies.

1.3 Research objectives

This study strives to obtain the following objectives;

- To anatomize the long run relationship econometrically and systematically, by investigating the impact of two strategic commodities (oil/gold) price fluctuations on the Johannesburg stock market of South Africa.
- To determine the casual relationship between stock market of South Africa on the fluctuations of oil/gold prices.

Other objectives

- To examines the fundamental aspects of gold and oil in terms of price, demand and supply.
- To emphasis the importance of Johannesburg stock exchange and its strides to become the hub of the world market.

1.4 Importance of the study

Financial analyst, macroeconomist, policy makers are always interested in the movements of oil/gold prices. In the contemporary environment to lure international investors, the stock market is the first port of call as the barometer used to propel the country's economic performance and its linkage with macroeconomic indicators. Oil/gold prices are used by many investors as macroeconomic variables due to their economic value, use and most importantly their information is readily available as everyone cares and stress about them. Setting an ambitious target to become one of best ten economies is bold and very encouraging. Market trading techniques, enhanced information, implementation of global investment portfolio strategies have all contributed to the importance to analyze the emerging economy of South Africa and need to comprehend the relationship between these indicators,

1.5 Research questions

a) What is the theoretical and empirical short and long term relationship between the stock market and oil/gold prices?

b) Is there a causal relationship between the stock market and international oil/gold prices?

c) Why is the recent drop in oil prices having minimum impact on the stock market and gold?

1.6 Justification of the study

The study is being carried out in partial fulfillment of the requirement of MSc banking and finance at Near East University. The present thesis will be of value to the following stakeholders;

a) South African government, policy makers, investment analysts, international investors

- Findings and analysis of the study will assist in understanding the dynamic relationship between oil/gold prices and the Johannesburg stock market. Potential as prediction model and portfolio diversification tool.

b) University

- The study will add to the reference material in the library for future use by other scholars who may wish to research on analyzing the relationship between oil/gold prices and the stock market.

c) Researcher

- The present paper will enhance the researcher's analytical skills and decision making in future business research.

1.7 Assumptions

The following assumptions are imposed in this present paper.

- The data will be secured electronically and will represent the South African stock market, world oil/gold prices respectively.
- Questions -the South African government and its institutions have equal opportunities in analyzing the relationship between the variables on this present paper.
- The Central bank monitors the Johannesburg stock exchange and the World Gold Council monitors the mechanisms of gold.
- Oil prices are determined on the world market (Brent)

1.8 Scope of the study

The research will focus on analyzing the relationship between the stock market and international oil/gold prices in South Africa. The present paper will dwell on South Africa because it is relevant to the objective of the study as the best emerging market in the world. The study will have a span from January 2004 to latest up-to-date data of 2014. Long period is required to be well objective in analyzing relationships when time series technique is applied. The thesis is solely based on secondary data and the research will be conducted in Cyprus (Nicosia). The Variables used will be the JSE/ALL SHARE INDEX (Johannesburg stock market), International oil price (Brent) and International Gold price.

1.8.1 Limitations

Access to information

- Although the variables information is available electronically through the internet, their validity is very important. As the data is sensitive, it can be spurious and need depth scrutiny. To avoid any spurious of data, well registered websites like the world gold council, Johannesburg stock exchange and the oil market (U.S energy administration Agency) will be well explored. Consultations from the academia stuff will be taken into account.
- The period taken into account might not reflect the actual objective of the study due to time constraints for this paper.

1.9 Organization of the study

This study is organized in six chapters. Chapter one is the problem and its setting, including the background of study, research questions, objectives and limitations of the study. Chapter two is the literature and theoretical framework. It highlights the prior empirical literature that has been conducted under this subject and in addition the theoretical framework will discuss the concepts of stock valuation and asset pricing models in relation to the study. Chapter three it's the general overview of the Johannesburg stock exchange and discussion of the international oil or gold in terms of prices, demand and supply. Chapter four is based on the methodology. Various econometric techniques used for the data analysis. Chapter five dwells on the empirical analysis and discussion of findings. Chapter six is the concluding remarks; discussion of major findings and in addition the implications of the findings, recommendations and areas for future explorations.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.0 Introduction

A historical perspective will be determined and draws up the conclusion regarding how strong or weak the relationship between the stock market and commodity markets (oil and gold prices). Some empirical studies indicate that there exist cointegrating among fluctuations in oil prices, gold and the stock market returns and on the other hand other studies suggest that stock market returns are not influenced by gold/oil prices. How does South Africa one of the emerging countries responds to such a dilemma? The theoretical aspects under the stock market and commodity market will be discussed. Investment maximization in these markets is galloping on the international market. Stock valuation is crucial to determine the returns on investment and the required rate of return on profitable corporate investments after undertaking risk is of paramount as to determine how these risky assets are valued. The deliberation is organized along three lines: there are studies related to stock market and oil; other studies focus on stock market and gold and some studies focused on both the gold/oil prices and the stock market, which is the similar case to present study. In each scenario developed economies will be given preferential deliberations due to the volume of empirical studies conducted in these countries and where available developing economies past studies will be acclaimed.

2.1 Empirical Literature Review

Oil prices had been fairly stable until 1973, and since then, the oil price has been quite fluctuating and the impact of oil prices shocks on the world economy has also been large (Le and Chang, 2011, 6). Arouri and Rault (2009) researched on the influence of oil prices on stock market using panel data analysis-cointergration techniques from 7 June 2005 to 21 October 2008 and from January 1996 to December 2007 for Gulf Corporation Countries (GCC). The main findings of the study found the presents of cointergration between the variables and also oil price increase have impact on stock retruns.BjØrnland (2008) investigated the effects of oil price shocks to Norway stock market an oil exporting state for the period of 1993 to 2005 using a structural VAR

model. The main outcome of the study was that oil has a direct impact on the stock market, an increase in the oil prices, stock returns increase immediately, increasing wealth and demand due to high oil prices. The results also emphasize on the role of other shocks, monetary policy shocks in particular as important driving forces behind stock market variability in short term. Arouri and Nguyena (2009) studied the relationship between oil prices and stock returns in Europe using econometric techniques. Their results showed strong linkages between the oil prices changes and stock market for most European sectors. Ono and Shigeki (2011) investigated the impact of oil prices on real stock return for BRICs using a VAR model with data span from January 1999 through September 2010. The results concluded that the stock returns responded positively to some of the oil indicators especially in China, India and Russian.

Apergies and Miller (2008) investigated the impact of structural oil-market shocks on stock returns for a sample of eight countries- Australia, Canada, France, Germany, Italy, United Kingdom and United States. Using monthly data sample with period of 1981-2007.The techniques for data analysis used were the Vector error-correction model (VEC) and Vector Autoregressive (VAR) models. The core finding of this study was that the international stock markets do not respond in large way to oil market shocks. The significant effects that exist prove small in magnitude. Jammazi (2010) explore how the interactions between crude oil (co) price changes and stock returns in five developed countries namely United States, Canada, Germany, Japan and United Kingdom. The Haar ā trans wavelet transformation (HTW) was applied to monthly data from 1989 to December 2007. The empirical results showed that the stock markets in United Kingdom and Japan do not receive significant shocks from crude oil markets, at the same time the stock markets in United States, Germany and Canada respond to shocks/volatility from the crude oil markets although the nature of responsiveness depend on the geopolitical area from which such shocks originates. Narayan and Narayan (2010) examined the impact of oil prices on the Vietnam's stock prices by performing econometric tests on daily data for the period from 28 July 2000 to 16 June, 2008 and the empirical results reviewed that oil prices have a significant positive effect on the stock prices in Vietnam. Sordorsky (1999) applied monthly data for a span period (1947:1-1996:4) to examine the relationship between S&P 500 Index and oil prices. Subjected to econometric

techniques, the empirical results show that positive shocks to oil prices depress real stock returns. Masih et al (2011) investigated oil price volatility and stock price fluctuations in an emerging market of South Korea. Monthly data from May 1988 to January 2005 where used and the VAR model was applied. The findings reviewed that oil price movements significantly affect the stock market negatively. Oskoow(2011) examined the oil price shock and stock market in an oil-exporting country of Iran and test for causality and variance. Weekly data from 2 January 1999 to 31 December 2010 was used. The two step procedure proposed by Cheung and Nguyena (1996) and Hong (2001) we applied. The empirical results reviewed that the variance of oil price fluctuations does not cause the variance of Iran stock returns. They was no causality between the variables. Sordorsky(2006) investigated the relationship between oil price and 21 Emerging stock market returns and applied the international multi-factor model. The period of study was from December 1992- October 2005, and the main findings reviewed that oil price risk positively impact stock returns in emerging markets. Kapusuzoglu (2011) investigated the long term relationships and short term dynamics between the Turkish main stock indexes (XU100, XU50 and XU30) and international Brent oil price using various econometric techniques. The period of study was between 04/01/2000 and 04/01/2010 daily data set. The empirical results from Johansen cointergration test, it was reviewed that there was a cointergration relationship between each stock index and oil prices(long run equilibrium) and Granger causality reviewed the presents of uni-directional causality(one way) from all the indexes of ISE to oil prices and oil price was not a casual cause of the three index.

Foote (2013) investigated the effects of oil prices on returns on the Nigerian stock exchange. Daily data was utilized over the period span from 12 December 2001 to 31 August 2011.Using GARCH-jump models the empirical results show a negative but insignificant effect of oil prices on stock returns in Nigeria due to dominance of the banking sector on the stock exchange. Aye (2015) investigated the oil price uncertainty for stock returns in South Africa.Appying weekly data covering the period between 1995:07:01 to 2014:08:30 using a bivariate GARCH-in-mean vector Autoregressive model. The results of oil price in US$ revealed a negative and marginally significant effect on stock returns. Lin et al (2014) examine the dynamic volatility and volatility

transmission between oil and Ghanaian stock market in a multivariate setting using VAR-GARCH, VAR-AGARCH and DCC-GARCH frameworks. Their results point to the existence of positive and significant volatility spill over and interdependence between oil and the stock market returns.

Ziaei (2012) analyzed the effects of gold price on the equity, bond and domestic credit for 8 East Asian countries (Indonesia, Malaysia, the Phillipines, Singapore, Thailand, China.Japan and South Korea) for a period span from 2006Q1 to 2011Q1. The study employed the panel GMM (generalized methods of moments) model consisting of quarterly data and the empirical results show a significant negative relationship between gold and equity. Ray (2013) investigated the casual nexus between gold prices and stock price in India for the period, 1990-91 to 2010-2011 based on annual time series data. The Jahansen cointegration test results confirmed that gold and stock price is cointergrated, indicating an existence of long run equilibrium relationship between the variables. Granger causality test finally confirmed the presents of uni-directional causality which runs from gold to stock price. Anand and Madhigarian (2012) analyzed the correlation and causality relation that may run between gold prices and stock markets returns across six countries (United States, United Kingdom and Germany as developed states and Japan, India and China as developing countries). Using Granger causality in the Vector Error Correction Model (VECM) for the period between January 2002 to December 2011. The final conclusion observed that in developing nations the stock's price granger cause the gold price whereas in developed nations the gold price granger cause stock prices. Creti et al (2013) investigated the links between stock price returns of 25 commodities and stocks over a period from January 2001 to November 2011 employing the dynamic conditional correlation (DCC) GARCH method and the empirical results showed that gold holds the safe haven status as gold correlates with stock returns(S&P500) and others where mostly negative and diminish in terms of stock prices. Bhunia(2011) examined the relationship between two commodity market indicators and the stock market in India. In the study performed for the period (2/01/1991-31/12/12) and in which Johansen cointergration approach and granger causality method were used. The empirical results of the co-integration test reveal the presents of cointergration between the variable in the long run. The granger causality

shows that there are bidirectional causality connections between the stock market and oil/gold prices. Akgùn (2013) looked into the effects of oil and gold on the BIST 100 index in Turkey. In the study performed for the period 2000/01 to 2013/04 and in which econometric techniques where applied. The Johansen cointergrating tests depicts that the BIST 100 index, oil and gold prices are cointergrated (they move together in the long run). They was a positive link between the oil price and BIST 100 index and whilst gold prices and the BIST 100 index share an inverse relationship. Biag et al (2013) conducted an investigation to determine the relationship between gold/oil prices and the stock returns in Pakistan. This study used monthly data for the period of 2000 to 2010. Unit root test, Johansen and Jesulius cointegration test was applied to detect the long run association and Granger causality were used to find the lead and lag relationship and co-movements between the variables and short term dynamics were determined by the variance decomposition and impulse responds function. The results reveal that they were no-cointergration between the KSE 100 and oil/gold prices. Granger causality test reveals uni-directional causality from oil to gold.

It is eminent that the empirical evidence on the relationship between the stock market and commodity market is blended. Several empirical findings mainly concentrated on advanced economies and a severe lacuna in developing nations(3^{rd} world countries) still prevails and as noted by the researcher only a drop of studies exist on developing nations concentrating on these two markets. This present study seeks to contribute towards filling this depression.

2.2 Theoretical Framework

Different investment assets are priced differently and the fundamental principle for any portfolio manager or investment specialist is to maximize the shareholders return by optimizing possible asset portfolios. The compensation for risk acquired on risky assets should be healthy. The trade-off between risk-return dilemma is what financial professionals strive to balance. Variance and Standard deviation have received much theoretical support as measures of risk.

Undiversifiable (systematic) risks are always integrated with risky assets. In a given environment, investors must labour to minimize the risk premium which is a function of

business risk, financial risk, liquidity risk, exchange risk and country risk. Diversification is linked with optimal solution of hedging against unsystematic risk. One cannot eliminate all variables and uncertainty of macroeconomic factors that affect all risky assets (Reilly and Brown 2003, 245). At this juncture it is of essence to shed some light on the tools available to investments and portfolio managers to value the prices and returns of corporate investments. " The essence of risk management lies in maximizing the areas where we have some control over the outcomes, while minimizing the areas where we have absolutely no control over the outcome and hence the linkage between effect and cause is hidden from us" (Bernstein 1996,197). The discussion will break the ice through the valuation of stocks by the Dividend Discount Models (DDMs) as all investors need to be aware on how their stocks are being priced on the market and this model will yield the importance of measuring the required rate of return by having a maximum optimization between the risk-return catastrophe. The main theoretical models of asset pricing which have been highly debated and still attract more attention in the 21st century are the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT).

2.2.1 Dividend Discount Model (DDM)

Method of estimating the value of share of stock as the present value of all expected future dividend payments (Corrado and Jordan, 2002, 154). The return can be calculated using different several models namely: zero growth models, constant-growth models, multiple model and infinite valuation model. All investors wish to get a dividend growth $D_t = D_{t-1}(1+g)$ for their investments. The cleanest and most straight formal measure of cash flows is dividends because these are clearly cash flows that go directly to the investor, which implies that you should use the cost of equity as the discount rate (Reilly and Brown 2011;378). The constant growth model states that dividends will grow from period to period at the same rate $D_0(1+g)$ and the value will be determined as$V = {D1}/{K-G}$. Valuation based on a finite holding period - the capitalization of income method of valuation involves discounting all dividends that are expected throughout the future (Sharpe et al, 1999, 533).

The valuing of share of common stock by discounting its dividend up to some point in the future and its expected selling price at that time is equivalent to valuing stock by discounting all future dividends (Sharpe et al, 1999, 533). DDM is very useful when discussing valuation for a stable, mature entity, where the assumptions of relatively constant growth for long term is appropriate (Reilly and Brown, 2003, 378). Also at the same time numerous literature have critised DDM as they are subjected to high manipulations, unreliable and also different sectors reward investments differently like the private and public sectors. Due to a number of its short sightedness and other failed empirical tests, other models where proposed as alternatives like relative valuation techniques (price/earnings ratio, price chashflow ratio, price book value ratio) and other equity methods such as present value operating free cash flows, discounted cash flow techniques and so on. Financial analysts readily acknowledge the limitations of dividend discount models; consequently they turn to other valuation methods to expand analyses (Corrado and Jordan 2002, 163).

2.2.2 Capital Asset Pricing Model (CAPM)

This model was introduced by individuals namely Sharpe (1964), Linter (1965) and Mossin (1966) and this model milks much of its foundations from the works of Markowitz (1952) portfolio theory. This model emerged as the spinal code of modern finance. It has received numerous attention of study by many interested parties (academics, practitionaries, market specialists and so on). The CAPM is a set of predictions concerning equilibrium returns on risky assets (Bodie et al 2002, 263). By simplification of the assumptions embodied in the model, the CAPM can be mathematically be represented by $\mathrm{E}(R)_i = rf + \beta_i[E(R_m) - rf]$. $\mathbf{R_i}$ = Expected rate of return,$\mathbf{R_f}$= risk free rate (zero beta),$\boldsymbol{\beta_i}$=Beta of capital (sensitivity);$\mathbf{R_m}$=the market return and ($\mathbf{R_m}$-$\mathbf{R_f}$) is the market risk premium.

The measure of an asset's systematic risk is referred to as its beta (Reilly and Brown, 2003, 22). The CAPM favored the use of beta over variance and standard deviation. To the extent that the CAPM is acceptable; 'risk' should be measured by each assets beta-coefficient, not its standard deviation of return (Bailey 2005; 154). Beta is the covariance of the assets with market portfolio as a fraction of the market portfolio. The

ultimate question regarding CAPM is whether it is useful in explaining the return on risky assets; especially is there a positive linear relationship between the systematic risk and the rate of return on these risky assets? Sharpe and Cooper found a positive relationship between return and risk although it was not completely linear (Reilly and Brown 2003, 261). This model preached about the importance of diversification and optimization of portfolios of risky assets. Diversification should not, in any case be constrained as a panacea for attenuating, let alone eliminate risky (Bailey 2005, 157). Single market (index) CAPM received multitudinous criticisms as they argued it failed as a pricing model. In effect the paradigm of the CAPM and efficient markets may need to be replaced with a paradigm of markets as vulnerable to capricious behavior (Dempsey, 2012, 9).

2.2.3 Arbitrage Price Model (APT)

Developed by Ross (1976) as the multi-factor model alternative to the myopia of the Capital Asset Pricing Model. Arbitrage is the process of earning riskless profits by taking advantage of differential pricing for the same physical asset/security (Sharpe et al 1999, 284). The concept of APT is central to CAPM (Boidie 2002, 320). The APT reduced the several assumptions of the CAPM to a minimal and argued the presents of factors(variables) which the CAPM overshadowed. The one assumption unique to APT is that unrestricted short selling exists-This acopian situation is available to only a few (such as investment banks and stock exchange specialists) in today's financial markets (Francis and Taylor 1992, 248).

One factor APT model - this model is equivalent to the CAPM. The law of one price (LoOP) principles are part of the APT model. Though some assumption from the CAPM; most investors prefer more wealth to less and risk aversion concept, the APT do not support the assumptions that returns are normally distributed, type of utility function and market portfolio to mention but a few. The one factor APT model is represented by $E(r)_i = \lambda_0 + \lambda_1 b_i$:where $\mathbf{E(r)_i}$ is the expected return on security **I,**$\boldsymbol{\lambda_0}$ is the return for zero beta portfolio, $\boldsymbol{b_i}$ is the sensitivity of the ith asset to the risk factor, and $\boldsymbol{\lambda_i}$ is the factors risk premium (Francis and Taylor 1992,248).

Two Factor APT model - $E(r)_i = \lambda_0 + \lambda_1 b_{i1} + \lambda_2 b_{i2}$ where $\boldsymbol{\lambda 2}$ is the risk premium associated with risk factor 2 and $\boldsymbol{b_{i2}}$is the factor beta coefficient for factor 2 and factors 1 and 2 are uncorrelated (Francis and Taylor 1992, 251). The APT gave room for multiple factors (variables) of affect the stock returns and shun away from all reliance on the betas as applied by the CAPM. Market perfection is impossible due to several fundamentals like the inflation rate,taxes,transaction costs, money supply, industrial production and so on thus the APT had an eye on such factors.

Multifactor APT model - $E(r)_i = \lambda_0 + \lambda_1 b_{i1} + \lambda_2 b_{i2} + \cdots \lambda_k b_{ik}$This is an extension of variables to **k** risk factors. The APT has one serious detrimental drawback; the model is silent on how to generate the factors and what they are? As such numerous studies have concluded that this model like the CAPM is not conclusive.

Both models the CAPM and APT had one goal; to aid in determine the required rate of return from risky assets. The CAPM commenced with its simple assumptions incorporated from the Markowitz portfolio theory. In general the first pot of call when evaluating the risk-return trade-off is the CAPM. The APT is a breed of CAPM. This model reduced the assumptions and advocated for more factors and left many guessing what are these factors or variables and how to determine them. CAPM is a simple model no rocket scientist is required to apply this model as compare to the APT which need a serious heart surgery in determining the factors and its applicability. At the end of the business day it all comes to the point where each model depends on what one needs to achieve by understanding each models concepts, applicability and limitations. It is probably safe to assume that both the CAPM and the APT will continue to be used to price capital assets; coincident with their use will be further empirical tests of both theories, the ultimate goal being to determine which theory does the best job of exploring current returns and predicting the future one (Reilly and Brown 2003,304).

2.3 Summary of the Chapter

This chapter covered the past studies and concluded that they are vacuums for future studies in developing nations. The literature also reviewed mixed relationships between the stock market and international oil/gold prices. South African responds to these two markets will be discussed is subsequent chapters. The chapter went further to discuss the

concepts or theoretical framework in finance. It looked at the valuation of stocks through the Dividend Discount Models (DDMs). These models are looked at firstly by many analysts due to their simplicity. However many noted their deficiency and advocated for other relative valuation techniques. Asset pricing tools namely the Capital Asset Pricing Model (CAPM) was discussed as the forefront technique of pricing assets due to its simplicity and applicability. However due to some failed empirical results the CAPM attracted multiple criticisms and resulted in other models being put forward. The Arbitrage Pricing Theory (APT) imaged as the alternative statistical model. It reduced numerous assumptions proposed by the CAPM and assumed more reasonable by its inclusion of many factors. It suffered a knock as it failed to disclose how to determine these factors and what exactly are they. Hence all these models proved inconclusive and their ability as theory to explain relevant empirical evidence was questionable. The use of these models rest on one's judgment, where to apply and the desired results required.

CHAPTER THREE

GENERAL OVERVIEW OF THE JOHANNESBURG STOCK EXCHANGE AND INTERNATIONAL OIL/GOLD PRICES

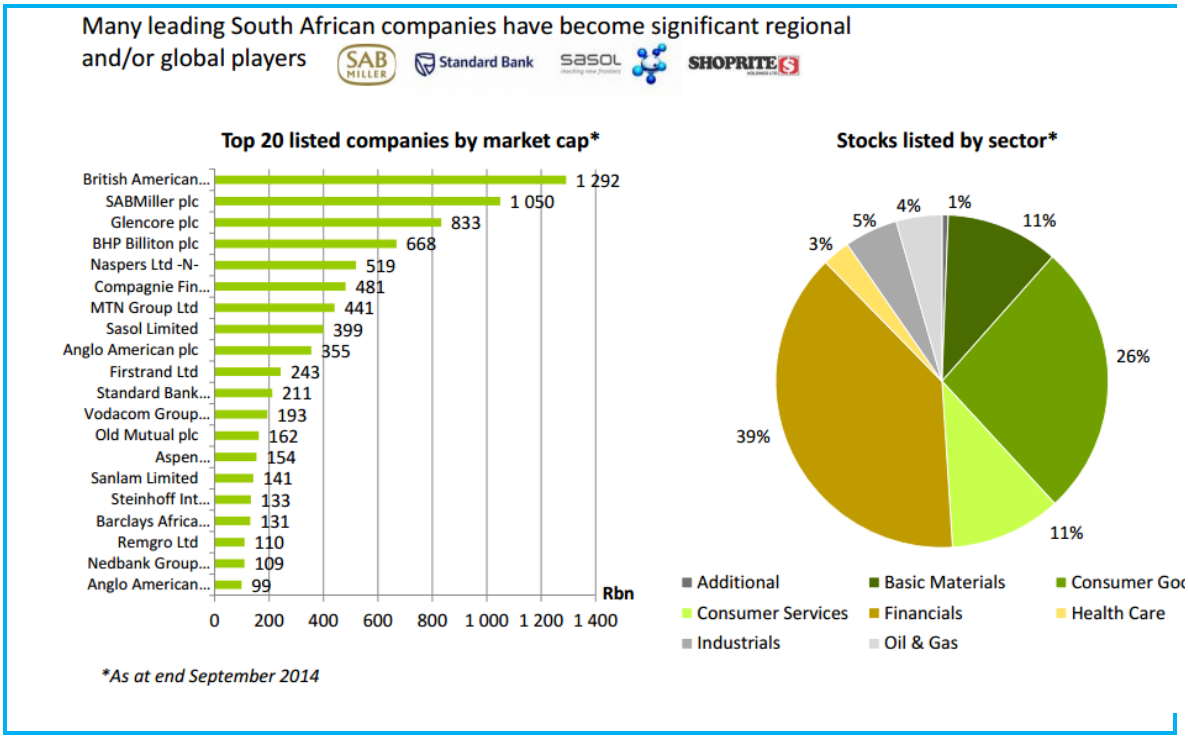
3.0 Introduction

This section will shed some light on the general features of the Johannesburg stock market, its role on the South African economy and on the African market. The international commodity prices of oil and gold will be discussed based on their price characteristics and the supply and demand as the major fundamentals that determine the volatility on this market.

3.1 The Johannesburg stock exchange

The gold stumped of 1887 unlocked the door of the Johannesburg stock market and ever since that day the stock exchange has experienced great strides. It is currently ranked the 19th largest stock market in the world due to it capitalization paged at US$ 1,007 billon as at 2013 and the largest market in the African continent. South Africa located in the Sub-Saharan Africa with an estimated population of 53,16 million as at 2013 and current GDP of US$366.1 billion in 2013(www.worldbank.org). Clearly a country with such figures requires a sound social-economic advancement. Security markets reflect what is expected to go in an economy because the value of an investment is determined by its expected cash flows and its future required rate of return and both of these factors are influenced by its expected aggregate economic environment (Reilly and Brown 2003, 408**).** In 2002 the stock market striked a fortune when it merged with the London stock exchange and became known as the FTSE/JSE all share index. This heavily connected the Southern African nation with the developed club.

Figure 3.1 leading companies listed on the Johannesburg stock exchange



Source captured: www.jse.co.za.

Multinational Corporations are encouraged to list on the exchange and this has seen corporate giants like BAT, SABMILLER, BHP Billion, BP, Anglo American listed and their share indexed; traded and these firms have dominated the market.

On the continental seen the Johannesburg stock exchange has assisted other governments to float their bonds on the market as a case of Namibia, floated 10 year bond. The Johannesburg stock exchange advocated for the integrated African board. The objective is to build a continental hub and spoke system of connections between Africa's increasing number of electronic bourses, capable of routing buy and sell orders and data between African exchanges, and thereby developing business strategy (www.worldfinance.com).

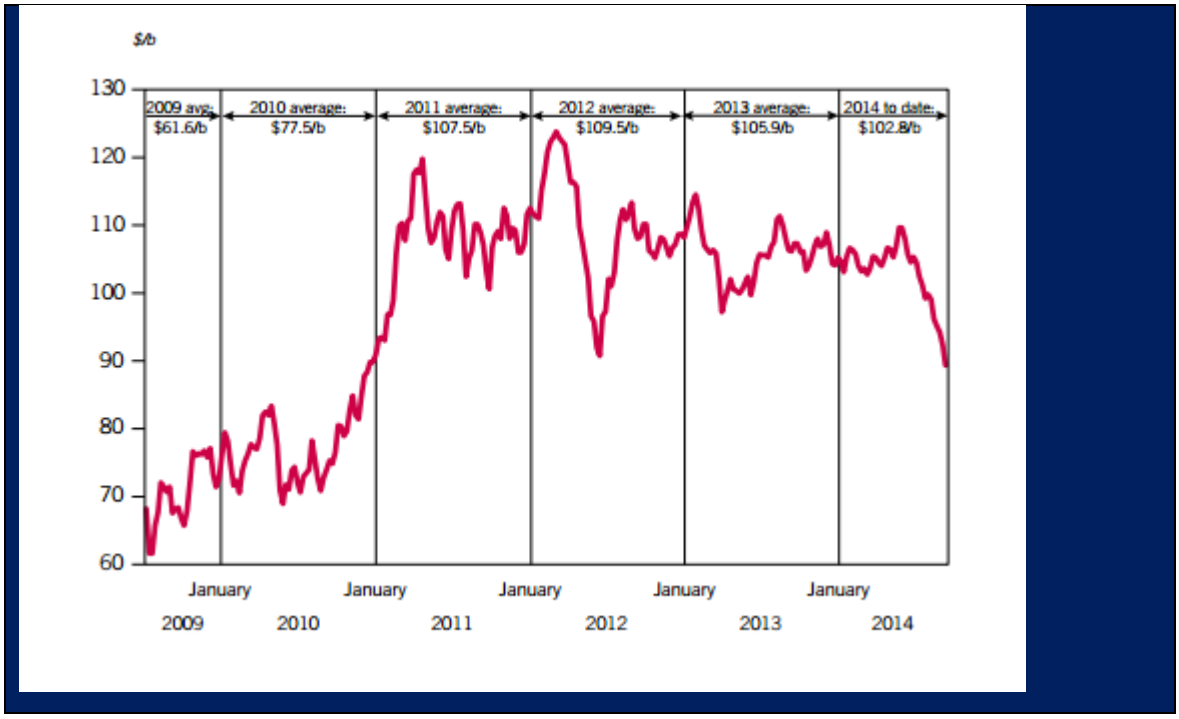
Financial sector in South African has dominated the stock exchange. Due to its sound stock market the economy was one of the countries to attract more foreign direct investment in 2014 in terms of emerging markets alongside Turkey,Chile,Indonesia ,Kenya. Not everyone is smiling with the success of the equity market as noted by Mungai, 2015, "The effect is Dutch disease of sorts, where money multiplies itself

endlessly on the stock markets, therefore a little incentive to direct it into production economy resulting in 'jobless growth' and outsized gains for investors in the financial markets; who can comfortably live off interest accrued from their financial assets and do not necessarily have to build anything in the labor-absorbing economy in order to create wealth."

3.2 International Oil Price

Oil muscled its way to the supremacy and acquired a permanent spot in the investment portfolio and resulted as one of the most traded commodity on the international arena. Drilling which started in the 19th century has resulted in major developments in this product to the level that the 21st century is at the receiving end. Crude oil futures were introduced in March 1983 and this contract is now the most heavily traded energy contract and the most heavily traded non-financial futures contracts (Huang et al 1996, 6). The mechanisms of demand and supply have been dominating the volatility of oil prices. Oil is a globally traded commodity and the price of oil is determined by global oil demand and global oil supply conditions (Henriques and Sadorsky, 2007, 999).

Figure 3.2 OPEC average international oil prices



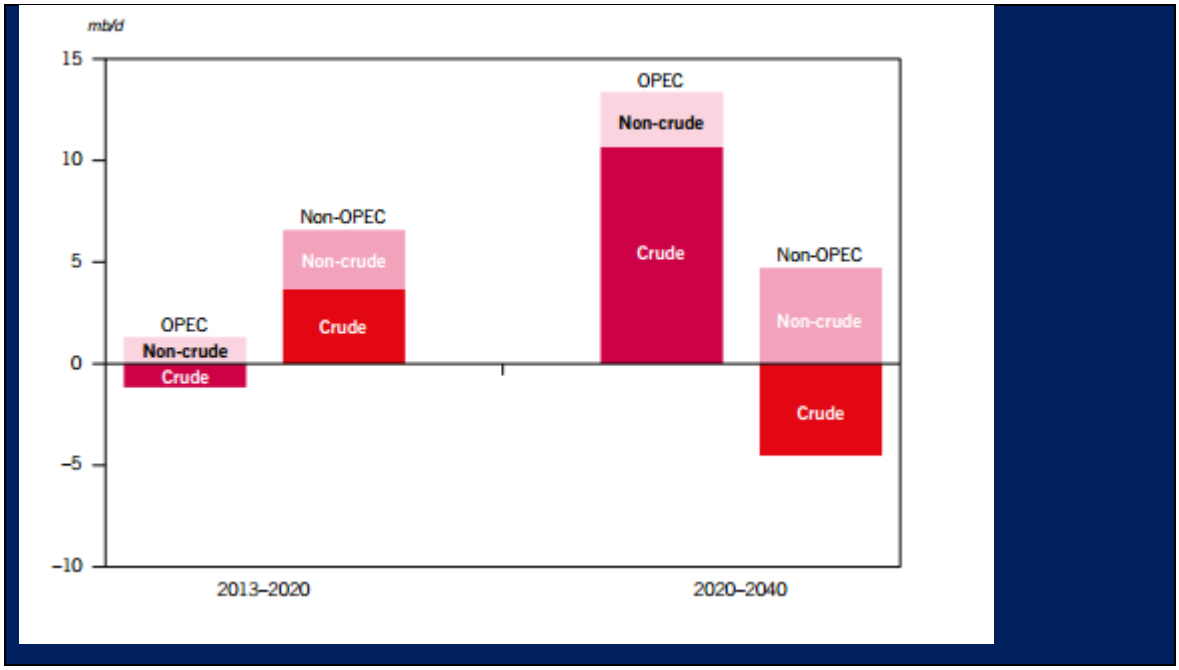
Source: World oil outlook 2014

The global financial crisis was coated with high oil prices and slowdown in economic activity (stocks crushed). Many empirical studies have highlighted inflation and recession as germinated by oil price fluctuations, for instance the oil price hike of 1974 and 1979 played critical roles in slowing down the world economy, at the same time inflation was also rising (Le and Chang 2011, 2). War prices and need for dominance from the OPEC cartel and the United States have been catastrophic on the oil prices. With the recent slump showcased in mid-2014 where a drop of close to 50% per barrel was witnessed, oil dropped from almost US$150 to $60 and this demonstrated how volatile this commodity can be. Figure 3.2 shows the oil prices as averaged by OPEC from 2009 -2014. Increasing oil prices will increase the production costs under the circumstances where there is no substitution possibility between factors of production, higher production costs will affect cash flow and will decrease stock prices (Kapusizoglu 2011, 99).

3.3 International Oil Supply

Although OPEC crude oil falls in the medium-term years below 29 mb/d over the long term it raises (OPEC 2014, 83).

Figure 3.3 Oil supply by both OPEC and Non-OPEC countries



Source: Captured World Oil Outlook 2014

Shocks to the physical supply of crude oil or to oil-specific demand, indicate a higher degree of macroeconomic uncertainty and are interpreted as bad news (Bastianin and Manera, 2014, 2). Due to the scarcity of world oil reserves, the global supply will always depend up to barons with investments they seek to maximize at all cost. OPEC is the main barometer to determine the supply of oil. As show from Figure 3.3 oil supply will never drop in the long run. Global economic activity in the long run will assist the increase or decrees in drilling. Recently the drop in oil prices did not spook the chief of the oil club, Saudi Arabia as she remained adamant to shelve production prospects and cut oil supply as most of its members are feeling the hot air due to the price slump. At the same juncture the United States has advanced its shale production leading to overflow of oil on the market. Simakova (2011, 653) depicted vital sentiments from Balaz (2002) that total oil supply depends on several factors: Amount of proven global oil reserves and new deposits, technical and technological advances in oil extraction and

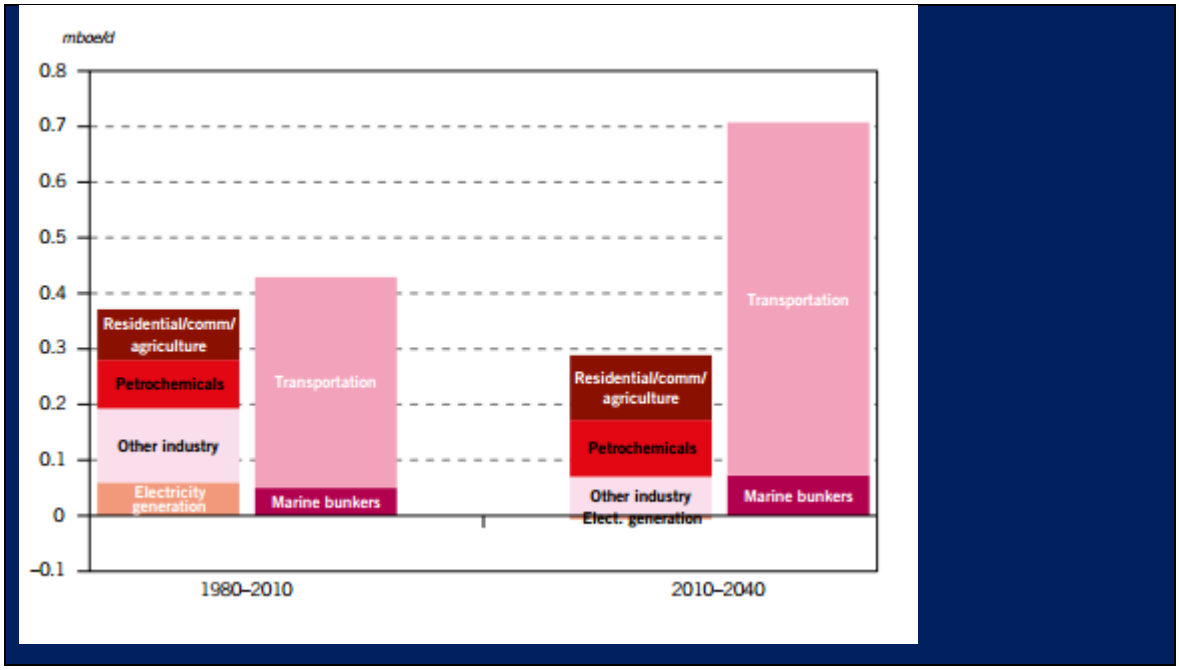
processing, monetary system in producing countries, political factors, the activities of OPEC and NOPEC (Non-Oil Power, Exporting Countries) and short term factors, natural disasters, accidents, political and military conflicts.

3.4 International Oil Demand

Only OECD regions falls demand and developing countries, China and other Asia, India they will experience an increase in oil demand and also in an annual basis in 2015, non OECD oil demand is expected to exceed that of the OECD for the first time, this was shared by OPEC in their Outlook report 2014. Increase in global economic activity will attract more demand for oil. Figure 3.4 demonstrates how the transportation sector is poised to dominate the oil demand in the years to come; this can be due to globalization as most people travel from one continent to another and increased trade volumes between countries. Oil in all forms of transportation, road-aviation, internal waterways and international marine- increased by an annual average of more than 0.7 mboe/d over the period 1980-2010 and was clearly the source of increase in demand (OPEC, 2014, 73). The demand can inversely be affected if they are a decline on global economic activity as is characterized with low investments, low spending and shrinking prospects.

Developing countries are also expected to demand a significant share of the oil produced. This can be due to high increase in global investment attraction.

Figure 3.4 the demand of oil from different sectors of the economy



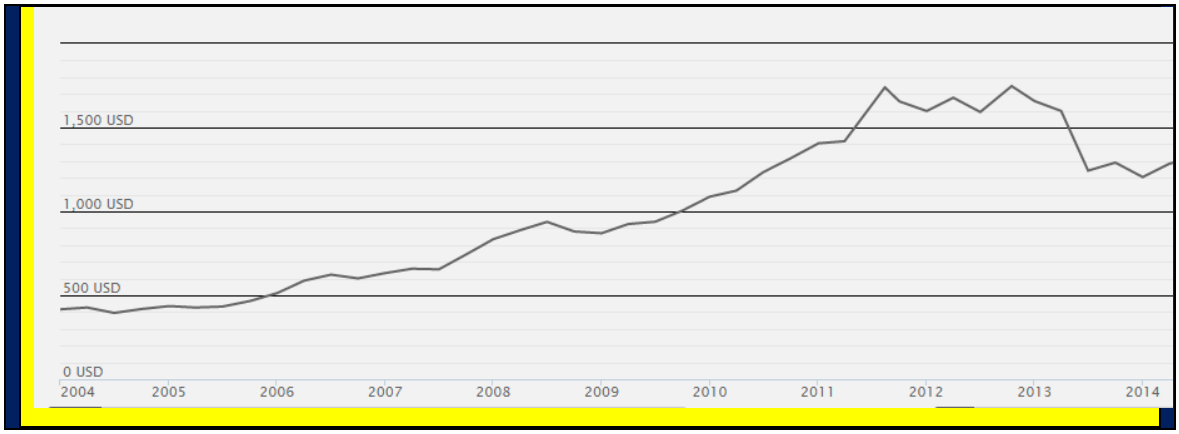
Sauce: captured from world oil outlook

Samakova(2011,653) from the works of Boloz(2000) noted that ,the driving forces of oil supply depends on several factors namely: Changes in world population, world GDP,structural changes in the economy, changes in energy balance, climatic conditions and changes, importers exchange rates against US dollar, commercial policy actions in importing countries and speculations and other factors.

3.5 International Gold Prices

Gold historically proved its significance as form of currency and of lately as an investment vehicle. The yellow metal is a non interest earner and hence its prices tend to drop when interest rates increases and make other investments superior or attractive. Gold has a critical position among the major precious metals class, even considered the leader of precious metal pack as increase in its prices seem to lead to parallel movements in the prices of other precious metals (Le and Chang 2011,2). The price of gold has little impact on oil and vice versa it's true. The correlation between oil prices and gold prices is very high.

Figure 3.5 International gold prices



Source: world gold council

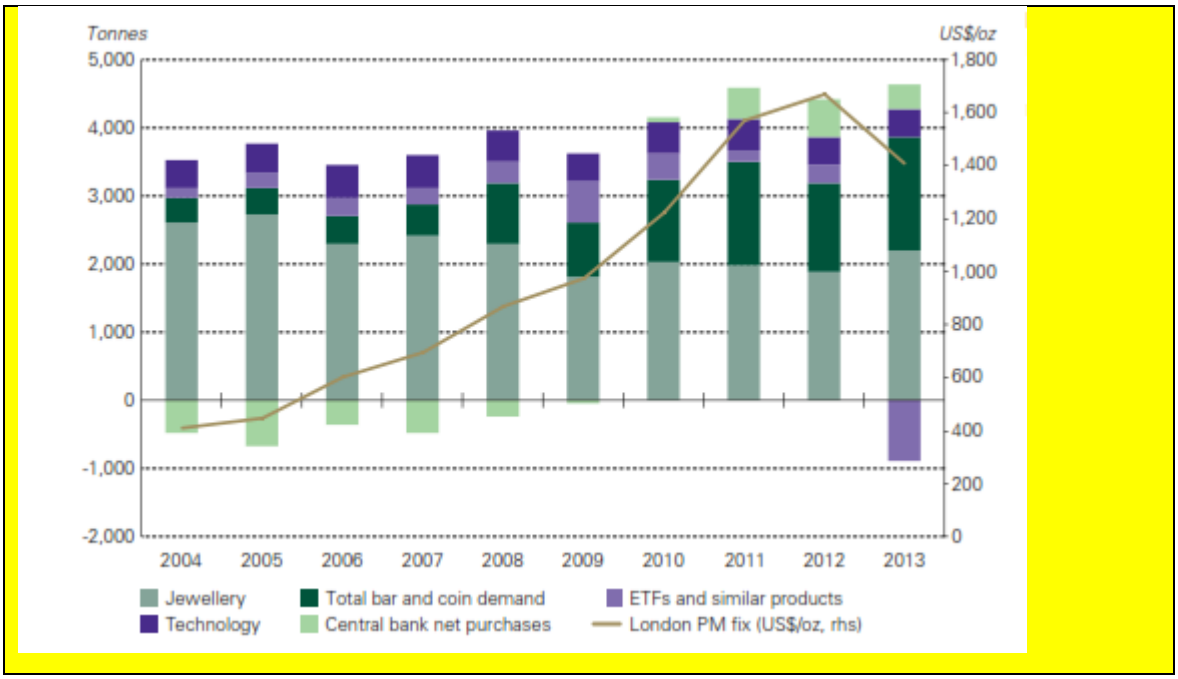
Dynamics of supply and demand in bullion are supported by functionality and features of this precious metal as well as investment characteristics (Samakova 2011; 654). After World War II, the Bretton Woods pegged the United States dollar of gold at a rate of US$35 per troy ounce (Sajit and Kumar 2011, 145). From this episode the price of gold have been a turbulent ride. Currently the prices of gold have been hovering between $1000 and $1300 market range. This is due to the decline is global economic activity.

Monetary policy performed by governments, changes in interest rates, inflationary policy, this all affects the price of gold, which is often used as an official reserve asset (Samakova 2011, 654). For centuries ever since the day gold became the first excavated mineral drilled by humans, it have received the safe haven status. Gold as an asset has a hybrid nature: it is a commodity used in many industries but also it has maintained throughout history a unique function as means of exchange and store of value, which makes it akin to money (Sajit and Kumar 20011, 145). Cheaper oil means lower inflation. This means gold should be affected negatively since it's usually considered a hedge against inflation as noted by Gilsory (2015) for Finance.yahoo.com. From Russia to South Africa to North America, the biggest producers saw profits turn to losses as prices plunged forcing them to cut spending on the mines in half over three years (Walt,2015).

3.6 International Gold Demand

Gold has been utilized as a strong commodity by many for decades now. Most people have concluded that gold is a 'safe haven' asset against turmoil's. As such it has increased its demand globally. Currently the US$ in which the gold bullion is quoted has gained its value and the gold price and demand have dealt a blow. Central banks are highly acquiring gold with a net purchases of 368.6t of gold in 2013,Russia 77t,Kazekastan 28t,Azebayijan 20t and Korea 20t (World Gold Council,2013).

Figure 3.6 Gold demand by category (tonnes) and the gold price (US$/oz)



Source: Adapted from World Gold Council

Figure 3.6 shows that 2013 proved to be the year of the consumer, with gold jewellery demand close to pre-crisis high levels and investment in small bars and coins, hitting a record high. The result was annual gold demand of 3,756 tonnes valued at US$170 billion (World Gold Council 2013). The World Gold Council also noted that full year demand totaled 3.953.7 tonnes in 2014 (from 4.087 in 2013) and the it went further to highlight the impact of a strong dollar against the metal. Central banks seeking continued diversification away from the US dollar, central banks absorbed 477.2t of gold in 2014, 17% above 2013s impressive 409 tonnes. This was highest year of central banks net purchases for 50 years after 5444 tonnes addition to global gold reserves

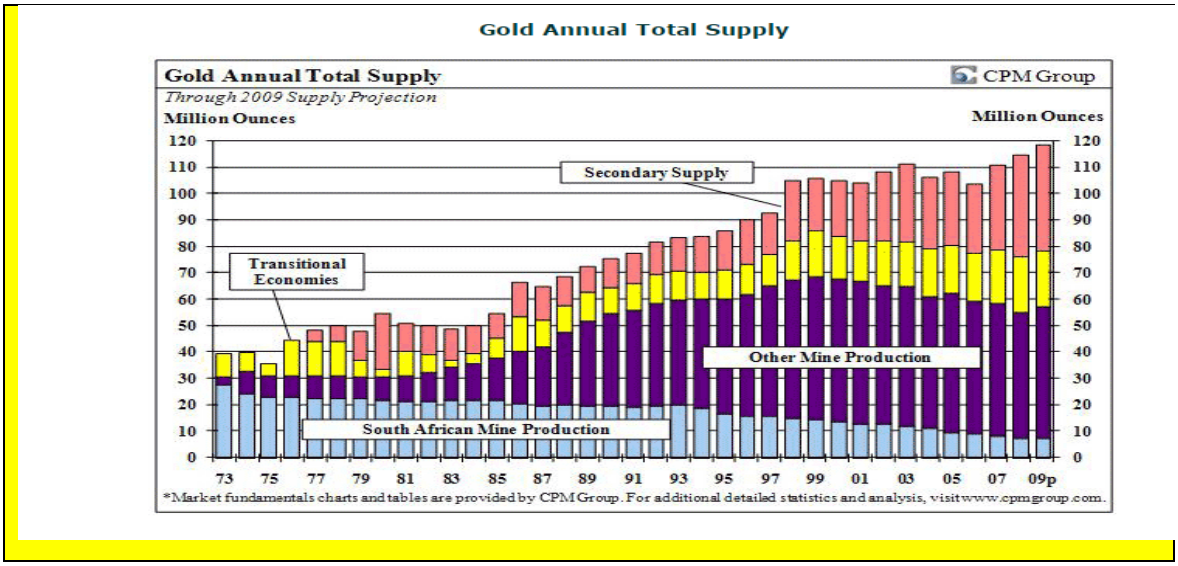
reported in 2012(world gold council 2015). Demand of gold also increases during the periods of price stability or moderate growth rates and then decreases in periods of volatility (Samakova, 2011, 654).

World population and world GDP,growth of living standards of population, policy of central banks, exchange rates against the US$ and speculative and effects where some of the factors highlighted by Samakova (2012,65) that have impact on the international gold demand market.

3.7 International Gold Supply

Gold was the first metals human excavated (Sujit and Kumar 2011.1). At the end of 2013, there were 177.200 tonnes of stocks in existence above ground, the world gold council revealed. China is the largest producer in the world accounting for around 14 percent of the total production. South Africa is the leading producer in Africa and in top 10 best producers of the world. Due to blink economic prospects the producers have dismantled their machinery as they struggle to run it due to continued losses. Finally we today face the fact that the gold output has declined by more than 20 percent since 1916, and we are told disaster impedes unless something is done to stimulate production (Berridge 1920, 181). The cost of production is not in line with the bar at which the gold price is. Samatova (2011;655) in his articles noted the main factors that affect demand of gold as summarized by the world bank: verified global gold reserves, recycled gold new deposits, technical and technological process in gold mining, monetary system in each country, political factors and short term factors: national disasatsers,political and military conflicts. Figure 3.7 shows the supply of gold from other economies and the South African supply to the International market. The supply of gold is currently being hampered by low returns and operating at higher operational costs.

Figure 3.7 Gold annual total supply



Source: captured from kitco.com

3.8 Summary of the Chapter

The Johannesburg stock exchange is discussed as the hub and viable stock market in the world, its role in South African economy and externally. The independent variables of the study (oil and gold prices) were highlighted in terms of their prices, demand and supply. The major outcome of the discussion reviewed different factors that prompt the demand and supply volatility on the market. It was also acknowledged that these commodities are crucial in 21st century as they make headlines on the international markets frequently. The role and importance of these variables also support the present study criterion of identifying these variables. The South African financial market has over powered the previously dominated territory by gold market. There is adequate liquidity to spend on oil imports and less stress on the fiscal to the extreme. Gold is produced locally and oil is import product thus the stock market plays as the arbitrage in order to optimize the portfolio.

CHAPTER FOUR

METHODOLOGY

4.0 Introduction

This section looked at the approach on carrying out the research and outlines all the methodological aspects of the present thesis in order to obtain the objective of the study and answer the research questions. The literature review highlighted some of the econometric techniques at the disposal in order to carry out empirical analysis and this section will outline all the appropriate techniques relevant for the present thesis.

4.1 Econometric Methodology

In the present empirical analysis the sample period regarding the South African model spans from 01/01/2004 to 31/12/2014, consisting of 132 observations for each variable. The analyses have been performed using monthly data.

Table 4.1 dispenses the definitions and the origin of the variables along with the derivation of the time series under evaluation. Regarding the data, the JSE/ALL SHARE index and international gold price (US$) data was retrieved online website (http://www.investing.com) and international Brent oil price (US$) have been obtained from the US Energy Administration Information Data System (http://www.eia.org.com).

Microsoft Office Excel 2010 and Eviews 8.0 package program have been used for the arranging of data and econometric analyses. Firstly all the basic series are converted into natural logarithms. Taking the natural logarithm of such a series effectively linearizes the exponential trend (since the log function is the inverse of an exponential) and differencing if one wants to remove the trend component from the (time) series entirely-i.e. to render it stationary-one needs to apply differencing, i.e. compute absolute changes from one period to the next (Asteriou and Hall, 2007, 18).

The JSE/ALL SHARE index represents 99% of the full market capital value that is before the application of any investability weightings of all ordinary securities listed on the main board of the JSE, subject to minimum free float and liquidity criterion

(http://www.ftse.com). International Brent oil price have highly validity and preference on the international market. The yellow metal, gold is widely monitored by international investors as it coated with the "safe haven" status.

4.2 Research model and variables of the study

Based on literature review, it is quite evident that a number of models were proposed by many researchers in an attempt to figure out the relationship equilibrium between the stock market and macroeconomic fundamentals. This recent study will adopt two strategic commodity indicators namely crude oil and gold price and analyze their affiliation with the stock market. The dependent variable will be stock and the independent variables (oil/gold prices). The proposed model is econometrically detailed as:

Econometric model:

$$JSE_{it} = \beta_0 + \beta_1 OIL_{it} + \beta_2 GOLD_{it} + \beta_3 DUM1_{it} + \beta_4 DUM2_{it} + \beta_5 DUM3 + \varepsilon_{it}$$

Where: JSE represent the Johannesburg stock exchange All Share Index (South Africa), Oil represent Brent crude oil price, Gold represent the international gold price and Dum1 represent the structural break of Oil (2008M08, Dum2 represent the structural break of JSE/All share index for (2008M06) and Dum3 (2007M7) structural break of gold. $\boldsymbol{\beta_0}$ is the intercept, $\boldsymbol{\beta_1}$, $\boldsymbol{\beta_2}$, $\boldsymbol{\beta_3}$,$\boldsymbol{\beta_4}$ *and* $\boldsymbol{\beta_5}$ are regression coefficients, $\boldsymbol{\varepsilon_t}$ represent the idiosyncratic risk factor. It is expected that crude oil will have inverse relationship with the stock market based on the norm that shocks that trigger oil price to soar will result in surge in cost production, inflation upwards and at the end the producers will pass the extra burden to the consumer to avoid negative returns or break even. Consumer spending will shrink and the value of equity will decline. Gold will have a negative relationship with stock market as it is a competitor or substitute investment asset especially periods of high uncertainty.

Table 4.1 Glossary and Definition of variables

SYMBOL	VARIABLE	DEFINATION/SOURCE
JSE/ALL SHARE	RETURN ON JSE/ALL SHARE It is a free-float market capitalization-weighted index(www.tradingeconomics.com)	Monthly average index of common stocks listed in the Johannesburg stock exchange(JSE/ALL SHARE index, not seasonally adjusted(Investing.com)
OIL	Crude Oil Price	Monthly crude oil international purchase price (US Energy Information Administration)
GOLD	Gold Price	Monthly international gold price(investing.com)
DERIVED SERIES		
ΔJSE	Return on JSE/ALL SHARE	$LogJSE_t - LogJSE_{t-1}$
ΔOIL	Change of oil prices	$LogOIL_t - LogOIL_{t-1}$
ΔGOLD	Change of gold prices	$LogGOLD_t - LogGOLD_{t-1}$

Source: Author's table: Adapted from empirical literature.

Table 4.2: The present study applies descriptive statistics to determine the mean, standard deviation, skewnes and kurtosis of data at level in panel A and at first difference in panel B.

Table 4.2 Descriptive statistics of variables.

Summary Statistics			
	JSE/ALL SHARE	**GOLD**	**OIL**
Panel A. Data in log levels			
Mean	10.17567	6.82042	4.340950
Std. dev.	0.423169	0.474662	0.367893
Minimum	9.221143	5.958425	3.429461
Maximum	10.84732	7.511251	4.888242
Skewness	-0.59354	-0.38672	-0.58002
Kurtosis	2.698997	1.871372	2.387127
Panel B. Data in first differences			
Mean	0.011628	0.008251	0.005240
Std. dev	0.045142	0.055203	0.087356
Minimum	-0.15031	-0.19851	0.310955
Maximum	0.115893	0.129863	0.180138
Skewness	-0.45415	-0.41781	-1.12434
Kurtosis	4.073439	3.810917	5.106685

Source: Author's table: computations on model variables.

Table 4.2 tabulates the descriptive statistics of the series in log and first difference of log level. The coefficient of standard deviation indicates that in log level gold has the highest volatility, followed by stock market and oil prices. For oil, gold and stock market, the mean of the first difference of the log of variables implies annualized average returns. All assets yields positive annualized returns with the stock as the highest performer with annual returns (0.011628), followed by gold at (0.08251) and lastly oil at (0.005240). The JSE/All Share Index grew at an average of 10% per month,

gold at 6% and oil returns of 4% per month for the period examined. At glance the skewness of the first differences series reviews both variables are negatively skewed and the values do not significantly differ from zero. All the variables witnessed a high kurtosis well above the value of normal distribution (three) with feasible effects on cointergration especially oil and JSE/all share index.

4.3. Econometric Techniques

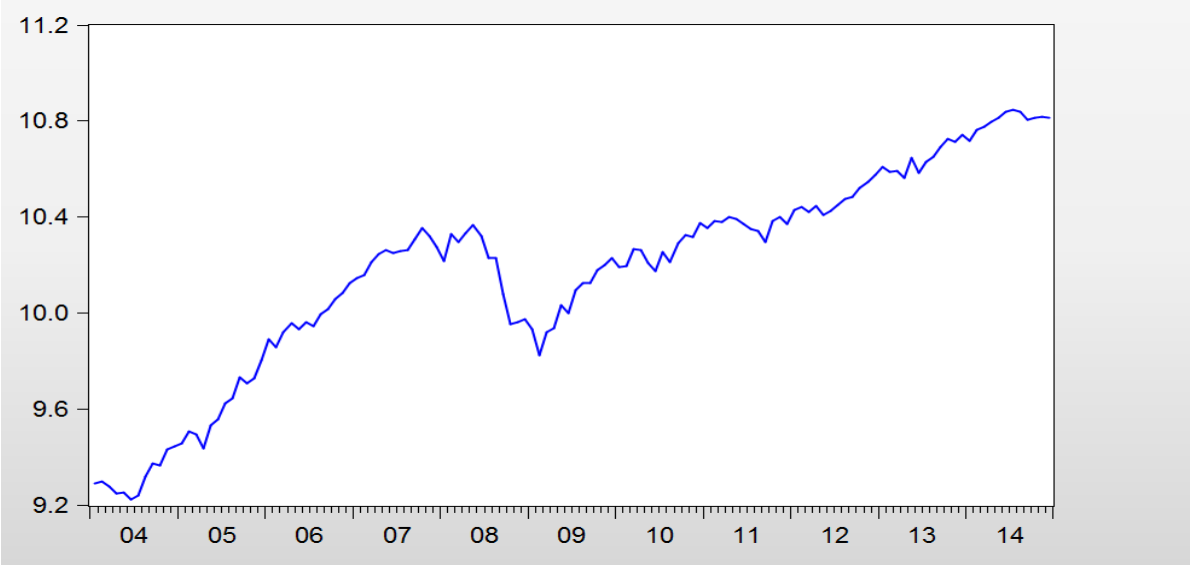
To be positive about the stationarity of the time series data the Augmented Dickey-Fuller test (ADF-1979) was applied and to support these findings the Philips-Perron test (PP-1988). The Johansen and Jesulius (1990) cointergraion test to search for the long run relationship between the time series was put into practical use and to examine the casual relationship and movement of causation the Granger causality test was employed. Innovation accounting techniques of the Impulse Responds Function (IRF) and the Forecast Error Variance Decomposition (FEVD) where applied to analyze interrelationships of the variables in the system and track out the path of the effect of structural shocks on the dependent variable of the model.

4.3. A. JSE/ALL share index and international oil price presentations.

For the period under examination. The time trend of the stock market and the commodity indicators in their log is graphed below.

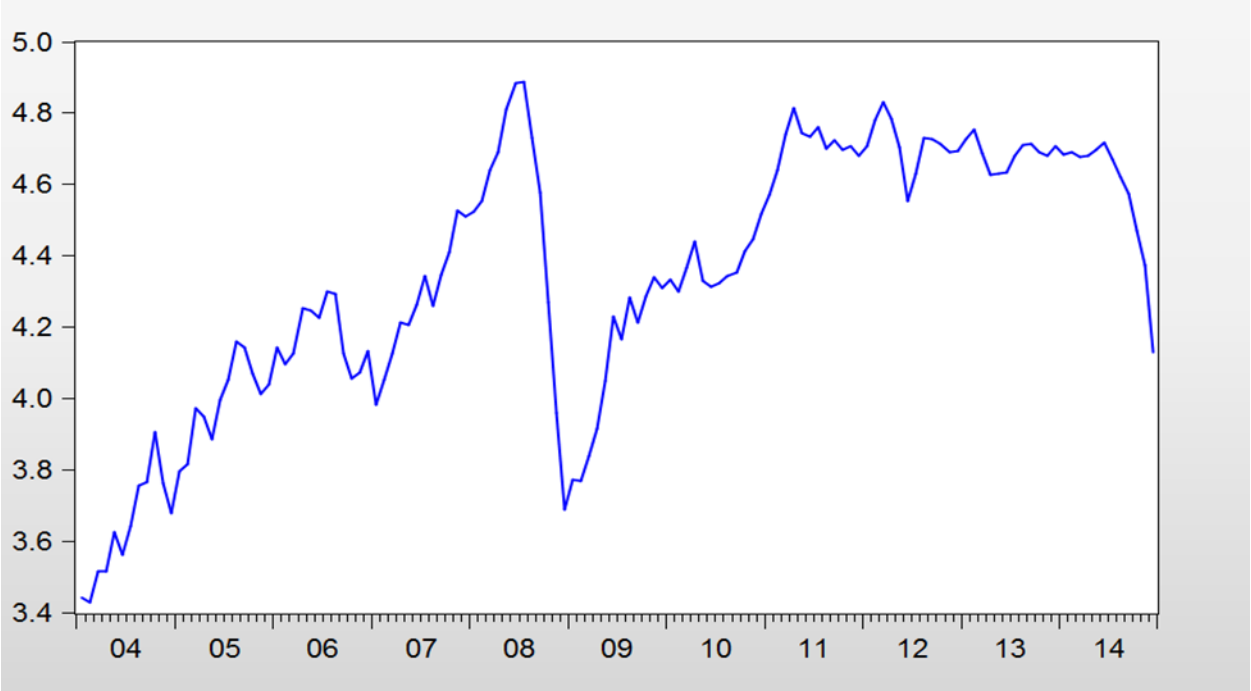
Visual checking of the JSE/ALL SHARE INDEX show the changing trend of the stock market returns during the periods of economic stability, growth and also along with a depression on the period of the global financial meltdown. The Zivot Andrews test was applied to determine the structural breaks of the series.

Figure 4.3 JSE/all share index In LOG



Source: Captured by Author from (E-Views 8.0)

Figure 4.4 International oil price in LOG



Source: Captured by Author from E-views (8.0)

Visual look at the above commodity market graph of international oil price shows that the prices were having upward trend/movements until the trauma of 2008, the global economic and financial meltdown. What started in the USA due to financial innovation,

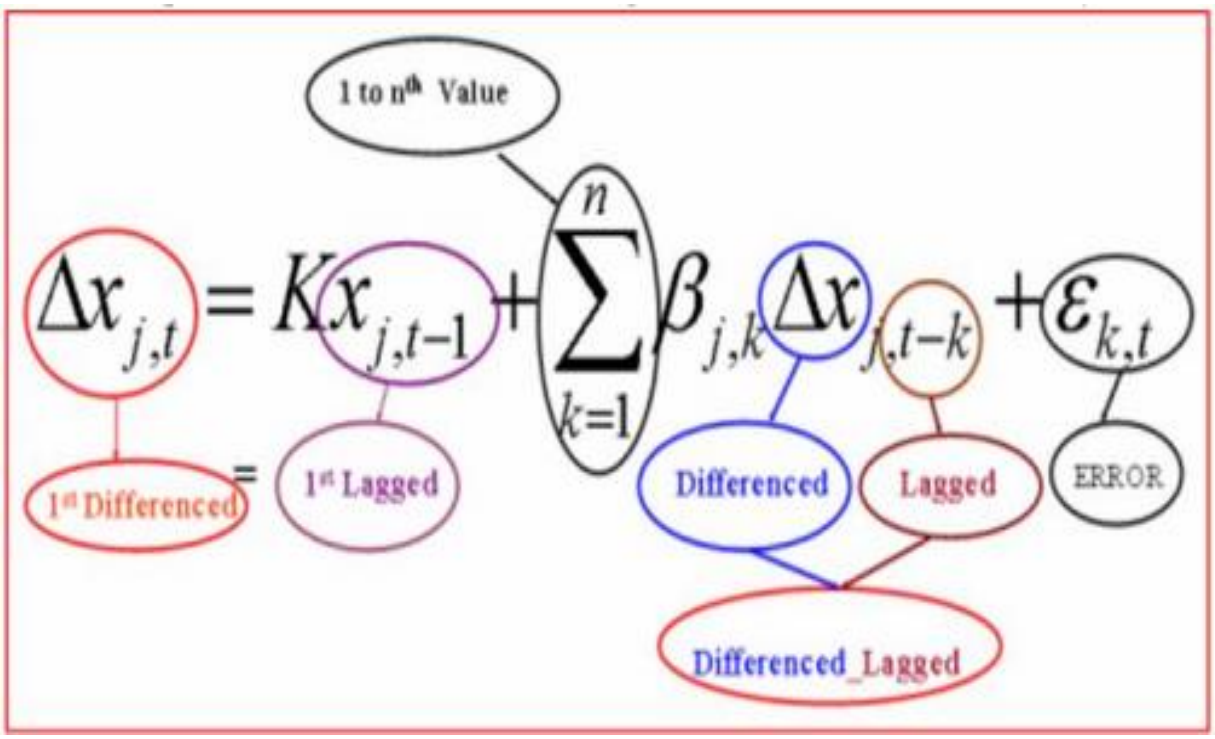
deregulation complexity, subprime lending and incorrect pricing of risk on different assets as some contributing factors resulted in high interest rates and significant drop in immovable property (real estate's i.e. Houses). The consequences of all these factors contributed to the bubble burst of the USA property sector and leading financial institutions like the Lahman brothers crushed and prompted liquidity crisis in the banking sector and the entire economy. There was no winner for international investors as the S&P 500 index (international credit rating index on the USA markets) showed its slowest point in 2009. USA as the leading oil consumer cut its import bill due to its homeland (financial) crisis which required an immediate extinguisher and other countries where affected as the USA have multi-global corporate investments as the world power house. Energy sector, the OPEC cartel was highly affected resulting in sudden slump in international oil prices, mid 2008. However as shown by the graph form 2009, the oil price drop ended and an upward movement prevails. In general economics the drop in oil prices is usually a characteristic of the demand and supply factors. In June 2014 as visualized on the graph the prices of crude oil are falling down again.

4.3.1 Stationarity

Multitudius researchers have concluded that financial and economic time series data have unit root problem. Data should be stationary when it's mean, variance and covariance don't vary systematically over time (Gujarati, 2009). OLS of the data might yield a high (R^2) coefficient and high level of significance (***t*** and ***F test***) yet the variance and covariance of the estimated coefficients are not true and not constant through time. Non-stationarity data will yield a spurious/nonsense regression in which the estimators and test statistics are misleading. The present paper utilized the well documented test of unit root test by modified by Dickey-Fuller called the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP-test) as both have the same null hypothesis that the time series is integrated of order 1 usually labeled as ***I(1)*** against the Alternative hypothesis that the series is stationary ***I(0)*** **.** To capture all dynamic structure in the endogenous variable and ensure that the residual is free from autocorrelation the optimal lags are included and the number of lags that minimizes the Schwarz Information Criteria was selected. The ADF mechanism will run the data at both the level and first difference to

dictate the unit root existence and it will include the constant with trend. The study utilized the PP test to cement the results of the ADF test. The PP test follow the same procedures of the ADF test and both tests produce similar results. PP test have an upper edge over the ADF test as it can detect and provide a shield of autocorrelation using covariance matrix and it is less sensitive to lag structure unlike the ADF test. To test for stationarity the following mathematical equation is applied:

Figure 4.5 Auto-Regressive Model for Unit Root Test.



Source: Applied by Dickey and Fuller (1981)

X can be any variable and the Augmented Dickey-Fuller (ADF) model can be well expressed as follows

$$\Delta X_t = \beta_1 + \beta_2 + \delta X_{t-1} + \sum \alpha_i \Delta X_{t-1} + \varepsilon_t \quad (1)$$

Where:

$\boldsymbol{\varepsilon_t}$ represents a pure white noise error term**,** Δ ***X t-1 = (Xt-1 – Xt-2)*** **,** Δ ***X t-2 = (Xt-2 – X t-3),*** Δ ***X t- i = (Xt- i – X t- j), i*** represents the number of recent time and j is the number of previous times or years see (Figure 4.3)

Hypothesis of Augmented Dickey Fuller (ADF) is Null hypothesis- ***H0:*** $\boldsymbol{\delta = 0}$. $\boldsymbol{X_t}$ the time series has a unit root (it is not stationary)

Alternative hypothesis assumes that the null hypothesis is not true meaning that ***H0:*** $\boldsymbol{\delta \neq 0}$. $\boldsymbol{X_t}$ Is stationary means that there is no unit root means that the data are stationary. It is concluded upon the rejection of the $\mathbf{H_0}$ hypothesis by comparing the statistics obtained by the test with the critical value (Enders, 1995). Applying the first differenced data $\boldsymbol{(\Delta\text{-}1)}$ both tests show that the null hypothesis is rejected for individual series at conventional (1%, 5% and 10%) level of significance at which the data is integrated of that order, ***I (d).*** Phillips-Perron test as the alternative test to check the results of ADF. The PP test reduces serial correlation in the error term by using non-paramedic statistical approach without add lagged difference terms found in the ADF.

$$\Delta y_t = \beta^1 D_t + pY_{t-1} + \varepsilon_t \quad (2)$$

Both methods share the same null hypothesis and yields similar results.

4.3.2 Co-integration Analysis

Cointergration test was performed to examine the link between the relations of an integrated series and the long run equilibrium (testing the long run affiliation between non-stationary time series data). Granger was the pioneer of this theory to determine the long run equilibrium between variables. However this study utilized the joint theory proposed by Johansen and Jeselius 1990 as this is a well-documented approach in analyzing the long run relationship between variables. Engle and Granger (1987) make use of a bivariate model which cannot be applied in multivariate models; as such the VAR model is the foundation of the Johansen and Jeselius cointergration approach. The procedure can be illustrated with the following Vector Auto Regressive (VAR) model:

$$X_t = C + \Pi_k X + \Pi \mathrm{X}_{t-k} + \varepsilon_t \quad (3)$$

Where:

$\boldsymbol{X_t X_{t-1} \ldots X_{t-k}}$ shows vectors of lagged and current values of **n** variables respectively which are I (1) in the mode,$\boldsymbol{\Pi 1, \ldots . \Pi k}$ are known matrices of a coefficient **n X n** dimensions,$\boldsymbol{c}$ is the intercept vector and $\boldsymbol{\varepsilon_t}$ is a vector of random errors (Katircioglu,2007). The maximum order of lags of the auto regressive have to be determined and the number of lag selection is found in such a way that the residual is not auto correlated. A decision has to be made on the account to include a trend or not. The rank $\boldsymbol{\Pi}$ depict the number of cointergration relationship (***i.e. r***) which is determined by testing weather the Max-Eigen value $\boldsymbol{(\lambda i)}$ are different from zero. The Johansen test applies both the trace test and the Max- Eigen value. Identification of the number of cointergrating vectors is based on the comparison of the Max-Eigen value and the Trace test with the test statistics. Johansen, (1990) suggests that using the Max- Eigen values of $\boldsymbol{\Pi}$ order from the largest to the smallest is for computation of trace statistics.

The trace ((λ trace) formula is shown as:

$$\boldsymbol{\lambda\, trace = -T \sum ln\,(1 - \lambda_i), i = r = 1 \ldots n - 1} \qquad \textbf{(4)}$$

With the tested hypothesis are:

H0: r = 0 H1: r ≥ 1

H0: r ≤ 1 H1: r ≥ 2

H0: r ≤ 2 H1: r ≥ 3

And the Max- Eigen value is given as:

$$\boldsymbol{\lambda max = (r.r + 1) = -T ln(1 - \lambda_{r+1})} \qquad \textbf{(5)}$$

Where $\boldsymbol{\lambda_i}$ is the estimated Max-Eigen values from the estimated **Π** matrix. **r** is the number of co-integrating vectors and **T** is the number of observations in the study. The trace statistics test the null hypothesis that the number of distinct co integrating vectors is less than or equal to **r** against a general alternative hypothesis (the number of distinct co integrating vectors is more than or equal to r) and the maximum Eigen value test

evaluates the number of cointergrating vectors versus that number plus one (Bhunia, 2011,9). If the variables in $\mathbf{X_t}$ are not co intergrated,the rank of Π is zero and still all the characteristics roots are zero; Since In(1)=0,each of the expressions ln(1-λ_i) will equal zero in that case (Bhunia,2011;9). Johansen and Jesulius(1990) fevoured the λmax test as more powerful relative to the trace test. The Maxi-Eigen statistics can identify the number of cointergrating vector, **r** more than the trace statistic. In this present study both statistics will be given special attention and analyzed as they are both important.

4.3.3 Causality

To determine the lead lag relationship association between the JSE/ALL SHARE index and the commodity indicators, the present study applied the Granger causality (1988) which is a statistical hypothesis test to harvest the desired results. Current values of X can be explained by past values of X and X 'granger cause' Y if past values of X can assist in explaining Y. A double causation (2 way) exists when X granger cause Y and Y granger cause X. A time series ***Y*** is said to be Granger-caused by ***X*** if the coefficients on the lagged ***Xs*** are statistically significant (Granger, 1969). The following model has been estimated to in order to determine the direction of causality

$$\Delta X_t = \sum_{i=1}^{n} \alpha_i \Delta Y_{t-i} + \sum_{j=1}^{n} \beta_j \Delta X_{t-j} + u_{1t} \quad \textbf{(6)}$$

$$\Delta Y_t = \Sigma_{i=1}^{n} \lambda_t \Delta Y_{t-1} + \Sigma_{j=1}^{n} \delta_j \Delta X_{t-j} + u_{2t} \quad \textbf{(7)}$$

The time series of variables is non-stationary **I** (1) and is not intergrated, the variables are converted into **I** (0) by first differencing. There is no auto correlation between $\boldsymbol{u_{1t}}$ and $\boldsymbol{u_{2t}}$**.** This present study will investigate the bilateral causality for the stock market and oil/gold prices. Causality from ***Y*** to ***X*** can be noticed under the estimated lagged Y in the equation (6) and are statistically different from zero $(\sum \boldsymbol{\alpha}_i \neq \mathbf{0})$ and the set of estimated coefficients on the lagged ***X*** in the equation (6) is not statistically different from zero $(\sum \boldsymbol{\delta j = 0})$. Also a unidirectional from ***X to Y*** can occur if the set of lagged ***Y*** coefficient in the equation (6) is not statistically different from zero $(\sum \boldsymbol{\alpha}_i = \mathbf{0})$ and the set of lagged ***X*** coefficient in equation (7) is statistically different from $(\sum \boldsymbol{\delta}\ \mathbf{j} \neq \mathbf{0})$**.** Eagle and Granger,(1987) suggests that bilateral causality exists when both regressions

of set ***Y*** and ***X*** coefficients are statistically significant from zero ***(∑ α i ≠ 0)*** and ***(∑ δ j ≠ 0).*** Hence the null hypothesis is that ***Y*** does not Granger – cause ***X*** in regression equation 6 and ***X*** does not Granger-cause ***Y*** in regression equation 7. The Granger causality will result in suspense conclusions as it have a pitfall of clearly reveal the impact significance details of the independent variables(oil/gold prices) on the dependent variable (stock market). The innovation techniques of Impulse response function and Variance decomposition will aid to fill this pitfall.

4.4 Summary of Chapter

This chapter ushered the methodological aspects of the study. Time series are prone to unit root problem and it was discussed that the unit roots tests that removes the problem to avoid spurious analyses are the Augmented Dickey Fuller (ADF) and Philips-Perron (PP test). The series was found to be unit root free after first difference. The lag structure selection was based on the Schwarz Information Criterion (SIC), Alkaike and Hamman-Quinn information criterion (HQ) and appropriate lag selection was 2 lags. The Johansen and Jesulius cointergration approach was applied to test for the long run relationship between the variables and the results showed the presents of two cointergrating relationship as presented by the trace and maximum Eigen statistical values. The study went on to test for casual relationships between the stock market and international oil/gold prices using the Granger causality test and found a unidirectional causality running from the stock market to the international oil prices. These results were also supported by the Granger causality/Block Exogeneity Wald test revealed the same, one way causality. Short term structural feedbacks on each variable from external shocks were determined by the application of the impulse responds function and the variance decomposition tests. Own innovations were the main courses of volatility on each variable.

CHAPTER FIVE

EMPIRICAL ANALYSIS AND DISCUSSION OF RESULTS

5.0 Introduction

This section was a practical implementation of the methodology discussed in previous chapter four. The chapter looked at the empirical analysis of results and discussion of findings. The long run relationship were determined with the application of the Johansen cointergration test and short run dynamics through causality and innovation accounting techniques of Impulse responds function and variance decomposition followed.

5.1 Results from stationary tests

Unit root test is performed to determine the stationarity of data. Test of the null hypothesis is that a series has a unit root (***H_0***: series has a unit root) and as such the series is non-stationary. Non stationary data will result in violation of the mean, variance and covariance, which need to be stable at all, levels. This study applied the widely popularized parametric test called the Augmented Dickey-Fuller (ADF) together with the Philip Perron (PP) test to investigate the existence of unit root or not in the time series data and the lag structure selection based on the Schwartz Bayesian Criterion (BIC) now popularly known as the Schwartz Information Criteria (SIC) computed as

$$SBC_k = \ln\frac{\left(\frac{SSR_M}{n}\right) + \ln n}{n}k$$

Where ***n*** is the size of the sample, ***k*** is the number of lags and ***SSRm*** is the sum of square error terms. Time series data is very sensitive to stationarity and non-stationary data can yield spurious regression showing high level of (R^2) and high level of significance (t* and F* statistics) implying that the variance and the covariance of the estimated coefficients are false and not constant over time.

Table 5.1: Results of unit root tests at log level and 1st difference.

Variables	Intercept no trend			Intercept and trend		
	Test Statistic	Critical Value	Prob*	Test Statistic	critical value	Prob*
		1%			1%	
Jse/all share	-1.483256	-3.480818	0.5391*	-1.811543	-4.029595	0.6937*
Oil price	-2.760086	-3.481217	0.0669*	-2.467005	-4.030157	0.3439*
Gold price	-1.702498	-3.480818	0.4277*	-0.644451	-4.029595	0.9744*
	Augmented Dickey Fuller Test @ Ist Difference					
Variable	Intercept no trend			Intercept and trend		
	Test Statistic	Critical Value	Prob*	Test Statistic	Critical Value	Prob*
Jse/all share	-11.79005	-3.481217	0.0000*	-11.81341	-4.030157	0.0000*
Oil price	-7592811	-3.481217	0.0000*	-7.779012	-4.030157	0.0000*
Gold price	-13.403031	-3.481217	0.0000*	-13.69289	-4.030157	0.0000*
Rejection of null hypothesis of unit root at 1% level of significance.						

Source: Computed by Author from (E-views 8.0 iterations Results) Test for unit root.

Inspection of the Augmented Dickey –Fuller (ADF) at log levels imply that all variables are non-stationary. We are unable to reject the null hypothesis for the stock market and the commodity indicators at any significant levels used (1%,5% and 10%) because their probability are more than 5% at level and the results are depicted the table 5.1 above. Both tests clearly show that the series under study were non stationary and depict the existence of a unit root. Order of integration is the number of unit roots that are contained in a series so as to be stationary. The Same tests as at levels are applied to their first differences under the same hypothesis. The conclusive results indicate the time series of all the variables are stationary at their first differences. For all the variables, the t* statistics was lower than the critical values, this indicate that the variables are integrated of order one (***i.e. (1)*** and stationary upon differencing once ***Δ (-1)***. Once differenced all variables review no indication for the presents of unit root and this

supports the caption ' ……no financial time series contain more than a single unit root…'(Brooks,2008,330)

Table 5.2 Philips - Perron (PP) test at log and First difference

Variables	Intercept no trend			Intercept and trend		
	Test Statistic	Critical Value	Prob*	Test Statistic	Critical Value	Prob*
		1%			1%	
Jse/all share	-1.461777	-3.480818	0.5499*	-2.032336*	-4.029595	0.5780*
Oil price	-2.602276	-3.480818	0.0951*	-2.341717*	-4.029595	0.4084*
Gold price	-1.785698	-3.480818	0.3862*	-2.219131*	-4.029595	0.9920*
	Phillips Perron(PP)Test at Ist Difference					
Variable	Intercept no trend			Intercept and trend		
	Test Statistic	Critical Value	Prob*	Test Statistic	Critical Value	Prob*
Jse/all share	-11.92453	-3.481217	0.0000*	-11.89722*	-4.030157	0.0000*
Oil price	-7.592811	-3.481217	0.0000*	-7.779012*	-4.030157	0.0000*
Gold price	-13.40209	-3.481217	0.0000*	-13.84647*	-4.030157	0.0000*
Rejection of null hypothesis of unit root at 1% level of significance.						

Source: Computed by Author from (E-views 8.0 iterations Results) Test for unit root.

Phillips- Perron (PP test) was applied to support and conformation of the results of the ADF test under same conditions and the results are quite similar. Stationary series (I (0)) it's mean reverting in the long run and is affected temporarily whilst non stationary I (1) process has an infinitely long memory, shocks affect permanently. The outcome of the study is at par with numerous previous literature that concluded that macroeconomic variables and the stock indexes are non-stationary and non-mean reverting.

5.2 Testing for Co integration

Cointergration test aims to investigate the existence of long-term dynamics among the variables. ***The present study hypothesis*:**

H_0: There is no long relationship between the JSE/ALL SHARE INDEX and oil/gold prices.

H_1: There is long relationship between the JSE/ALL SHARE INDEX and oil/gold prices.

The Johansen Jeseluis Cointergatrion (1988) test was applied in the study. Schwarz Information Criterion (SIC), Alkaike and Hamman-Quinn information criterion (HQ) have been used to describe the optimal time lags to be included in the cointergration analysis in order to obtain valid results. All the tests suggest two (2) lags as appropriate lag structure. Gonzalo (1994), finds that the Johansen cointergration test is quite sensitive to the lag length. All the variables for the cointergration test are recognized to be integrated at the same order: **I (1).** This test allows us to dictate the long run equilibrium association among the series. The results of the trace test and the maximum Eigen test are shown below in table 5.3 and 5.4 respectively.

Table 5.3: Johansen Co-Integration (Trace Test)

Unrestricted Co-integration Rank Test(Trace test)			
Hypothesized No of CE(s)	**Trace Statistics**	**Sig.level: 0.05 Critical value**	**Prob.****
None*	32.86850	24.27596	0.0033
At most 1*	16.74273	12.32090	0.0085
At most 2	1.467814	4.129906	0.2645
Trace test indicate 2 co-integration at the 0.05 level **denotes rejection of the hypothesis at the 0.05*			

Table 5.4: Johansen Co-integration Rank (Maximum Eigenvalue)

Unrestricted Co-integration Rank Test(Maximum Eigenvalue)			
Hypothesized No of CE(s)	**Max-Eigen Statistics**	**Sig.level: Critical value**	**Prob****
None*	16.12577	17.79730	0.0876
At most 1*	15.27492	11.22480	0.0092
At most 2	1.467814	4.129906	0.2645
Max-eigenvalue indicates no co-integration at the 0.05 level *denotes rejection of the hypothesis at the 0.05			

Source: Computed by Author from (E-views 8.0 iterations Results) Test for co-integration

The above results (table 5.3) illustrate that the series is cointergrated as the trace statistics reject the null hypothesis; **H_0:** they is no long run relationship between the stock market and oil/gold prices at 95% confidence levels citing market intergration.The value of the trace (32.86850) was greater than the critical value (24.27596) and also the probability of (0.0033) was less than 5%. The trace statistics shows the presents of 2 cointergrating equations suggesting they are two long run relationships between the stock market and international oil/gold prices.

Normalized Co-Integration Equilibrium Equation

JSE/ALL SHARE INDEX =7.533254OIL - 3.350212GOLD

One unit increase in oil prices causes 7.533254 unit increase in the JSE/ALL SHARE INDEX. Whereas one unit increase in gold prices causes the JSE/ALL SHARE INDEX to decrease by 3.350212 as a negative effect. These results support the other findings in literature which exhibit that there is relationship between the stock prices, international oil and international gold prices (Akgùn et al, 2013, 730). International oil prices is characterized with global economic growth and gold save as substitute of stock markets.

5.3 Pairwise Granger Causality tests.

By applying the causality tests for the stock market index under the examination and the strategic commodities the study investigated in detail the casual relation among the variables and the direction of causation. The lead lag test was concluded by the Granger causality test. The pairwise Granger causality test was applied and the results are presented in table 5.5.

Table 5.5: Pairwise Granger Causality Test

Null hypothesis	Obs	F-statistics	Prob
DlogGold does not Granger Cause DlogOil	129	1.17208	0.3131
DlogOil does not Granger Cause DlogGold		1.06601	0.3475
DlogShare does not Granger Cause DlogOil	129	10.2808	7.E-05***
DlogOil does not Granger Cause DlogShare		0.41371	0.6621
DlogShare does not Granger Cause DlogGold	129	0.31889	0.7275
DlogGold does not Granger Cause DlogShare		0.30793	0.7355

****denotes10% significant level. SOURCE: Computed by Author from (E-views 8.0 iterations Results) Test for Causality*

The null hypothesis (**H_0**)**:** Stock market does not granger cause oil/gold prices); can be explained in detail with the above results. Gold does not granger cause oil and vice versa, both have more than 5% probability hence we accept the null hypothesis. A unidirectional causality relationship exist between the JSE/ALL SHARE index and international oil prices. JSE/ALL SHARE granger cause oil prices (JSE/ALL SHARE index has a one way causality relationship in the direction of international oil price). The probability is less than 5% and the hypothesis was rejected and the alternative accepted. As the case maybe, there is evidence that the fluctuations on company performance and slow down of economic activity will affect the consumption of oil. There is no granger causality between JSE/ALL SHARE index and international gold prices. Trend in one indicator is not the ground for trend in other indicator under the present study and it can be concluded that causal relationship is merely a trend of the selected data under the period of study, as supported in (Awe, 2012). These results were also verified by the VAR (Granger causality/Block Exogeneity Wald tests) and they reviewed the same results with JSE/ALL SHARE Index granger causes Oil with a **0.0017** probability which is less than 5% and we reject the null hypothesis and conclude they are short run equilibrium between the variables.

5.4 Innovation Accounting

Impulse responds function (IRF) and Forecast Error Variance Decomposition (FEVD) are used to analyze the interrelationship between variables in the system. IRF show the effects of shocks on the adjustment path of the variables and the FEVD measure the contribution of each type of shock to the forecast error variance. It is well known that economic variables reverberate through a system (Enders, 1995).

The FEVD measure the proportion of movement in sequence attributed to its own shock to distinguish it from movements attributable to shocks to another variable (Enders, 1995). A standard analysis instrument in stationary VARs which strive to lay down the interrelations among the variables the short run dynamics. It provides vital information about the relative importance of each random innovation in affecting the variables in VAR.

5.4.1. Forecast Error Variance Decomposition (FEVD)

The results show that to larger extent all the variables are driven by own innovations. About 100% of the variations in the JSE/ALL SHARE index are due to its own innovations/shocks during the first months of the forecast period under study. In the long run in period ten it can be seen that own innovations of the stock market amass great share as compared to oil/gold prices. The stock market is less dependent on the international oil and gold prices. The variability of gold prices are mainly explained by its own disturbances. During the first period under study, 88% variations in gold prices were due to own innovations and oil shock had no impact. Stock market and oil prices innovations have no major impact on the gold prices in the long run. Variability in oil prices was due to own innovation of oil price fluctuations. Only the stock market shocks can affect the oil market with 23% in the long run. This is in line with the causality tests that they exit a unidirectional causality running from the stock market to oil market.

Table 5.6: Variance decomposition Analysis-summary statistics

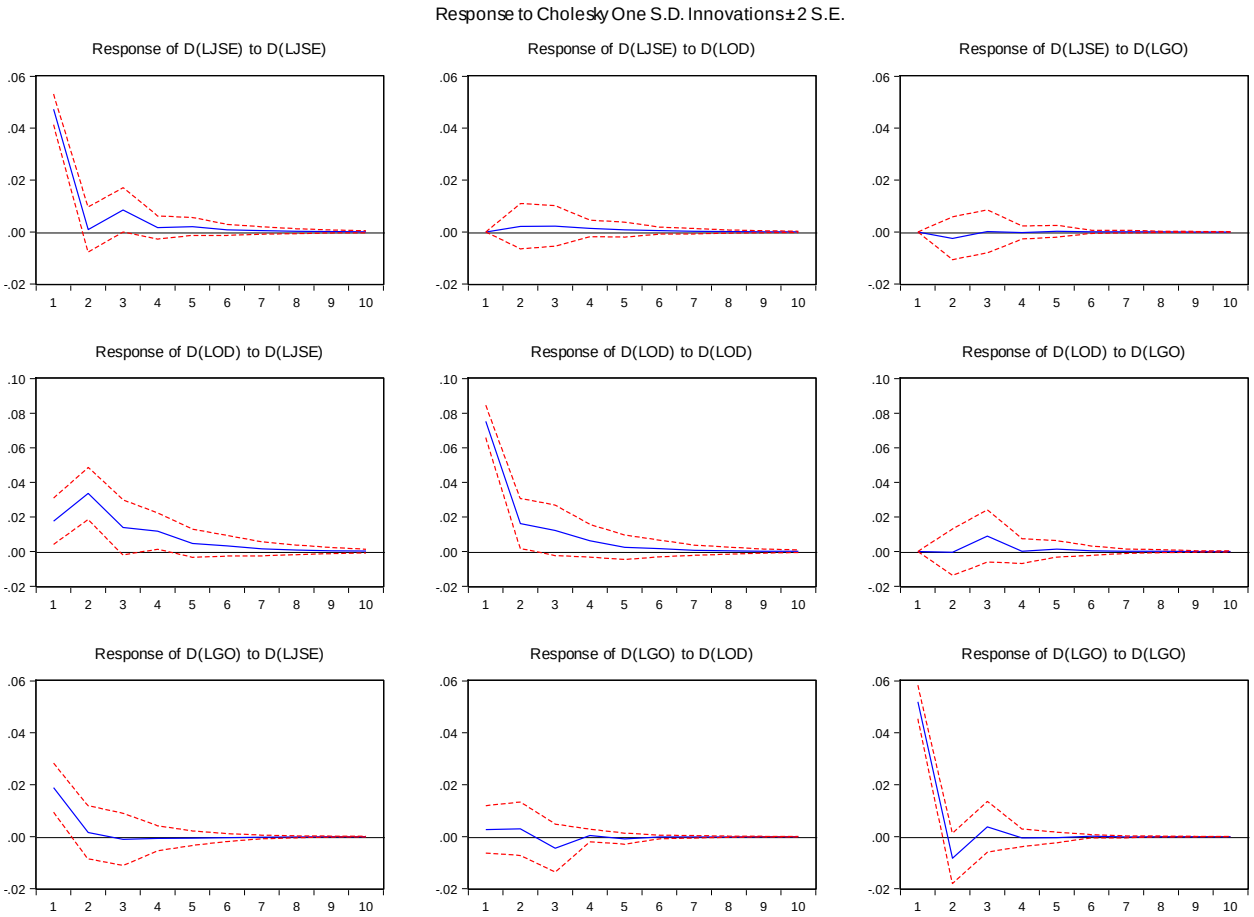
Series explained JSE/all share index: Proportion of error variance decomposition		
Horizon(monthly)	OIL PRICE	GOLD PRICE
1	0.000000	0.000000
5	0.537280	0.262735
10	0.552076	0.263021
Series explained Oil price: Proposition of error variance decomposition		
Horizon	JSE/ALL SHARE	GOLD PRICE
1	5.152915	0.000000
5	22.41664	1.051221
10	22.54467	1.051653
Series explained Gold price: Proposition of error variance decomposition		
Horizon	JSE/ALL SHARE	OIL PRICE
1	11.64762	0.249344
5	11.35462	1.183636
10	11.36077	1.184732

Source: computed by Author from (E-views 8.0 Iterations results) from variance decomposition

5.4.2. Impulse Responds Function (IRFs)

Impulse responds show the impact of a one standard deviation shock/innovation of one variable on the current and future values of another variable (Henriques and Sadorsky, 2008, 1001). Figure 5.1 showed the reaction of stock market and oil/gold prices in the system to a single standardized shock of each variable in the system.

Figure 5.1: Impulse responds to Cholesky One S.D Innovations



Source: Captured by Author from (E-Views 8.0 Iterations results) from impulse response analysis

The JSE/ALL SHARE index is more efficient and less dependent on the commodity market as the stock market responds positively to own innovation and this effect is positive and significant for up to at least six months into the future. One standard deviation shock of the JSE/ALL SHARE index will have a positive and significant impact on oil prices up to at least eight months into the future. This can be supported by the previous results: the two variables have a unidirectional causality running from stock market to oil prices. South Africa is an agro-based economy and the JSEA/ALL share will be less influenced by the increase in imported oil price. At the same interval the result shows that one standard deviation of JSE/ALL SHARE index has no significant effect on the gold prices and only positive impact up to at least two months into the

future and this impact quickly diminishes and remain constant. Diversification is possible for the investors as no risk transmission between the variables in the long run.

5.5 Summary of the chapter

In this chapter the long run relationship and short run dynamics between the stock market and oil/gold prices has been investigated. Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests were used to detect the unit root properties of time series data. The conclusive results of both tests indicate the time series of all the variables are stationary at their first differences. The lag structure selection was based on the Schwartz Information Criteria (SIC) and number of optimal lags was found to be two. Alkaike and Haman-Quinn Criterion (HQ) also supported SIC with two lag structures as appropriate. The Johansen cointegration approach reviewed the presents of long run relationship between the variables. Uni-directional causality between the JSE/ALL SHARE INDEX and International oil prices were shown by the Granger causality test. The direction of causality was running from the stock market to oil prices and lastly innovation accounting techniques of impulse response and forecast error variance decomposition analysis highlighted that variability in variables was mainly due to own shocks in the short run.

CHAPTER SIX

CONCLUDING REMARKS

6.0 Introduction

In this chapter the study looked at the empirical conclusions drawn by the researcher and advocacy to corporate investors and policy markers the policy implications of these results and finally shedding light on areas of tomorrow's explorations.

6.1 Summary

Country's equity market trajectory in the long run reflects the macroeconomic phenomenon. Oil and gold are immensely exceptional commodity assets that have rejuvenated as hot trading assets on the international arena. Their love of uncertainty has lured countless attention from all corners of the world. Demand and supply concepts have imaged as top determinates of commodity markets behaviour. Shocks to the physical supply of crude oil or to oil specific demand, indicate a higher degree of macroeconomic uncertainty and are interpreted as bad news (Bastianin and Manera 2014, 10). Gold hold the keys of the safe haven status and oil is the most traded contact future on the global market at the same point stocks are "king of good times" as they flourish during high economic activity and wilt during economic malaise. Asset pricing models are hence applied to evaluate the required rate of return or profitability of corporate investments on risky assets and portfolios.

6.2 Discussion on major findings

The present study examined the relationship between the Johannesburg stock exchange and two strategic commodity indicators during the period of January 2004 to December 2014. The time series employed in the study comprised of monthly data. The study was subjected to econometric techniques to obtain the objectives of the study. The variables employed into the system were identified upon simple and initiative financial theory, based on the assumption that they constitute a systematic force to lure global attention (every news flash or front page headline that sells the print is about the commodity

market) and international investors microscope the performance of stock markets and assess their responds to turbulences of oil/gold prices.

Stationarity through the unit root tests of ADF and PP indicate that all variables (series) were integrated of order one ***I (1***) and confirm stationary in their first difference (***Δ-1***).

The first research question of this study was: (What is the empirical short and long run relationship between the stock market and oil/gold prices?); to anatomize this question the Johansen cointegration analysis was applied to determine the long run equilibrium relations among the variables. The result of the Johansen cointegration reveals that there is co integration or long run relationship between the JSE/all share and the international oil/gold prices. The results exhibit that in the long run the variables present movement together.

Is there causal relationship between the stock market and oil/gold prices?, was the second question of the study and to answer that question, the Pairwise Granger causality test and VAR Granger causality/Block Exogeneity Wald test where applied. The importance of causality is its ability to shed light whether a variable is useful in forecasting another variable for a given set of data. Causality between JSE/ALL SHARE INDEX and international oil were found to have unidirectional causality and this causality running from the stock market to oil prices. This means stock market granger cause oil prices (one side feedback). The stock market can forecast the trends in international oil prices. As investors are running away from the commodity market and shifting their investments towards equities and other assets. Top HSBC analysts (Ulgen and Di Luo) support the present study, "Although South Africa is a major gold exporter of gold, South African economy is in fact more sensitive to the oil price than the bullion" (Barnato.K, 2013) . There was no granger cause between stock market and gold and also between oil and gold. Short run dynamic linkages and feedback of the variable due to external shocks between the JSE/ALL SHARE INDEX and oil/gold prices were investigated using Impulse Respond Function and forecast error variance decomposition. The analysis displays a short run shock between stock market and oil prices in the short period of less than five months. In the long run the stock market is not influenced by

both variables. Variance decomposition shows that all the variables are largely affected by own innovations in the short run.

6.3 Policy Implications

"One size fits all" approach when it comes to individual investors does not hold. Different individuals have different perceptions towards different assets and require individual problem-solving mechanisms that maximize their investments. South Africa has one of the best stock market in the world ,one of major gold producer and highly dependent oil importing state, it is crucial that Monetary authorities, corporate investors, fund management can get future inferences about what lies ahead and make sound decisions. Key findings of the present study lies on asset allocation and maximization of required rate of return and hedge against markets volatility. The study appraises that in the long run the stock market and commodity assets (oil/gold) labour in the same cointergrating structure. This shows a team work cooperatioinn between variables. A sound and efficient economy strive on mechanisms that stimulate growth or economic activity because at the end of the day the stock market reviews the wealth of its citizens. Consumers can only spend more only when the economic output expands optimal liquidity on the market and the equity market is geminating. The variables in the study need to be looked at together with other several macrocosmic variables like interest rate, inflation, money supply, exchange rate (major monetary policy instruments) consumer price index and GDP just to mention but a few. Surge in production costs leads to high price levels, firm's battle to mark up or break even and hence they will shelve /cut expansion projects in anticipation of better return and this is nightmare to the economy. Consequently South African policy makers and investment experts must pay close attention to the general trends in international oil prices as they chunk the bulk of current account through the import bill. It will not always be the case that the stock market will predict the future movement of the oil market (the stock market granger cause oil prices); the 2008 meltdown is a case study. Equity can be appetizing and before one blinks it approaches a bubble stage and bust into a nuclear bomb. All concerned parties with interests on the equity and commodity markets have to hold contingency and structural measures and reduce management/policy by crisis. Innovation, capital

controls, macro-prudental policies as some key aspects to hedge against the volatility of risky assets.

6.4 Recommendation

Policy makers and investment experts should strategically step in and put on trial internal experimentation policies, innovations as they are greatly appealing as compared to external policies. Home grown proposals, ideas should be given more attention in debates. Serious elucidation is needed when adopting international polices and most developed nations have the capacity, technical knowhow, technology and mostly the resources to implement such policies.

International and local investors should eyeball the exchange rates, international oil and gold prices together with other macroeconomic variables as core systematic risk when constructing asset allocation and hedging mechanism.

Corporate world, policy makers, academics, think tanks, general public should all work hand in glove to generate new ideas on how to strategically tackle macroeconomic issues in order to attract international capital, boost investment and economic activity.

6.5 Implications for future research

In terms of future studies, it is recommended that the studies incorporate more variables with larger samples either commodity variables (copper, diamond, platinum metals), soft commodities like tobacco, maize or macroeconomic variables like exchange rate, inflation, money supply. Methodological aspect in terms of applying other econometric methods to determine the relationship between these variables. Methods like the new bounds testing for cointergration (Autoregressive Distributed Lag (ARDL)) as this method can capture specific strength independent variables. Other methods that capture daily data to make the result more precise and accurate like the GARCH model can be applied. Daily or weekly data applied to determine the sensitivity of data frequency.

The present thesis only concentrated on single country (South Africa) and other future explorations can make comparative cases from developing and developed countries and make inferences

REFERENCES

AccountancySA (2015), “Oil takes lead role in market drama”.

http://www.accountancysa.org.za/oil-takes-lead-role-in-market-drama/ [Accessed on 17/04/2015]

Akgùn, A. (2013).The effect of variations in gold and oil prices on BIST 100 index. *Mediterranean Journal of Social Sciences.*10, pp.726-730

Anand, R and Madhogaria, S.(2012).I s Gold a ‘Safe Haven’-An Econometric Analysis.*Procedia Economics and Finance* 1.pp.24-33.

Apergis, N.and Miller, S.M. (2009).Do structural oil-market shocks affect stock markets? *Energy Economics*, 31.pp.569-575.

Arouri, M.E.H, and Rault.C (2009). “On the influence of oil prices on stock markets: Evidence from Panel analysis in GCC countries.” William Davidson Institute Working Paper no 961

Arouri, M. and Nguyen, D.K. (2010).Oil prices, stock markets and portfolio investment: Evidence from sector analysis in Europe over the last decade. *Energy policy*, 38(8), 4528-4539.

Asteriou.D and Hall.S.,(2007).Applied Economics. Revised Edition. PALGRAVE MACMILLAN.ISBN-13-978-0-230-50640-4.

Awe, O.O. (2012).On Pairwise Granger Causality, Modelling and Econometric Analysis of Selected Economic indicators.

Bailey, R.E. (2005).The Economics of Financial Markets.Cambridge.Cambridge University Press.

Barnato, K.(2013).Why Gold’s fall is no big deal for South Africa?

http://www.cnbc.com/id/10066791 [Accessed on 14/03/2015]

Basher, S.A.and Sadorsky, P. (2006).Oil price risk and emerging stock markets. *Global Finance Journal* 17 pp.224-251.

Bastianin,A.and Manera, M. (2014).How does stock market volatility react to oil shocks?.*FONDAZIONE ENI ENRICO MATTEI.*

Bernstein P.C. (1996). AGAINST THE GODS: The remarkable story of risk. John Wiley and Sons.

Bhunia, A.(2013).Cointergration and Casual relationship among crude price, domestic gold price and financial variables: Evidence of BSE and NSE.*Journal of Contemporary issues in Business Research* 2(1), 1-10.

Biag, M.M., Shahbaz, M.,Imran,M.,Jabbar,M.and Ain,Q.U(2013).Relationship between Gold and Oil prices and Stock Market returns.*ACTA UNIVERSITATIS DANUBIUS* 9(5).

Bjørnland H.C., (2009). "Oil price shocks and stock market booms in an Exporting country" *Working Paper NORGES bank.*

Bodie, Z.,Kane, A.and Marcus,A.J (2002).Investments 5th edition, McGraw Hill

Brooks,C.(2008).Introductory Econometrics for Finance.2nd edition.Cambridge:Cambridge University Press.ISBN-13 978-0-511-39848-3.

Corrado,C.J.and Jordan,B.D.(2002).Fundamentals of Investments: Valuation and Management 2nd edition,McGraw Hill

Creti,A.,Joëts M., and Mignon,V.(2012).On the links between stock and commodity market's volatility.*CEPII*, wp.20.

Dempsey.,(2012).The Capital Asset Pricing Model(CAPM):The History of a Failed Revolutionary Idea in Finance. *A Journal of Accounting, Finance and Business Studies*.ABACUS,49

http://onlinelibrary.wiley.com/doi/10.1111/j.1467-6281.2012.00379.x/pdf

Dickey,D.,Fuller, W.(1979).Distribution of the estimators of autoregressive time series with a unit root. *Journal of the American Statistical Association*,74(366),427-431.

Enders,W.(1995).Applied econometric time series. New York: John Wiley and Sons,Inc.

Engle,R.F and Granger,C.W.J.,(1987).Cointergration and Error Correction Representation, Estimation and Testing.*Econometrica*,55(2),251-277.

Eviews user's guide I&II (Version 8.0).

Fowowe,B.(2013).Jump dynamics in the relationship between oil prices and the stock market:Evidence from Nigeria. Energy Journal, 56.pp, 31-38.

Francis,J.C and Taylor,R.W.(1992).Schaum's outline of:Theory and Problems of Investments. McGraw Hill Inc.

FTSE/JSE ALL SHARE (JALSH)

http://www.investing.com/indices/ftse-jse-all-share-historical-data [Accessed 05/03/2015]

Gilroy. A (2015). Lower oil prices impact gold.

http://finance.yahoo.com/news/low-crude-oil-prices-impact-160002068.html [Accessed on 05/03/2015]

Gold Futures-Aug 15(GCQ5):

http://www.investing.com/commodities/gold-historical-data [Accessed on 05/03/2015]

Gonzalo,J.(1994).A comparison of five alternative methods of estimating long run equilibrium relationships. *Journal of Economics*,60 pp.203-233.

Granger,C.W.J(1988).Some recent developments in a concept of causality. *Journal of Econometrics*, 39 pp.199-211.

Granger,C.W.J.,(1969).Investigating causal relations by econometric models and cross spectral methods.Econometrica ,37(3),pp,424-438.

Gujarati,D and Porter A.(2009).Basic Econometrics. McGraw Hill, New York.Guyane,R.N(1979). "Oligopolistic reaction" Area 2(4),140-145.

Henriques,I and Sadorsky .P (2007).Oil prices and the stock prices of alternative energy companies.Energy Economics 30,pp 998-1010.

Huang,R.D.,Masulis,R.W and Stoll,H.R.(1996).Energy shocks and financial markets. *Journal of Futures Markets*,16(1).

Jammazi,R.(2012).Cross dynamics of oil-stock interactions' redundant wavelet analysis. *Energy* 44,pp.750-777.

Johannesburg stock exchange.

www.jse.co.za

Johannesburg stock exchange supports African commodities; trading grows:

http://www.worldfinance.com/inward-investment/middle-east-and-africa/johannesburg-stock-exchange-supports-african-commodities-trading-grows [Accessed on 17/04/2015]

Johansen,I.S.(1988). Statistical analysis of cointergration vectors. *Journal of Economic Dynamics and Control*,12,pp.231-254.

Johansen,S.and Jeselius,K.(1990).Maximum likelihood estimation and inferences on co-integration with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*,52,pp.169-210.

Kapusuzoglu,A.(2011).Relationship between oil price and stock market: An Empirical analysis from Istanbul Stock Exchange. *International Journal of Economics and Finance* 3(6),99-106.

Katircioglu.Y.A.,Altiparmak,U.E.,Duman.S.(2007).Comparison of three methods for the treatment of pterygium:amniotic,membrane graft,conjunctival outograft and conjunctival autograft plus mitomycin C.Orbit,26(1),5-13.

Le,Thai-Ha and Chang.Y.(2011).Oil and Gold: Correlation or Causation?*DEPOCEN working paper series.*

Le T.H and Chang Y. (2011): Dynamic relationships between the price of oil, gold and financial variables in Japan: a bounds testing approach, Munich Personal RePEc Archieve.

Online at http://mpra.ub.uni-muenchen.de/33030/

Lin,B.L.,Wesseh,P.K. and Appiah,M.O(2014). Oil price fluctuation, volatility spillover and Ghanaian equity market: Implication for portfolio management and hedging effectiveness. *Energy Economics* 42(c),172-182.

Lin,C.C.,Fang,C.R and Cheng,H.P.(2009).Relationship between oil prices and shocks and stock market: An empirical analysis from the Greater China.

Masih,R.,Peters,S. and Mello,L.De.(2011).Oil price volatility and stock price fluctuations in an emergying market: Evidence from South Korea. *Energy Economics* 33,975-986.

Mossin.J.,(1966).Equilibrium in a Capital Asset Market.*Econometrica*,34(4),768-784.

Mungai, C.(2015).The trouble of South Africa will not be traced to spaza shops but to the JSE floor.

http://www.theeastafrican.co.ke/news/-/2558/2689844/-/4egor8z/-/index.html [Accessed on 26/04/2015]

Narayan,P.K and Narayan,S.(2010). Modelling the impact of oil prices on Vietnam's Stock Prices. *Applied Energy*,87 pp.356-361.

Oskooe,S.A.P. and Shamsavari, A.(2011).Asymmetric effects in emerging stock markets-The case of Iran Stock Market. *International Journal of Economics and Finance*, 3(6).

Phillips,P.C.B.,Perron,P.(1988).Testing for unit root in time series regression.*Biometrika*,75(2),335-346.

Ray, S. (2013).Causal nexus between gold price movement and stock market: Evidence from Indian Stock Market.Econometrics,Sciknow Publications Ltd.

Reilly,K.F and Brown,K.C.(2003).Investment Analysis and Portfolio Management,7th ed.South Western.

Ross.S.A.,(1976).The Arbitrage Theory of Capital Asset Pricing. *Journal of Economic Theory*,13,341-360.

Sadorsky,P.(1999).Oil price shocks and stock market sensitivity. *Energy Economic*, 21 pp. 449-469.

Sari,R.and Soyatas,U.(2006).The relationship between stock returns,crude oil prices,interest rates and output:Evidence from a developing economy.*The empirical economics letters*.5(4),205-220.

Sharpe,F.,Alexander,J. and Bailey,V.J.(1999).Investments 6th ed.Prentice Hall.Inc. ISBN-0-13-010130-3

Sharpe.,(1964).Capital Asset Prices: A Theory of Market Equilibrium under conditions of Risk. *Journal of Finance*, 19,425-442.

Šimakovà,J.(2011).Analysis of the relationship between oil and gold prices. *Journal of Finance*,51(1),651-662.

South African Stock Market (FTSE/JSE)-Trading Economics

http://www.tradingeconomics.com/south-africa/stock-market [Accessed on 05/03/2015]

Sujit, K.S and Kumar, B.K.(2011).Study on dynamic relationship among gold price, oil price, exchange rate and stock market returns. *International Journal of Applied Business and Econometric Research*.9 (2), 154-165.

Technical Gold Charts and Data-London-Fix-Kitco

http://www.kitco.com/charts/CPM_charts.html [Accessed on 29/04/2015]

U.S.Energy Information Administration.

http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm [Accessed on 05/03/2015]

VERITAS Wealth,(2015), 2015:From the Petrol Pump To Your Pocket.

http://veritaswealth.co.za/2015-from-the-petrol-pump-to-your-pocket/

Walt, E.V.D (2015), Gold Bust means less mine spending.

http://www.bloomberg.com/news/articles/2015-04-06/gold-supply-boom-ending-as-price-slump-means-less-mine-spending [Accessed on 10/03/2015]

World Bank (2015), Understanding the plunge in oil prices: Sources and Implications

http://www.worldbank.org/content/dam/Worldbank/GEP/GEP2015a/pdfs/GEP2015a_chapter4_report_oil.pdf [Accessed on 27/04/2015]

World Gold Council (2013) ,Gold demand Trends: full year 2013;

https://www.**gold**.org/download/file/3262/GDT_Q4_**2013**.pdf [Accessed on 1/04/2015]

World Oil Outlook (2014)

www.**opec**.org/**opec**_web/static_files_project/.../WOO_**2014**.pdf [Accessed on 4/04/2015]

Ziaei,S.M. (2012).Effects of gold prices on equity, bond and domestic credit: Evidence from ASEAN+3.*Procedia- Social and Behavioral Science* ,40 pp. 341-346

Zivot,E. and Andrews.K (1992).Further evidence of the Great Crash, the oil price shock, and the unit root Hypothesis. Journal of Business and Economic Statistics 10(10), pp,251-70.

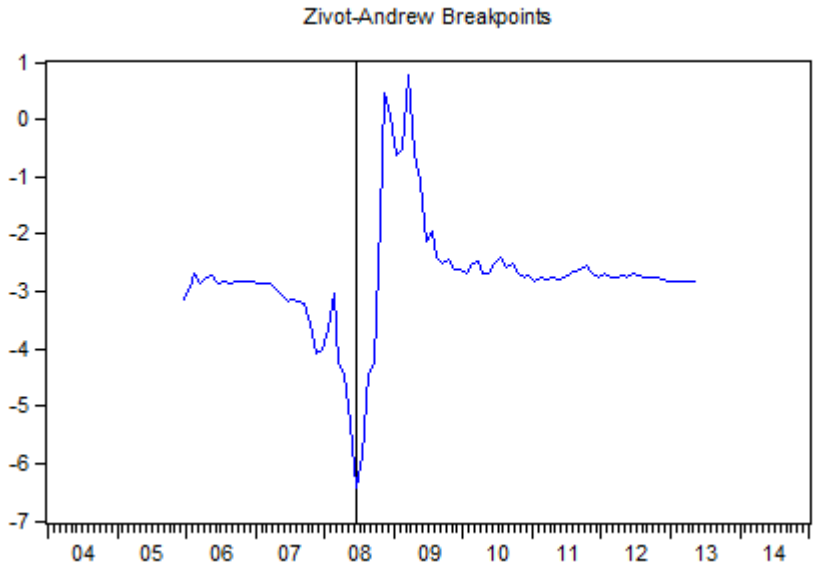
APPENDIX

Appendix I: Zivot-Andrews unit root test for JSE/ALL SHARE INDEX

Zivot-Andrews Unit Root Test
Date: 04/28/15 Time: 11:04
Sample: 2004M01 2014M12
Included observations: 132
Null Hypothesis: LJSE has a unit root with a structural break in both the intercept and trend
Chosen lag length: 4 (maximum lags: 12)
Chosen break point: 2008M06

	t-Statistic	Prob. *
Zivot-Andrews test statistic	-6.422012	7.53E-08
1% critical value:	-5.57	
5% critical value:	-5.08	
10% critical value:	-4.82	

* Probability values are calculated from a standard t-distribution and do not take into account the breakpoint selection process

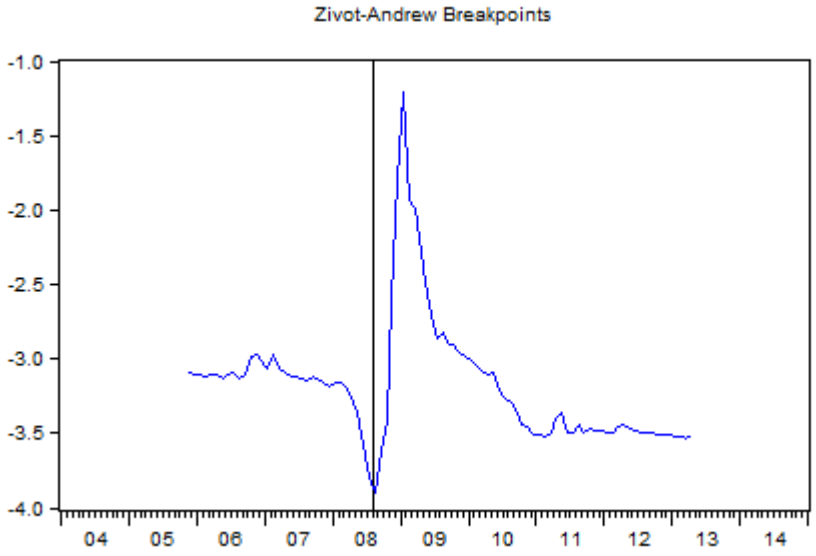


Appendix II :Zivot-Andrews unit root root test for International Oil Price

Zivot-Andrews Unit Root Test
Date: 04/28/15 Time: 11:04
Sample: 2004M01 2014M12
Included observations: 132
Null Hypothesis: LOD has a unit root with a structural break in both the intercept and trend
Chosen lag length: 2 (maximum lags: 12)
Chosen break point: 2008M08

	t-Statistic	Prob. *
Zivot-Andrews test statistic	-3.902994	0.030240
1% critical value:	-5.57	
5% critical value:	-5.08	
10% critical value:	-4.82	

* Probability values are calculated from a standard t-distribution and do not take into account the breakpoint selection process

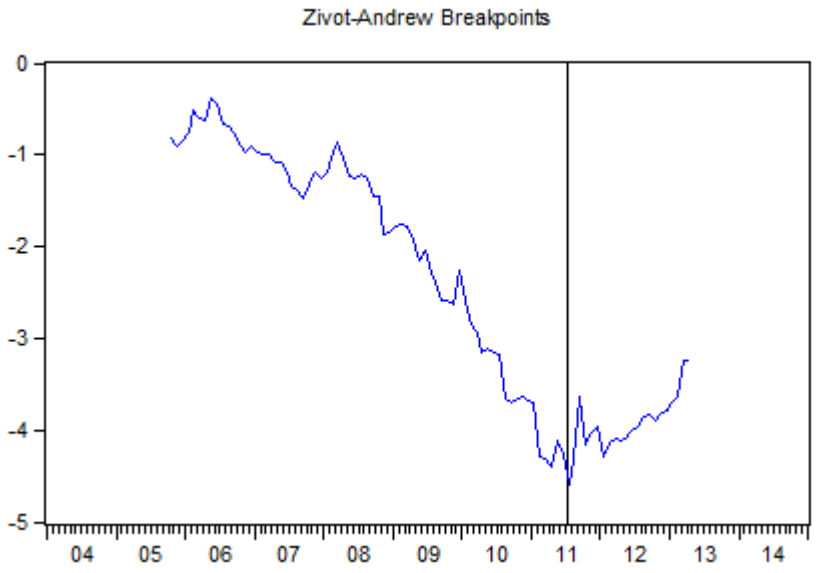


Appendix III: Zivot-Andrews unit root test for International Gold

Zivot-Andrews Unit Root Test
Date: 04/28/15 Time: 11:04
Sample: 2004M01 2014M12
Included observations: 132
Null Hypothesis: LGO has a unit root with a structural break in both the intercept and trend
Chosen lag length: 1 (maximum lags: 12)
Chosen break point: 2011M07

	t-Statistic	Prob. *
Zivot-Andrews test statistic	-4.592238	0.007561
1% critical value:	-5.57	
5% critical value:	-5.08	
10% critical value:	-4.82	

* Probability values are calculated from a standard t-distribution and do not take into account the breakpoint selection process



Appendix IV: VAR Lag Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LJSE LOD LGO
Exogenous variables: DUM01 DUM02 DUM03
Date: 05/21/15 Time: 09:53
Sample: 2004M01 2014M12
Included observations: 124

Lag	LogL	LR	FPE	AIC	SC	HQ
0	NA	NA	0.270520	7.206193	7.410891	7.289347
1	NA	1856.699	4.59e-08	-8.383380	-7.973984	-8.217073
2	NA	44.68445*	3.60e-08*	-8.626779*	-8.012685*	-8.377320*
3	NA	11.70765	3.75e-08	-8.586150	-7.767359	-8.253538
4	NA	3.302936	4.22e-08	-8.471291	-7.447802	-8.055526
5	NA	13.10274	4.32e-08	-8.449740	-7.221553	-7.950822
6	NA	2.785951	4.88e-08	-8.331627	-6.898742	-7.749556
7	NA	12.64845	5.00e-08	-8.312950	-6.675368	-7.647726
8	NA	10.42697	5.22e-08	-8.275284	-6.433003	-7.526906

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix V: Granger Causality/Block Exogeneity Wald Tests

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 05/21/15 Time: 09:46
Sample: 2004M01 2014M12
Included observations: 129

Dependent variable: D(LJSE)

Excluded	Chi-sq	Df	Prob.
D(LOD)	2.526411	2	0.2827
D(LGO)	1.242974	2	0.5371
All	3.452841	4	0.4851

Dependent variable: D(LOD)

Excluded	Chi-sq	Df	Prob.
D(LJSE)	12.79241	2	0.0017
D(LGO)	1.827605	2	0.4010
All	13.76123	4	0.0081

Dependent variable: D(LGO)

Excluded	Chi-sq	Df	Prob.
D(LJSE)	0.578204	2	0.7489
D(LOD)	1.098528	2	0.5774
All	1.609445	4	0.8071

Appendix VI: Variance Decomposition Analysis

Variance Decomposition of D(LJSE):

Period	S.E.	D(LJSE)	D(LOD)	D(LGO)
1	0.047260	100.0000	0.000000	0.000000
2	0.047382	99.52626	0.208048	0.265693
3	0.048195	99.31563	0.426307	0.258065
4	0.048244	99.23376	0.505922	0.260315
5	0.048297	99.19999	0.537280	0.262735
6	0.048306	99.18958	0.547716	0.262700
7	0.048310	99.18632	0.550705	0.262972
8	0.048311	99.18529	0.551708	0.262999
9	0.048312	99.18500	0.551987	0.263017
10	0.048312	99.18490	0.552076	0.263021

Variance Decomposition of D(LOD):

Period	S.E.	D(LJSE)	D(LOD)	D(LGO)
1	0.077338	5.152915	94.84708	0.000000
2	0.085874	19.49750	80.50050	0.001998
3	0.088323	20.94027	78.00952	1.050209
4	0.089325	22.21680	76.75566	1.027540
5	0.089498	22.41664	76.53214	1.051221
6	0.089577	22.51284	76.43566	1.051500
7	0.089594	22.53433	76.41417	1.051501
8	0.089600	22.54190	76.40644	1.051661
9	0.089602	22.54401	76.40435	1.051645
10	0.089602	22.54467	76.40368	1.051653

Variance Decomposition of D(LGO):

Period	S.E.	D(LJSE)	D(LOD)	D(LGO)
1	0.055295	11.64762	0.249344	88.10304
2	0.056029	11.42500	0.529330	88.04567
3	0.056346	11.33455	1.156888	87.50857
4	0.056355	11.34724	1.162349	87.49041
5	0.056365	11.35462	1.183636	87.46174
6	0.056367	11.35948	1.184221	87.45630
7	0.056367	11.36017	1.184532	87.45530
8	0.056368	11.36066	1.184704	87.45464
9	0.056368	11.36074	1.184718	87.45455
10	0.056368	11.36077	1.184732	87.45450

Cholesky Ordering: D(LJSE) D(LOD) D(LGO)