THE INTERACTION BETWEEN OIL PRICE SHOCKS, CURRENCY VOLATILITY AND STOCK MARKET PRICES: EVIDENCE FROM SOUTH AFRICA

By

MIKOVHE TSHIVHASE

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Supervisor: DR T. Qabhobho

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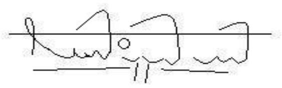
DECLARATION

I, Mikovhe Tshivhase of Student number: 210083131, hereby declare that this dissertation for student’s qualification to be awarded is my own work and that it has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another qualification.



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ABSTRACT

Crude oil is an essential and strategic commodity in modern economies. Therefore, energy price fluctuations have the potential of affecting the economic welfare of a country. For instance, they have the potential to undermine the government's attainment of its economic growth targets (National Treasury, 2016:2). The South African Reserve Bank (SARB) also considers oil price movements to be one of the major threats to currency volatility and the continued attainment of its inflation targets of about (3-6, per cent), as evidenced by numerous recent statements by its monetary policy committee (SARB, 2016:5-13). This study used co-integration tests to investigate the interaction between oil price shocks, exchange rates and stock market prices in South Africa over the period 1 January 2011 to 1 April 2018.

The study employed the Johansen co-integration test. The results found no long run co-integration between oil prices, exchange rate and stock market prices. Therefore, this study adopted the VAR model for causality tests. Using the VAR model, this study found the existence of a unidirectional causality between stock prices and oil prices, with stock prices leading the oil prices changes. The all share index, resources and financials index were found to be significant variables to explain oil prices. This result is consistent with the business cycle view, which states that oil price fluctuations are mainly driven by demand factors. Furthermore, strong world output growth trends especially in emerging markets, could give rise to an upward surge in oil prices. The study also found that there is a weak correlation between stock price and exchange rate in South Africa. This is consistent with the asset approach.

The findings of this study add to the already largely debated theories that seek to explain the relationship between the oil prices, exchange rates and stock market prices. The recommendation of this research is that, policy makers, researchers and investment bankers or fund managers who have interest or trade these financial instruments, may have to consider the role of stock market prices in the various sectors of the economy in their models for forecasting the path of the oil prices and the Rand/US Dollar exchange rate trend.

DEDICATION

I humbly dedicate this dissertation to my family. A special feeling of gratitude goes to both my parents, Mrs. Hanedzani Miriam Tshivhase and the late Mr Avhatuwi Richard Mapikule Tshivhase. To my older brother and sisters, Kutelani Tshivhase, Thetshelesani Tshivhase and Shingirai Hudivhanyi Tshivhase. Your words of encouragement though out the completion of this study echoed in my ears. Thank you for your support.

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This dissertation encompassed a huge amount of hard work and dedication. However, I want to firstly thank God, who by his grace I completed this dissertation. Secondly, I would like to extend a special word of gratitude to my supervisor, Dr Thobekile Qabhobho. Without his help, support and patience, the completion of this dissertation would also have been impossible.

I would like to put it on record that, writing this thesis has been an exercise in sustained suffering and sleepless nights. The casual reader may, perhaps, exempt him or herself from excessive guilt, but for those of you who have played the larger role in prolonging my agonies, well . . . you know who you are, and you owe me.

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LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
ALSI	All Share Index
ARCH	Autoregressive Conditional Heteroskedasticity
CAPM	Capital Asset Pricing Model
EU	European Union
EX	Exchange Rate
FEVD	Forecast Error Variance Decomposition
FIN	Financials Index
FPE	Final Prediction Error
GARCH	Generalised Auto Regressive Conditional Heteroskedasticity
GCC	Gulf Cooperation Council
HQ	Hannan-Quinn Criterion
ICB	Industrial Classification Bench mark
IMF	International Monetary Fund
INDI	Industrials Index
IRF	Impulse Response Function
JSE	Johannesburg Stock Exchange
KPSS	Kwiatkowski–Phillips–Schmidt–Shin
OP	Oil Prices
OPEC	The Organization of Petroleum Exporting Countries
PP	Phillips-Perron
RESI	Resources Index
SIC	Schwartz Information Criterion
SKP	Stock Prices
UK	United Kingdom
US	United States
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
WTI	West Texas Intermediate

CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND

Crude oil has become an essential and strategic commodity in the modern industrial economy since its discovery in Pennsylvania in 1869. Oil is a source of energy used to generate electricity and heat. It also serves to power machinery and automobiles used in the production process of goods and services (Basher and Sadorsky, 2006:224). This broad use has made crude oil a vital commodity, which has both a direct and indirect influence on the global economy. From the early twentieth century, the increased global demand for oil has seen crude oil develop into a financial asset that is traded daily on the international stock exchange (Sedick, 2016:1-5).

Historically, international crude oil prices were determined primarily by multinational oil companies until the 1970s (Nkomo, 2006). However, since the late 1980s, world oil prices have been set by a market-related pricing system which links oil prices to the 'Market price' of a category of crude, for instance the Organization of Petroleum Exporting Countries (OPEC), Brent, or the West Texas Intermediate (WTI) reference prices (Farrell, Kahn and Visser, 2001: 69).

Oil shocks are generally defined in terms of price fluctuations. These fluctuations emanate from changes in either the supply of or the demand for oil (Wakeford, 2006:56-87). In practice, it is unlikely for demand to grow rapidly enough to cause a price shock unless it is motivated by fears of supply shortages. Therefore, the supply side has been primarily responsible for the observed oil price shocks, or at least as the initial trigger (Wakeford, 2006:56-87).

The surge in oil prices in recent years has generated much discussion amongst investors, policymakers and academic researchers in South Africa (Sedick, 2016:1-5). It has prompted the industry players to seek a better understanding of the interaction between oil shocks and other macro-economic variables such as exchange rates and stock market prices.

Being a relatively minor net oil-importing country, South Africa is a price taker on the international oil market. However, South Africa is the largest energy consumer and a quintessential economy in Africa (Sedick, 2016:1-5). The world bank ranks the South African economy as an upper-middle-income economy which contributes about 24 per cent towards Africa's total gross domestic product (World Bank, 2012:15-21). Therefore, rising energy prices have a significant impact on the South African economy. These energy price fluctuations have, for instance, the potential to undermine the government's economic growth target (National Treasury, 2016:2).

The South African Reserve Bank (SARB, 2016:5-13) considers oil price movements to be one of the major threats to currency volatility and the continued attainment of its inflation targets of about (3-6, per cent), as evidenced by numerous recent statements by its monetary policy committee.

The South African Rand is one of the most traded currencies amongst other emerging market currencies. The exchange rate specifies how much one currency is currently worth in terms of the other. In South Africa, exchange rate regimes have evolved from being fixed, to managed floating and finally to free floating in the year 2000 (Mlambo, 2013:562). However, the external value of the currency is still of concern to the SARB because it influences the degree of import price inflation (SARB, 2016:5-13).

Exchange rates play an essential role in affecting stock prices (Nieh and Lee, 2001). The theoretical literature which seeks to explain the relationship between exchange rates and stock prices is readily available. However, there is no consensus regarding the direction of causality between exchange rate and stock prices (Nieh and Lee, 2001:9-18).

The stock market is an important part of the economy of a country. It plays a pivotal role in the growth of a country's economy. It is for this reason that the government, industry and even the central bank of the country keep a close watch on the stock market (Nieh and Lee, 2001:9-18).

Although there is isolated literature on, the relationship between oil prices and stock prices, oil prices and exchange rates and on exchange rates and stock prices, the interaction between these three streams have not been closely studied, especially within the context of South Africa (Basher, Haug and Sadorsky, 2011:227).

The effect of crude oil price fluctuations on exchange rates and stock market prices can be explained by either a direct or an indirect interaction of these variables. Sedick (2016:1-5) furthermore urges that, the interaction could have a negative or positive effect on both the local and the global economy. An indirect oil price movement is usually caused by the constantly changing market sentiments from domestic and foreign portfolio investors. As a result, this can have a positive or negative impact on the stock market prices and the exchange rate of a country. More directly, increases in crude oil prices have the secondary effect of increasing fuel prices and other utility prices. This in turn results in the escalation of production costs (Maslyuk, Rotaru and Dokumentov, 2013:2).

1.2. PROBLEM STATEMENT

Oil price shocks have the potential to undermine the rate of economic growth in an oil importing country (Roubini and Setser, 2004:13). They may affect both the government's monetary and fiscal policy. The South African Reserve Bank (SARB) considers oil price movements to be one of the major threats to the continued attainment of its inflation target (SARB, 2016:5-13). Increased oil prices tend to increase production costs of goods and services. This in turn translates to increased prices for consumer goods and services which has an unpleasant impact on the middle-income level and poor citizens' wellbeing (Sedick, 2016:1-5).

The exchange rates affect factors such as interest rates and inflation. The external value of the currency is of concern to the SARB because it is one of the most important determinants of a country's relative level of economic health (SARB, 2016:5-13). Exchange rates play a vital role in a country's level of trade, which is critical to an open economy like that of South Africa (Nieh and Lee, 2001:9-18). Exchange rates also have a direct impact on the real return of an investor's portfolio (Wakeford, 2006:56-87).

Oil price movements can also be caused by various market sentiments. A negative oil market sentiment for instance, can affect the risk appetite of investors through a stock market portfolio disinvestment or through a decrease of direct foreign investment (Wakeford, 2006:56-87). A disinvestment on the stock market affects the growth of the affected industry and the general economy of a country. If the negative impact of oil price chocks is not addressed, this could have an undesirable impact on the future economic vision of South Africa (National Treasury, 2016:2) and the New Growth Path (NGP), which promotes, amongst other things, employment and economic growth in South Africa (National Development Plan: Vision 2030. 2011:1010).

This study is guided by the following research questions: Firstly, is there a positive or negative relationship between 1) crude oil prices and the USD/ZAR exchange rate; 2) oil prices and stock market prices in the various sectors; and 3) the exchange rate and the stock prices?' Secondly, 'What is the direction of causality between these variables?' Thirdly, 'Is there a short- term or long-term relationship?' And lastly, 'To what degree are these variables sensitive to each other?'

1.3. OBJECTIVES OF THE STUDY

The main objective of this study is to examine the interaction of oil price movements, the exchange rate and the stock market price movements in South Africa. However, the specific objectives of this study are:

a) To investigate whether there is a positive or negative relationship between:
    - Crude oil prices and the USD/ZAR exchange rate
    - Oil prices and stock prices in the various sectors (Resources, Industrials and Financials sector), and
    - Exchange rate and the stock prices.

b) To explore the direction of causality of these variables.

c) To explore whether there is a short-term or long-term relationship between these variables.

d) To investigate how sensitive these variables are towards each other.

1.4. SIGNIFICANCE OF AND MOTIVATION FOR THE STUDY

Economists and researchers still have not reached any consensus regarding the interaction and relationship between, oil prices, exchange rates and stock market prices (Bahmani and Sohrabian, 1992:459–464). An investigation into the linkage between these three markets would be useful for predicting a crisis before it happens. By predicting the direction of anyone of these variables, investors and government policymakers can predict the behavior of one market using the information from the other if the variables are closely related (Granger, 2000:337-354).

This understanding can also help investors forecast and manage their positions and portfolios. They are then able to take advantage of the inherent lag effect of the JSE to respond to these price changes and thus maximise their profits. Fund managers may also devise fundamental investment strategies using news on changes in demand and supply of oil or exchange rate changes as a reliable indicator for where the stock price is headed. It is therefore important and suitable to carry out further investigations on these variables.

1.5. ORGANISATION OF THE STUDY

This study is organised as follows:

- **Chapter One:** Presents an introduction, the objectives of the study, a problem statement, and the significance of the study.

- **Chapter Two:** Provides historic considerations and trend analysis for the variables investigated in the study namely, the (OPEC) oil prices, Rand/Dollar exchange rate and the South African stock market JSE All share index (ALSI) and its major sectors (Resources, Industrials, and Financials).

- **Chapter Three:** This chapter provides a theoretical literature review, firstly on the oil market models and the prevailing views. Secondly, how exchange rates are determined in South Africa by exploring the various models of exchange rate determination. Thirdly, the Capital Asset Pricing Model (CAPM) is presented to explain stock price determination. Lastly, a literature review on: the relationship between oil price shocks and the exchange rates, oil price shocks and the stock market prices, and lastly the relationship between exchange rates and the stock market prices.

- **Chapter Four:** Reviews the previous empirical studies that have been conducted on oil prices, exchange rates and the stock market prices.

- **Chapter Five:** The methodology used to empirically investigate the research questions is outlined.

- **Chapter Six:** This chapter presents the empirical results of the data collated. It provides an analysis and interpretation of the results. Furthermore, various facets of the research question are linked and discussed in terms of their implications on policy-makers and developing economies like South Africa.

- **Chapter Seven:** Provides an overview of the study, as well as several recommendations.

CHAPTER TWO

HISTORIC CONSIDERATIONS AND TREND ANALYSIS

2.1. INTRODUCTION

This chapter presents the historic background and trend analysis of the oil market, the exchange rate market and the stock market of South Africa. Section 2.2, examines the five major oil price shocks that considerably affected the global price of oil during the post-war era from 1971 to 2016. Section 2.3, presents the trend analysis of the oil market. Section 2.4, explains the South African exchange rate regime. Section 2.5, presents the historic and trend analysis of the Rand/US Dollar exchange rate. Section 2.6, shows the structure and composition, and how the South African stock markets have a significant impact on the national economy.
The last section presented a summary of the chapter.

2.2. HISTORICAL OIL PRICE SHOCKS

Oil prices have fluctuated considerably over the past decades. There are five major oil price shocks that considerably affected the global price of oil in the post-war era. The price shocks have occurred particularly during the global oil crises of 1971-74, 1979-80, 1990, 2003-06 and 2014-2016 (Planet Energies, 2011:1).

The first oil crisis started in 1971 when the Bretton Woods international monetary system was abandoned. It intensified in 1973 during the Yom Kippur war, when Arab oil-producing nations placed an embargo on oil shipments to countries that supported Israel which affected mostly the Unites States and the Netherlands (Williams, 2011:1). Oil prices quadrupled within a year, from about $3 per barrel prior to the war to around $11.50 per barrel in 1974 (Wakeford, 2006:12). This shock had severe implications for many of the developed industrial economies, including inflation, recession and stagflation. Developing countries like South Africa suffered from the decline in world trade and the fall of primary commodity prices (Degut, 1978: 29). South Africa's import bill rose, on average, by 13.82 per cent per annum.

The second oil shock followed on the inception of the Iranian revolution in 1978 - 1979 and the subsequent war between Iraq and Iran in 1980. The Iranian revolution resulted in the loss of about 2 million - 2.5 million barrels per day of oil production between November 1978 and June 1979 (Williams, 2011:1). By September 1980 a year later, production was down by 6.5 million barrels per day and at one-point, production almost halted. This caused worldwide crude oil production to decrease by about 10 per cent. The loss of production from the combined effects of the Iranian revolution and the Iran War caused crude oil prices to surge up more than double. The nominal price went from $14 in 1978 to $35 per barrel in 1981 (Wakeford, 2006:12). The terms of trade for developing countries like South Africa worsened considerably in the wake of the second oil crisis. The rate of consumer price inflation (CPI) escalated to double figures and became much more volatile in 1979 - 1981 and ensued into a severe recession in 1983 (Van der Merwe and Meijer, 1990: 15).

The third oil shock was characterised by a spike in crude oil prices in 1990. The oil price shock was set off by the invasion of Kuwait led by President Saddam Hussein of Iraqi in August 1990 (Planet Energies, 2011:1). Kuwait has crude oil reserves of approximately 104 billion barrels, which is estimated to be 9 per cent of the world's reserves. Kuwait's oil reserves are the fourth largest in the world and the Burgan field is the second largest oil field in the world. In the months that followed, the world oil market experienced extreme turbulence due to the lower oil production of the captured Kuwait’s oil fields and the political unrest of what became known as the Gulf War to liberate Kuwait (Williams, 2011:1).

Consequently, the price of oil climbed by a factor of about two from $17 per barrel in July 1990 to an average of $35 per barrel in October (Van der Merwe and Meijer, 1990: 4). However, the oil prices had recovered by February 1991, with the price dropping to below $20 per barrel. This was mainly due to the rapid deployment of US and other allied United Nations military forces who experienced subsequent victory in the Gulf war in early 1991. This prevented the crisis from spreading and it calmed sentiments in the oil market (Wakeford, 2006:14).

There are multiple reasons that triggered the fourth oil price shock of 2003 to 2006. One of the reasons was the steep increase in demand of oil especially by major emerging economies such as China and India, but also by developed countries like the US (Planet Energies, 2011:1). During this period, these countries especially China were experiencing major re-industrialisation and robust economic growth. On the other hand, supply had expanded less rapidly than demand. Moreover, there were recurring disruptions to the flow of oil in some areas because of a range of factors, such as the ongoing conflict in Iraq; sporadic conflict and sabotage in Nigeria, the 2005 US's devastation Hurricanes Katrina and Rita in the Gulf of Mexico; and a leaking pipeline leading to a temporary closure of the Prudhoe Bay field in Alaska in August 2006 (Williams, 2011:1).

Consequently, the price of crude oil rose from around US$25 per barrel in 2003 to a high point of US$78 per barrel in July 2006. The global effect of the oil price increases fuelled inflation in many of the world's economies including South Africa. The South African Consumer Price Index (CPI) inflation rose from an average of 3.6 per cent in 2005 to 5.1 per cent in 2006 which prompted many central banks to initiate an interest rate tightening cycle (Wakeford, 2006:15).

The fifth oil shock saw the oil price collapse in 2014, in the start of 2015 oil prices had fallen below $50 per barrel despite rising world demand. This was caused by the standoff for market share between OPEC's Saudi Arabia and the US. Saudi Arabia increased its oil production in the hope to force US to reduce their output. This caused an excess supply of oil and drove the price of Brent oil to slip to below $30 a barrel by January 2016. These low-price levels had not been seen since 2003, and this created serious trouble for some oil-producing nations such as Venezuela, Algeria and Russia (Hou, Keane and Velde, 2015:8-10).

Oil prices began to recover in February 2016, reaching about $50 per barrel in June 2016. This was mainly due to the decision of Saudi Arabia, Venezuela, Qatar and Russia to freeze production. However, the general trend toward lower prices significantly undermined investment, because of the uncertainties and political risks that remained in these oil producing countries. This lack of investment could threaten the availability and production of oil over the coming years and may cause an upward spiral in oil prices (Grigoli, Herman and Swiston, 2017:7).

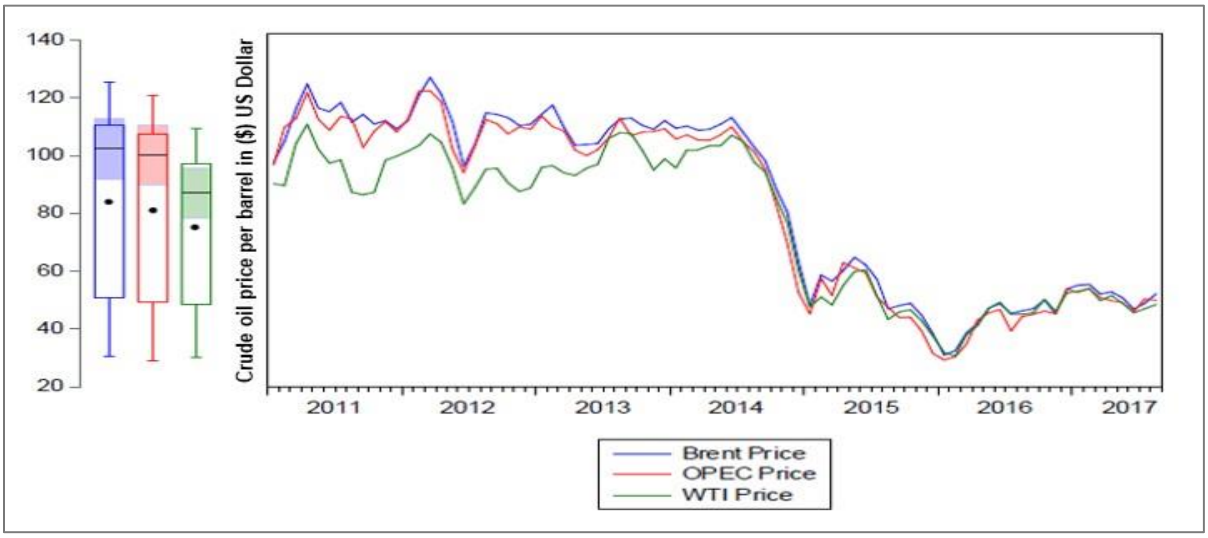
2.3. OIL MARKET ANALYSIS

There are three main oil price sources, namely the West Texas Intermediate (WTI), Brent Blend and the OPEC oil prices. The West Texas Intermediate crude oil is a blend of several U.S. domestic streams of light sweet crude oils. This grade of crude oil is used as a benchmark in oil pricing. WTI is produced in different areas of the United States and refined mostly in the Midwest and Gulf Coast regions. The major trading hub for WTI is Oklahoma (Baumeister and Kilian, 2016: 131). Brent Blend is a combination of different oils from 15 fields throughout the Scottish Brent located in the North Sea. Brent Blend production, much like that of WTI is a major oil pricing benchmark for other crude oils in Europe or Africa (Hamilton, 2008: 20 -23).

The acronym OPEC stands for (Organization of Petroleum-Exporting Countries) which is an organization that was formed in 1960 to create some common policy for the production and sale of oil within its jurisdiction. The OPEC basket oil is a collective seven different crude oils from Algeria, Saudi Arabia, Indonesia, Nigeria, Dubai, Venezuela and the Mexican Isthmus. OPEC's willingness or ability to quickly increase production when needed makes OPEC a consistent major player in the oil industry (Hamilton, 2008: 20 -23). Fin24 (2014) reported that nearly half (45 per cent) of oil imports to South Africa come from Saudi Arabia. A further 23 per cent comes from Nigeria, 18 per cent from Angola, 4 per cent from Ghana, and the remaining 10 per cent from other sources.

Figure one below illustrates that the WTI is often priced between $5 and $7 lower per barrel than the OPEC oil basket and on average, between $1 and $2 lower per barrel than the Brent Blend oils. Furthermore, the Brent Blend oil price is often priced at a $4 higher per barrel compared to the OPEC basket price.

Figure 1: Oil Price (Benchmark Variations).



Source of Data: Thomson Reuters (2017). Computed by Author.

2.4. THE SOUTH AFRICAN EXCHANGE RATE REGIME

Post 1994, South Africa's exchange rate regime has evolved from being fixed, to managed floating and finally to free floating in the year 2000 (Mlambo, 2013:562). The South African government used a gradual approach to phase out the old exchange rate regime and to implement the liberalisation of exchange rate controls. This allowed government more time to implement other policy changes to achieve the preconditions necessary for a successful liberalisation of exchange controls (SARB, 2007). In South Africa the determination of the exchange rate is stipulated by the South African Reserve Bank (SARB) system, but essentially controlled by market forces under conditions where exchange control is still exercised but only in respect of capital movements (Van der Merwe, 1996:1).

The South African Rand is one of the most traded currency among the other emerging markets currencies. The Rand is ranked at the 18th most traded currency. Based on the foreign exchange (forex) trading data of the JSE in 2011, forex trading accounted for 0.3 per cent ($27 billion) of the world's daily foreign exchange market turnover, yet the Rand accounted for 1.1 per cent ($60 billion) of world's daily currency trading (STANLIB, 2013:1).

The US Dollar remains, by-far the dominant globally traded currency, represented in 87 per cent of all foreign exchange trades in April 2013 (Ocran, 2010:362-375). The USD/ZAR accounts for only 1 per cent of world currency trade but is the most dominant traded currency pair involving the Rand. The Bank for International Settlements (BIS) report identifies that the USD/ZAR pair accounts for a massive 85 per cent of the entire Rand market. However, in calculating South Africa's real effective exchange rate the reserve bank uses a much broader range of currencies, including a significantly higher weight for the Euro (STANLIB, 2013:1). This is because the reserve bank is trying to reflect South Africa's value of foreign trade in goods and services and not the value of the Rand traded on the financial markets (Ocran, 2010:36).

Exchange rates are also used to influence trade in terms of imports and exports with other global trading partners. A countries currency value can have both a positive or negative impact on aggregate imports and goods exports (Todani and Munyama, 2005: 19). There has been a growing trend of some economists and policy makers advocating for less expensive or depreciated currency to boost the export sector. Investigating the linkage of the foreign exchange market, with the oil and stock market may be useful for predicting the direction of each of these aspects. This would be of great use for policy makers to know whether such a policy would weaken or strengthen the oil market and the stock market (Granger, Huang and Yang, 2000:337-354).

2.5. HISTORIC EXCHANGE RATE ANALYSIS (RAND / US DOLLAR)

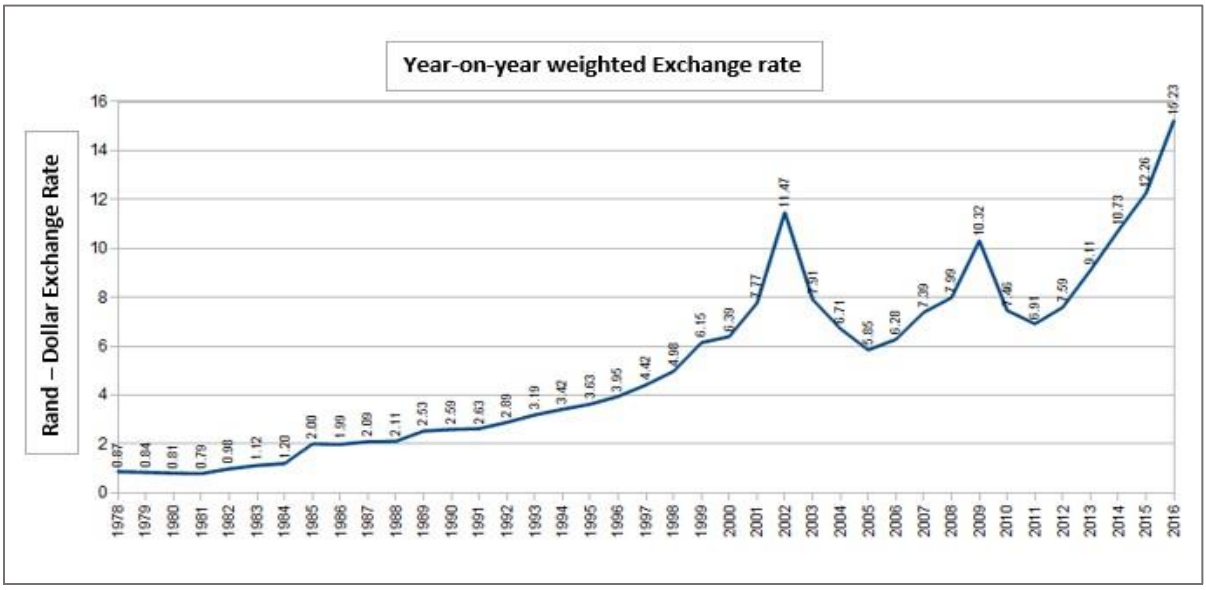
Since the early 1980's the general trend over the past decades of the Rand/ US Dollar currency pair has mostly been to weaken, but the rand has also strengthened significantly after major blowouts in 1985, 1998, 2002, 2008, 2013 and 2015. Figure two below shows the year-on-year (Rand/Dollar) exchange rates from 1980 to 2016. The first major disruption to the South African currency was in 1985. This was due to several reasons which included, a currency collapse and reintroduction of the financial Rand because of the new tight forex controls. Furthermore, the US banks suspending loans to South Africa leading to a debt stoppage and the Rubicon speech by former President P.W. Botha (Refused to make economic and political reforms to the apartheid government) causing the rand to fall further (Business Tech, 2016:1).

In 1996, the markets were unease over the first current account deficit in a decade. Thereafter, in 1998 was the East Asia financial crisis, the Rand fell from R5.10 per Dollar to R5.80 per Dollar. The SARB reacted by hiking the prime rate to 25 per cent and spent billions trying to defend the Rand. In 2001, the Rand fell to a record low of R13.71 to the Dollar due to the dot-com crash, the Zimbabwe land invasions and the US 9/11 terrorist attacks also added to the negative sentiments (MarketWatch, 2016). However, the markets managed to bounce back due to the low interest rates in the West and rising commodity prices fuelled by the Chinese industrialisation supporting the Rand (Fin24, 2016).

The global financial crisis of 2008 also caused the Rand to collapse along with most global currencies except the Dollar, Euro and Yen. The financial market did manage to recover, due to lowering of interest rates globally and major central banks making huge monetary stimulus. This resulted in the strengthening of emerging market currencies because of the search for yield (SARB, 2013:43).

In 2012-13 the South African currency was under immense pressure due to labour unrest, especially in the mining sector. In December 2015, the Rand also took a big knock after President Jacob Zuma unexpectedly fired finance Minister Nhlanhla Nene and replaced him with Minister David van Rooyen. This combined with extremely slow growth, a widening current account deficit and one of the worst droughts in the country's history, the Rand reached a high record of R16.84 to the dollar (MoneyWeb, 2016).

Figure 2: Rand/US Dollar History.



Source: BusinessTech , 2016

2.6. SOUTH AFRICAN STOCK MARKETS

South Africa has mature capital markets that serve the domestic economy and the wider continent. The Johannesburg Stock Exchange (JSE) is among the world's 20 largest stock market exchanges by market capitalisation of about ($1,007bn at end of 2013) and is the largest exchange in Africa (JSE, 2013).

The South African stock markets have a significant impact on the national economy. The stock market is worth almost twice the country's gross output. A study by Hassan (2013) found that the ratio of market capitalization to gross domestic product, is about 187 per cent. This is relatively large, and was only exceeded by Hong Kong, where the ratio was a staggering 908 per cent and Singapore, at 217 per cent. This suggests that fluctuations in these stock markets can have a significant effect on aggregate spending and the share of consumption in the domestic output, which is GDP (Hassan, 2013: 26-30). Germany and Tokyo reported the least market capitalization to gross domestic product of 33 per cent and 55 per cent respectively. This suggests that fluctuations in these stock markets do not have a major effect on aggregate spending and GDP of these countries.

Furthermore, the South African Institution of Stock Brokers (SAIS, 2015:167) found that different industries typically perform well in different stages of the economic and business cycle. Table one below illustrates the performance of different industries under various business cycles. Firstly, it shows that towards the end of a recession i.e. (market bottom and early bull market), expectations are that housing construction and loan demands will increase. Consequently, financial stocks outperform the market as investors expects banks earnings to increase as the economy and loan demand recover. Once the economy begins its recovery i.e. (Bull Market and expansion), expectations are that consumer durables such as cars, fridge, and computers become attractive investments (SAIS, 2015:167).

Table one below also illustrates that, as the economy expands, and companies realise that levels of consumer spending are sustainable i.e. (market top and early bear market), they consider increasing capacity to meet rising demand. Therefore, capital good industries such as heavy equipment and airplane manufacturers become attractive investments. Lastly, when the economy peaks and turns, inflation increases as demand starts to exceed supply. Basic industries, such as gold and timber industries become attractive investments. This is because an increasing rate of inflation has less impact on the cost of extracting these products. During a recession i.e. (bear market and contraction) consumer staples such as pharmaceuticals and food industries tend to perform better than other industries as consumers still need necessities (SAIS, 2015:172).

Table 1: Business Cycles and the Industry Performance.

Stock Cycle	Business market Cycle	Industry	Characteristics
Market bottom Early bull market	Late contraction lower turning point	• Banks • Energy • Media • IT hardware • Software • Computer services	• Declining interest rates and recovering credit demand. • Improving advertising spend • Growing consumer confidence and disposable income Expenditure on expensive • consumer durables increasing
Bull Market	Expansion	• Retailers • Transport • Property • Household goods • Engineering and machinery Motor vehicles	• Recognition that economy is recovering and improving consumer spending is sustainable. • High capacity utilisation – companies consider expansion to satisfying rising demand Interest – rate – sensitive and • cyclical industries (capital goods or consumer durables) become attractive
Market top Early bear	Late expansion Upper turning point	• Aerospace & defence Food retailers • Food producers • Utilities • Tobacco • Basic industries	• Inflation increases as demand outstrips supply Large • companies with ample liquidity and operating stability and companies producing stability and companies producing non-volatile consumer goods become attractive.
Bear market	Contraction	• Telecommunications • Pharmaceuticals • Insurance	• High interest rates and slowdown in demand Spending • falls in all areas except necessities

Source: South African Institution of Stock Brokers (SAIS), 2015.

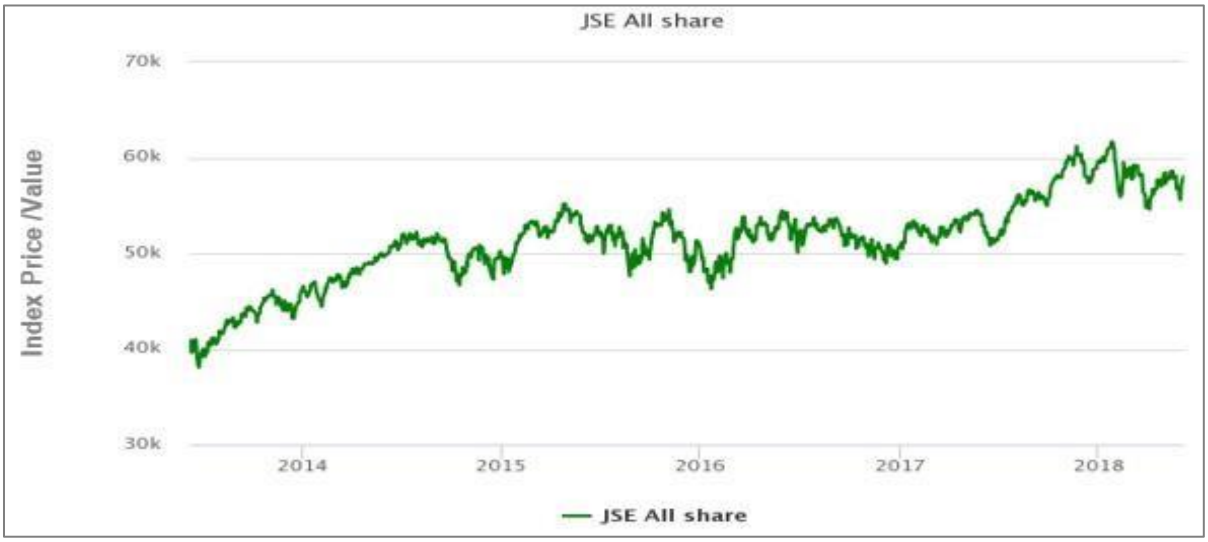
2.6.1. JSE Market Performance

The JSE categorises all listed capital instruments into one of three industry sectors, namely Resources Industry, Financials and Industrials sector, based on their revenue. All these sectors make up the JSE All Share Index (JSE, 2013:1). The JSE All Share Index, is a major stock market index which tracks the performance of all companies listed on the Johannesburg Stock Exchange (JSE) in South Africa. It is a free-float, market capitalization weighted index. The index includes shares from all sectors of the stock market; therefore, it gives the best indication of general market direction (JSE, 2015).

Figure three below presents a graph that show the general trend of the JSE all share index. The index reached a record low of 26738.91 points in August of 2010. The country faced a looming fiscal crisis. The major cause was the growth in expenditure like, social grants and civil service wages, combined with a slowdown in the growth of the economy (Fin24, 2016). The first quarter of 2018 saw the index reach a record high of 61684.77 points. This was mainly due to an increase in consumer and business confidence amid positive political and economic developments (MarketWatch, 2018:1).

There has not been much movement in terms of which companies make up the top 25 of the all share index since 2013. Companies such as British American Tobacco, BHP Billiton, Richemont and Naspers have consistently retained their titles as SA's biggest companies. This might be a sign of concentrated dominant market power (JSE, 2013).

Figure 3: JSE All Share Performance.



Source: MoneyWeb, 2018

2.6.2. Resources Industry

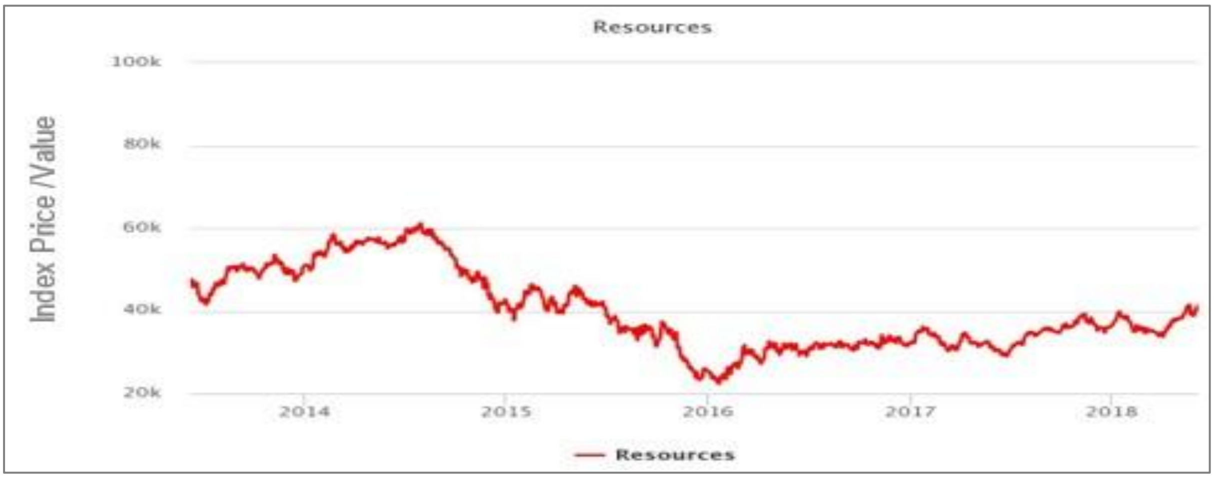
The JSE Resources Index (RESI-20) tracks the performance of the 20 largest mining companies by market capitalisation (market value). The resources industry includes

JSE listed companies that belong to sub sectors of Industries oil and gas and basic materials (JSE, 2015). The oil and gas sector include all listed companies that are oil and gas producers (e.g. Sasol), oil equipment, services and distribution and companies involved in alternative energy. The basic materials sector is a category of stocks that accounts for companies involved with the discovery, development and processing of raw materials.

The sector includes the mining and refining of metals, chemical producers and forestry products. The basic materials sector is sensitive to changes in the business cycle. The sector supplies mostly materials for construction, therefore it depends on a strong economy (JSE, 2013). About 26 per cent of the total value of all JSE-listed companies are contributed by the basic materials sector, valued at approximately R2 trillion. The basic materials sector is the largest component of the JSE, given South Africa's wealth of natural resources (Sharenet, 2013).

Figure four below presents a graph that show the general trend of the JSE resources index. The index reached a record high of 60 676.79 points in August of 2014. However, the index collapsed in 2015 along with commodity prices. This was because of concerns that some large mining companies might go bankrupt because of the huge debt accumulated when commodity prices were much higher (MoneyWeb, 2016).The first quarter of 2016 saw the index reach a record low of 22 878.94 points. This was mainly due to agreements to freeze oil output by both OPEC and Non-OPEC oil producers. South African mining production also experienced a 5.4 per cent decline in production in the same year (MoneyWeb, 2016:1).

Figure 4: JSE Resources Index Performance.



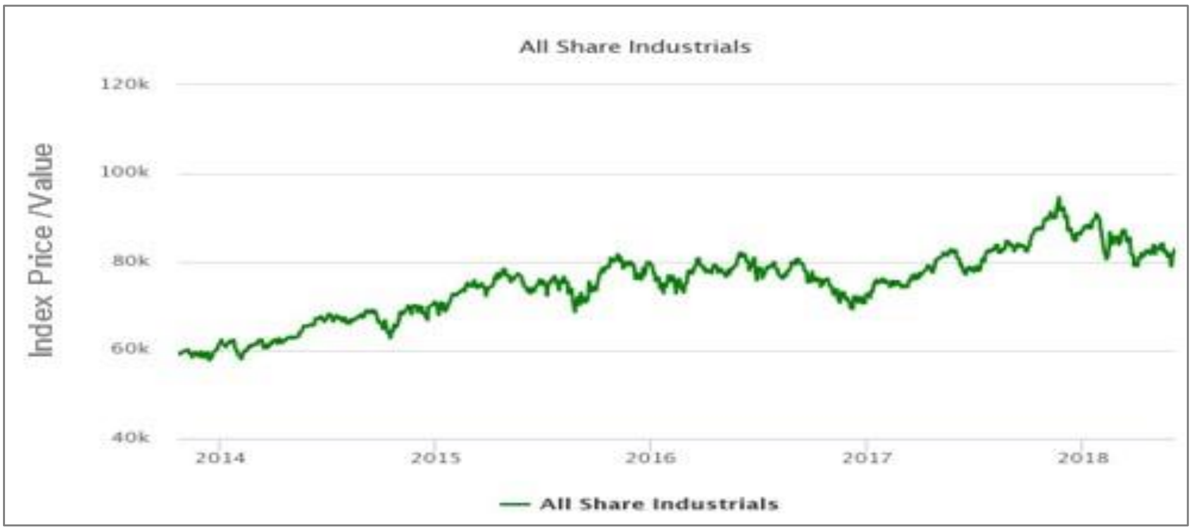
Source: MoneyWeb, 2018

2.6.3. SA Industrials

The JSE Industrial 25 INDI tracks the performance of the 25 largest industrial companies by market capitalisation (market value). SA Industrials includes all remaining JSE listed companies that do not belong to ICB (Industry Classification Benchmark) industries, financials, oil and gas and basic materials. These include the consumer goods, health care, consumer services, telecommunications and the technology industries (JSE, 2015). The consumer services sector is the second largest component in the JSE, worth about R1.6 trillion (JSE, 2013). The South African telecommunication market has been dominated by four companies since 2011 namely, Vodacom with approximately 42.1 per cent of the entire market share, MTN 34.9 per cent, Cell C 17,3 per cent and Telkom with 4.5 per cent (Fin24, 2011:1).

Figure five below presents a graph that shows the general trend of the JSE industrials index. Economic activity contract in the first quarter of 2017. The index reached lows of 72 495.50 points in January. However, the economy saw sustained growth for the remainder of the year. The fourth quarter experienced the highest growth rate of 2017, with the economy expanding by 3,1 per cent quarter-on-quarter (Sharenet, 2013).The index reached highs of 93 033.59 points in December. The strengthening in economic activity over 2017 was partly driven by an agriculture industry bouncing back from one of the worst droughts in recent history. A bumper maize crop and recovery in other agricultural commodities saw agriculture production rise by 17,7 per cent in 2017 compared with 2016 (StatsSA, 2017:1).

Figure 5: JSE Industrials Performance



Source: Money Web, 2018

2.6.4. Financials Industry

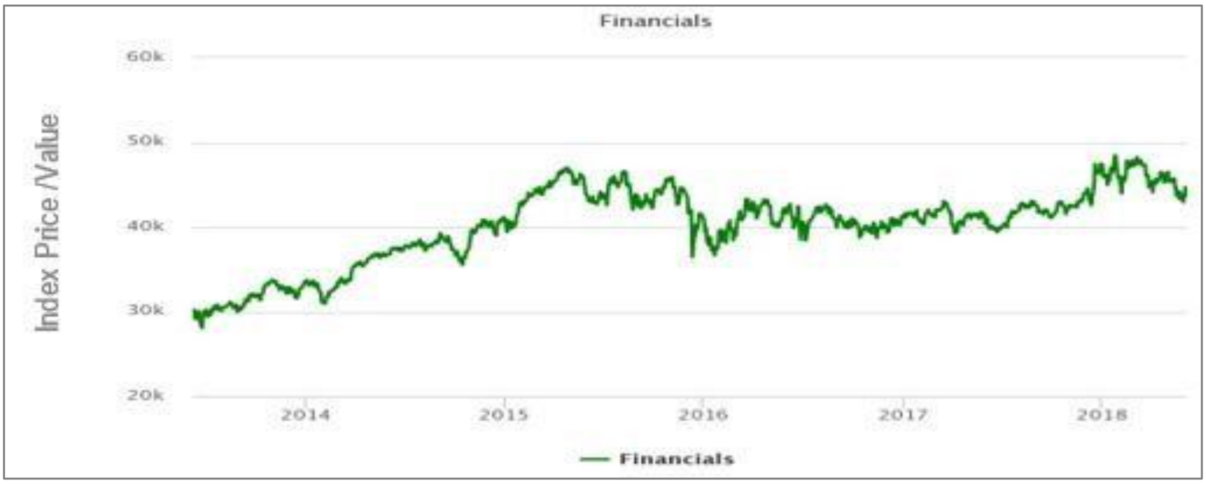
SA financials industry includes JSE listed companies that belong to ICB industry financials. The financial sector come in third place, contributing about R1.5 trillion. This industry sector includes, listed banks, insurance providers, real estate and financial service i.e. equity and non-equity investment instruments (Sharenet, 2013).

The South African banking sector is highly concentrated, with four banks accounting for over 80 per cent of total banking assets (Standard bank, Capitec, ABSA bank and First National Bank). Some of these banks have expanded internationally, especially in the SADC region, where they acquired substantial market shares (MFW4A, 2013).

Figure six below presents a graph that show the general trend of the JSE financials index. The index reached a low of 37 744.56 points from 45 408.54 points in January of 2016. This was mainly due to the IMF downgrading global growth because of fears of excess oil supply and S&P citing negative economic outlook for South Africa (IMF, 2016:23). During the mid-year of 2016, the BRIXT incident also pushed the index down to 39 444.42 points.

The country faced a looming political crisis in 2017. The share prices of South African's top four banks plunged more than 5 per cent after President Jacob Zuma unexpectedly replaced Pravin Gordhan as minister of finance with Malusi Gigaba, and a further 3 per cent after the allegations of state capture became intense in the first quarter of 2017. In November of the same year the credit ratings agency S&P global, downgraded South Africa's credit rating to full junk status, while its counterpart Moody's placed the country on review for downgrade (Fin24, 2017:1).

Figure 6: JSE Financials Performance.



Source: MoneyWeb, 2018

2.7. CHAPTER SUMMARY

This chapter presented the historic background and market overview of the oil market, the exchange rate market and the stock market of South Africa. There are five major oil price shocks presented that considerably affected the global price of oil post-war era. These price shocks showed that the global effect of raising oil prices, fuels inflation in many of the world's economies. For instance, developing countries like South Africa suffered from the decline in world trade and the fall of primary commodity prices.

This section also identified three main oil price sources used as a benchmark in oil pricing, namely the West Texas Intermediate (WTI), Brent Blend and the OPEC oil prices. Nearly half (45 per cent) of oil imports to South Africa come from Saudi Arabia. A further 23 per cent comes from Nigeria, 18 per cent from Angola, 4 per cent from Ghana, and the balance 10 per cent from other sources.

This chapter also examined the South African exchange rate regime and the historic (Rand /US Dollar) currency exchange. In South Africa the determination of the exchange rate is stipulated by the South African Reserve Bank (SARB) system, but essentially controlled by market forces under conditions where exchange control is still exercised but only in respect of capital movements. The South African Rand is one of the most traded currency among the other emerging markets currencies. The Rand is ranked at the 18th most traded currency. The US Dollar remains, by-far, the dominant globally traded currency, represented in 87 per cent of all foreign exchange trades. The USD/ZAR accounts for only 1 per cent of world trade but is the most dominant traded currency pair involving the Rand. The USD/ZAR pair accounts for a massive 85 per cent of the entire Rand market.

This chapter also explained the structure and composition of the South African stock markets. The South African stock markets have a significant impact on the national economy. The different industries within the economy and stock market typically perform well in different stages of the business cycle. A sign of concentrated dominant market power was noted, because since 2013 there has not been much movement in terms of which companies make up the top 25 of the all share index, with the likes of British American Tobacco, BHP Billiton, Richemont and Naspers retaining their titles as SA’s biggest companies. The South African banking sector is also highly concentrated, with four banks accounting for over 80 per cent of total banking assets (Standard bank, Capitec, ABSA bank and First National Bank). The South African telecommunication market is dominated by four companies since 2011 namely, Vodacom with 42.1 per cent of the entire market share, MTN 34.9 per cent, Cell C 17,3 per cent and Telkom with 4.5 per cent. The next chapter will discuss the theoretical literature review.

CHAPTER THREE

THEORETICAL LITERATURE REVIEW

3.1. INTRODUCTION

This chapter provides a theoretical literature review, firstly on the oil market prevailing views, namely the constrained supply view, the elastic supply view, the business cycle view and the substitution and conservation view. Secondly, this section presents how exchange rates are determined in South Africa by exploring the various models of exchange rate determination, namely the monetary approach model, the balance of payment approach and the non-macroeconomic determinants of exchange rate volatility. Thirdly, this section explains the capital asset pricing model to explain stock price determination.

Furthermore, this chapter explains the theoretical literature regarding the relationship between oil prices and stock returns, the relationship between oil prices and exchange rates, and finally the relationship between exchange rate and stock prices. This section discussed the three main theories that explain the relationship between stock prices and exchange rates namely: the traditional approach, also known as the "flow-oriented model", the portfolio approach which is sometimes referred to as the "stock-oriented model" and the asset approach. Then the last section concludes the chapter.

3.2. OIL MARKET PRICING MODELS.

Rabah, Zoltan, Douglas and Wang, (2017: 7-10) in their study with the International Monetary Fund (IMF), they suggested four key prevailing views of the oil market prices. Firstly, the view that the supply of oil is constrained, and that depletion forces will dominate the future of oil supply. As these forces become more binding oil prices will rise. This suggests that existing conventional oil fields, which account for about 80 per cent of current supply, are depleting rapidly (Hamilton, 1996: 215). Hotelling, (1931) suggests that the price of an exhaustible natural resource and the production needs to be balanced against the consideration that, once consumed, the resource will be unavailable to future generations. However, Hotelling's theory appears to be at odds with the general long run behaviour of crude oil prices. The first possible reason is that, although oil is in principle an exhaustible resource, in practice the supply has always been perceived to be so vast, and the rate at which it will finally be exhausted has been thought to be so far into the future, that the exhaustibility of the resource had essentially no relevance for the current price (Hotelling, 1931: 75).

Secondly, the view that supply of oil is elastic, and future oil demand will be satisfied without a large and sustained increase in the real price of oil because of improvements in oil exploration and extraction technology. The elastic supply view of the oil market focuses on the idea that higher prices eventually stimulate oil supply by encouraging investment in exploration (Cooper, 2003: 1-8). New wells typically cause the production to increase in the initial phase of development. However, as more oil is removed, less remains in the original deposit and it becomes increasingly difficult to continue to extract oil at the same rate. The elastic supply view outlines the role of technological progress, which could lower marginal extraction costs and lead to investment in the discovery of new fields. To keep total production increasing, it is necessary to find new fields continuously. Historically, this has been achieved by moving to new geographical areas (Pindyck, 1978: 841).

Thirdly, the business cycle view, which suggests that the business cycle will drive future oil demand, and oil prices will start rising when the global economy starts to pick up. According to the business cycle view, oil price fluctuations are mainly driven by demand factors. Strong world output growth trends, especially in emerging markets, could result in an upward surge in oil prices. Cyclically strong world growth at a time of low oil supply capacity can trigger a period of persistently high oil prices. For instance, in 2013 on January 17, United States reported good economic news, however oil refinery shutdowns led to the dramatic price increases, the WTI benchmark oil reached its highest level going over $95 and Brent crude rose above $110 per barrel (Hamilton, 1996: 215).

Lastly, the substitution and conservation view. This view notes that efficiency and alternatives in the oil market has been improving and will continue to improve, and this will help offset the increase in the demand for oil from fast-growing emerging market economies (Blanchard and Riggi, 2013: 1032). According to the substitution and conservation view, efforts towards oil substitution and conservation are the dominant forces in shaping the oil market prices. Currently oil is mainly used for transportation, while other fossil fuels such as coal and natural gas, are mostly used for generating power (Blanchard and Riggi, 2013: 1032). Oil faces competition from other sources of energy. As the price of oil rises, the demand for oil decreases as consumers switch to substitutes such as biofuels or natural gas.

According to the International Energy Agency (IEA) projections, natural gas consumption will increase significantly at the expense of oil, with emerging markets and developing economies accounting for the bulk of the growth. Oil conservation efforts can also lead to a reduction in oil demand. As the price of oil rises, incentives for developing and implementing oil-efficient technologies are higher (CEA, 2015: 14).

3.3. EXCHANGE RATE DETERMINATION

Since South Africa operates within a flexible exchange rate regime, the value of the Rand like any commodity, is determined by the market forces of supply and demand. The demand for a currency relative to its supply will determine its value in relation to another currency (Mariya, 2013: 7). Therefore, if for this reason some people increase their demand for a specific currency, then the price will rise provided that the supply remains stable. On the contrary, if the supply increases the price will decline, provided that the demand remains stable. Theoretically, the demand for a floating currency, which is linked to its continuous value and price changes is based on a multitude of macroeconomic determinates (Fatima, 2016:4).

There is no consensus in the literature on the macroeconomic determinants of exchange rate volatility. This is due to different approaches used based on different theoretical models of exchange rate determination. The approaches include, the monetary approach model, the balance of payment approach and the effect of non-macroeconomic determinants of exchange rate volatility (Mpofu, 2016: 4).

3.3.1. The Monetary Approach Model

The monetary approach is the oldest approach used to determine the exchange rate. It is also used as a yardstick to compare the other approaches to determine exchange rate. This approach suggests that exchange rates are the relative prices of assets, which are determined in organised markets where prices can adjust instantaneously. One important assumption of the monetary model is the purchasing power parity (PPP) (James, 1988: 5).

According to the PPP theory, when there is a fluctuating exchange rate, the rate of exchange between two currencies will be fixed in the long run by their respective purchasing powers in their own nations. Therefore, the price of a good that is charged in one country should be equal to the one charged for the same good in another country, being exchanged at the current rate. This rule is also known as the law of one price. It is an economic theory that estimates the amount of adjustment needed on the exchange rate between countries for the exchange to be equivalent to each currency's purchasing power (Mariya, 2013: 9).
The PPP relationship can be expressed as follows:

$$S_t = P_t - P_t^* + C + \varepsilon_t \qquad (1)$$

where C is a constant, S_t is the logarithm of the exchange rate expressed in units of home currency per foreign currency unit, P_t and P_{t^*} is the domestic and foreign price levels respectively, and ε_t is an error term, which follows a stationary process. Therefore, If C = 0, Equation (1) implies an absolute PPP relationship, and denotes that the relative PPP holds.

Another key feature associated with the monetary model approach is the assumption that the domestic and foreign countries currency has a stable monetary demand function. Macroeconomic variables like a countries interest rate and inflation rate influence the exchange rate (James, 1988: 5). Whenever there is an increase of interest rates in the domestic market, the investment funds increase causing a decrease in demand for foreign currency and an increase in supply of foreign currency. When inflation increases there is less demand for local goods (decreased supply of foreign currency) and more demand for foreign goods (increased demand for foreign currency) (Mpofu, 2016: 4).

The money market equilibrium condition in both domestic and foreign countries is assumed to depend on the logarithm of real income (y), the logarithm of the price level (p), and the nominal interest rate (i). A similar relationship is assumed to hold for the foreign country, where foreign variables are denoted by asterisk. The monetary equilibrium in both domestic and foreign countries can be expressed as:

$$m_t = p_t + \beta_2 y_t - \beta_3 i_t + \mu_t \quad (2)$$

$$m_{t^*} = p_t^* + \beta_2^* y_t^* - \beta_3^* \; i_t^* + \mu_{t^*} \quad (3)$$

Where m_t and denote the domestic and foreign money demand in logarithm and are assumed in equilibrium to be equal to their respective money supplies; β2 and β_{2^*} are the income elasticity of demand for money, β3 and β_{3^*} are the interest rate semi elasticity for the domestic and foreign countries, and are error terms, respectively. Rearranging equations 2 and 3 and solving for the domestic and foreign price levels and substituting into equation (1) yields the flexible price monetary model of the exchange rate:

$$EX_t = m_t - m_t^* - \beta_2 y_t + \beta_2^* y_t^* + \beta_3 i_t - \beta_3^* \; i_t^* + c + {}_{t^*} \quad (4)$$

Where βs are parameters stated above, c is an arbitrary constant, and $_{t^*}$ is a disturbance term. Considering the importance of the interest rate in the real world international financial market and the possible failure of the uncovered interest parity, equation (2) does not include the uncovered interest parity condition. Moreover, equation (3) does not follow the common practice of assuming that the economic structure of the foreign country is the same as that of the home country.

3.3.2. The Balance of Payment Approach

The balance of payments theory is another method that seeks to explain the factors that determine the supply and demand curves of a country's currency. According to the theory, a deficit in the balance of payments leads to a fall or depreciation in the rate of exchange, while a surplus in the balance of payments strengthens the foreign exchange reserves, causing an appreciation in the price of home currency in terms of foreign currency (Mpofu, 2016: 8).

A deficit balance of payments of a country implies that demand for foreign exchange is exceeding its supply. Therefore, the price of foreign money in terms of domestic currency must rise, i.e., the exchange rate of domestic currency must fall. On the other hand, a surplus in the balance of payments of the country implies a greater demand for home currency in a foreign country than the available supply. As a result, the price of home currency in terms of foreign money rises, i.e., the rate of exchange improves (Mariya, 2013: 11).

Due to the interdependence between the trade openness of a country and the balance of payment, these two factors are important in explaining exchange rate volatility. Hua (2002) finds a negative relationship between real exchange rate volatility and trade openness on a study he did on OECD countries. This suggests that the more open an economy is to trade, the less it will experience real exchange rate volatility. However, the theoretical linkage between real exchange rate volatility and openness also depends on the magnitude of monetary and real shocks of each country.

3.3.3. Non-macroeconomic determinants.

Andersen and Bollerslev (1998), identified the role of non-macroeconomic determinants of exchange rate volatility. This includes microstructure factors like the aggregation of many news sources. Scheduled and unscheduled news typically raises volatility and often causes price discontinuities, shocks or jumps. Microstructure theory supports the argument by many researchers that, market condition heterogeneity of interpretation, the presence of conflicting information or the state of the business cycle, or the quality of information influence reactions to announcements, bring about volatility (Laakkonen and Lanne, 2009).

More recently, researchers have considered the relative importance of public and private information publications in creating exchange rate volatility. Studies found that volatility is autocorrelated to regularly scheduled announcements. Especially those that affect returns, they display intraday and intraweek patterns (Cai, 2001; Evans, 2002; Evans and Lyons, 2005).

Factors such as announcements on political instability and poor economic performance can reduce investor confidence. This inevitably forces foreign investors to seek out stable countries with stronger economic performance. Thus, a country that is perceived to have positive attributes will attract investment away from countries perceived to have more political and economic risk. The study of announcements and volatility also has direct implications for policy. For example, some policy analysts have proposed taxing foreign exchange transactions to reduce allegedly meaningless churning i.e. a broker conducting excessive trading in a client's account mainly to generate commissions, because churning creates “excess” volatility (Melvin and Yin, 2000).

3.4. STOCK PRICES DETERMINATION

The analysis of a company’s prospects generally starts by examining the global economy. Many domestic firms have direct exposure to the global economy through international capital, product and commodity markets and the company’s foreign operations. Even firms without direct exposure are sensitive to changes in the global economy due to the impact on the domestic economy through international trade, foreign direct investment, foreign purchases and sales of domestic shares. The most common approach to determine an asset price is the capital asset pricing model (Ryan, 2016).

3.5. Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model (CAPM) of William Sharpe (1964) and John Lintner (1965) marks the birth of the asset pricing theory. The capital asset pricing model is a model that describes the relationship between systematic risk and expected return for assets, particularly stocks. CAPM is widely used throughout finance for the pricing of risky securities, generating expected returns for assets given the risk of those assets and calculating costs of capital.

The CAPM builds on the model of portfolio choice developed by Markowitz (1959). In Markowitz's model, an investor selects a portfolio at time t -1 that produces a stochastic return at t. The model assumes investors are risk averse and, when choosing among portfolios, they care only about the mean and variance of their one period investment return.

Sharpe (1964) and Lintner (1965) note two key assumptions to the Markowitz model to identify a portfolio that must be mean variance efficient. The first assumption is *complete agreement*: given market clearing asset prices at t -1, investors agree on the joint distribution of asset returns from t -1 to t. This distribution is assumed as the true one and is the distribution from which the returns we use to test the model are drawn (Lintner, 1965:13-37). The second assumption is that there is *borrowing and lending at a risk-free rate*, which is the same for all investors and does not depend on the amount borrowed or lent (Sharpe, 1964:425-442). The break of the CAPM is as follows:

$$\bar{r}_a = r_f + \beta_a (\bar{r}_m - r_f) \quad (5)$$

where r_f is the risk-free interest rate, β_a the beta of the security and $\bar{r}_m$ is the expected market return. The general idea behind CAPM is that investors need to be compensated in two ways: time value of money and risk. The time value of money is represented by the risk-free (r_f) rate in the formula and compensates the investors for placing money in any investment over a period of time. The risk-free rate is customarily the yield on government bonds.

Tests of the CAPM are based on three implications of the relation between expected return and market beta implied by the model. First, expected returns on all assets are linearly related to their betas, and no other variable has marginal explanatory power. Second, the beta premium is positive, meaning that the expected return on the market portfolio exceeds the expected return on assets whose returns are uncorrelated with the market return (Sharpe, 1964:425-442).

3.6. RELATIONSHIP BETWEEN OIL PRICES AND STOCK RETURNS

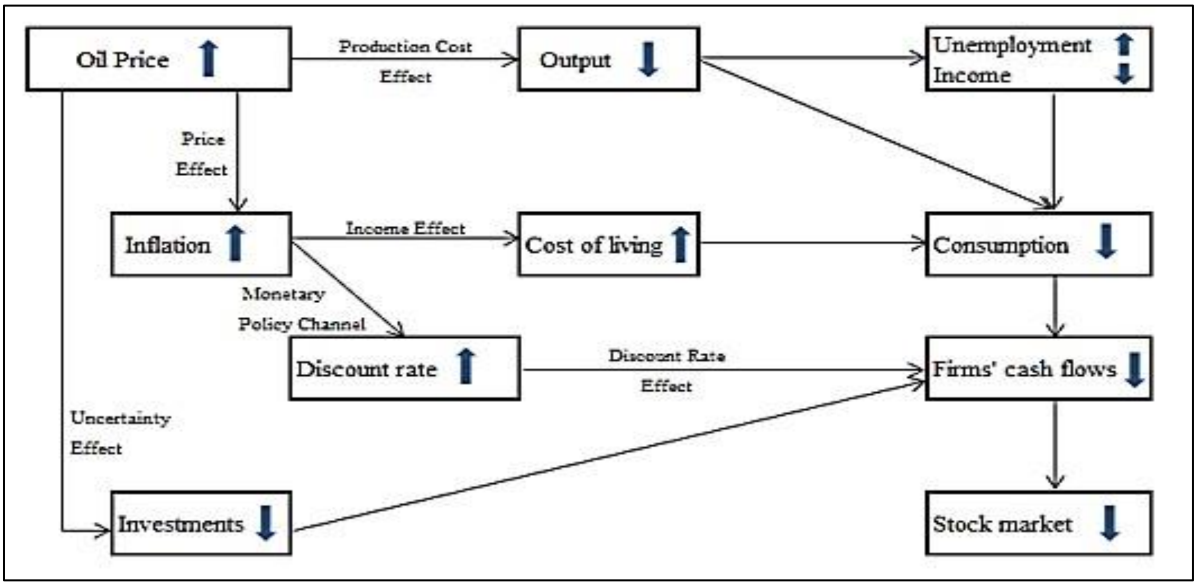
Theoretically, changes in the price of crude oil are generally considered an important factor in understanding fluctuations in stock prices. There is still no consensus amongst economists, about the relationship between stock prices and the price of crude oil (Lin, Rou Fang and Cheng, 2009:5-11). Most of the research conducted on the impact of the oil price on the stock markets in developed countries (which are mostly oil-importing countries) has revealed a negative relationship between the oil price and stock markets (Driesprong, Jacobsen and Maat, 2008; Miller and Ratti, 2009; Basher and Sadorsky, 2011).

Some researchers have found a positive relationship between the oil price and stock markets in the oil-exporting countries (Mohanty, Nandha, Turkistani and Alaitam, (2011); Fayyad and Daly, (2011); Lescaroux and Mignon, (2008); Hammoudeh and Choi, 2006). Other researchers, however, suggest that there is no relationship between the oil price and stock markets (Al Janabi, Hatemi and Irandoust, 2010: 47-54). However, According to Filis, Degiannakis and Floros (2011) Crude oil price changes can affect stock prices in several ways. One of the ways in which oil price shocks may affect stock markets is the uncertainty that is created by oil price fluctuations on the financial markets. Depending on the nature of the shock (demand-side or supply-side), stock market sentiments may respond positively to an oil price shock, which originates from the demand side, and negatively if the shock originates from the supply side.

Economic theory suggests that the price or value of a share in a company at any one time is equal to the expected present value of discounted future cash flows (Huang, Masulis and Stoll, 1996:1-27). Therefore, any factor that could alter the expected discounted cash flows would have a significant effect on these asset prices. Oil price changes can also affect stock prices directly, by impacting future cash flows (Filis, Degiannakis and Floros, 2011: 152-164). An oil price increase may trigger a chain of, higher production costs, higher consumer price inflation which brings about reduced consumer spending and savings, and lastly restrained future profits for companies. Consequently, this may cause a decrease in shareholders' value causing the value and price of the asset to decrease (Filis, Degiannakis and Floros, 2011: 152-164). Higher consumer prices may also lead to lower production because of lower spending and thus increased unemployment causing stock markets to react negatively to that element. Hence, any oil price increase is usually accompanied by a decrease in the stock prices (Filis, Degiannakis and Floros, 2011: 152-164).

According to Basher and Sadorsky (2006), rising oil prices are often seen as inflationary by policymakers and central banks because of the higher prices for final goods and services produced. The central bank usually responds to inflationary pressures by raising interest rates which affects the discount rate used in the stock pricing formula. A summary of the aforementioned oil channels is shown below in Figure seven.The various channels can either impact firms' cash flows or their discount rate. In both cases the transmission channels suggest that higher oil prices lead to lower stock market returns for stock markets operating in oil-importing economies.

Figure 7: Transmission Channel of Positive Oil Price Changes.



Adapted from Tang, Wu and Zhang (2010).

3.7. RELATIONSHIP BETWEEN OIL PRICES AND EXCHANGE RATE

Considerably most studies that have been conducted on the impact that oil prices have on exchange rates have been based on oil- producing countries than on the smaller oil-importing countries. Despite the widespread acknowledgment of the significant role that oil plays in most African economies, there is little evidence of the effect oil prices have on the exchange rates of non- oil exporting African countries (Kin and Courage, 2014:193-199). The relationship between oil prices and exchange rate is ambiguous.

One view focuses on oil as one of the determinants of the terms of trade. For oil-importing countries, an increase in oil prices will lead to a deterioration of the trade balance and subsequently to a depreciation of the local currency. A variation in oil prices even determines most of the variation in trade (Backus and Crucini, 2000:185-213).

On the other hand, since most oil benchmarks use the US dollar to price their oil, changes in the US Dollar exchange rate can negatively affect oil prices. More specifically, the exchange rate can change oil prices via its effect on oil supply and oil demand, and via financial markets. First, on the supply side of the oil market, a depreciation in the US Dollar might lead oil producers to limit oil supply and raise oil prices to stabilise the purchasing power value of their export revenues in Dollars (Yousefi and Wirjanto, 2005: 177-197). Conversely, a depreciation in the Dollar might increase the demand for oil, as oil imports become cheaper in local currency for importing countries (De Schryder and Peersman, 2012:14-27).

Another view focuses on the balance of payment. Oil prices can also affect exchange rates via the wealth effects. According to Krugman (1983) and Golub (1983:576-593), higher oil prices transfer the wealth from oil importers to oil exporters, which leads to a change in the exchange rate of the importing country through current account imbalances and portfolio reallocation.

In the South African context, assuming that, oil-exporting countries have a strong preference for Rand-denominated assets, an oil price hike will cause the Rand to appreciate in the short run but not in the long run. Equally, if oil exporters do not have a strong preference for Rand-denominated assets, an oil price hike will cause the Rand to depreciate in the short run (Kin and Courage, 2014:193-199).

The final impact of oil prices on the exchange rate depends on the elasticity of imports, as well as the share of exports to oil-exporting countries. This is called the elasticity approach. The impact of oil prices on the exchange rate depends on the elasticity of import demand of the importing country. Price elasticity of demand is a measure of the responsiveness of quantity demanded to a change in price (Jehle and Reny, 2011:32-50). The lower the response of domestic demand to price changes, the stronger the effect an oil price hike will have on the exchange rate. The elasticity of imports determines whether the imports will decline, stay the same or rise. It is therefore imperative to consider the responsiveness of imports to a change in the price of oil (Kin and Courage, 2014:193-199).

3.8. RELATIONSHIP BETWEEN EXCHANGE RATE AND STOCK RETURNS

The relationship between stock prices and exchange rates is explained by three main theories: the traditional approach, also known as the “flow-oriented model”, the portfolio approach which is sometimes referred to as the “stock-oriented model” and the asset approach. This topic has been extensively researched. However, studies are still inconclusive and show no real consensus regarding the direction of causality between stock prices and exchange rates.

3.8.1. Traditional Approach

The traditional approach is also known as the “flow-oriented” model. This approach, according to Dornbusch and Fischer (1980) hypothesises that changes in the exchange rate or exchange fluctuation will affect the competitiveness of a firm, which will consequently influence the firm’s profits and net worth and stock prices in general.

The “flow-oriented” model assumes that the exchange rate is determined mostly by a country’s current account or trade balance of performance. Solick (1987) proposes that real currency appreciation is a hindrance for domestic corporations, because it reduces their competitive ability to export, whereas a real currency depreciation enhances their ability to export in the short run.

According to Dornbusch and Fischer (1980) Firms that participate in international trade activities may be exposed to foreign exchange risk. Foreign currency movements affect international competitiveness and the balance of trade position. Consequently, they influence the real economic variables such as income and output of a country.

Granger, Huang and Yang, (2000) argues that a change in exchange rates may change the market value of all firms that trade globally. Granger (2000) further suggests that the impact of exchange rates on a firm’s stock prices could depend on the firm’s status in terms of net importers or exporters: the currency devaluation would have a positive effect on a firm’s profitability and thereby its stock market values if the firm is a net exporter.

The traditional approach suggests that fluctuations in exchange rates may cause a change in stock prices. A devaluation of the domestic currency will make local firms who export more competitive and in turn raise their stock prices. Under such conditions, one may anticipate a positive causal relationship running from exchange rates to stock prices (Granger, 2000:337-354).

3.8.2. Portfolio Approach

The portfolio approach is typically referred to as the "stock-oriented" model. The portfolio approach emphasises the role that the exchange rate plays in the demand for and the supply of local as well as foreign assets from the position of internationally diversified portfolios (Ajayi and Maigoue, 1996:193-207). This model assumes that individuals hold local and foreign assets, including currencies in their portfolios. When domestic prices increase, individuals will demand more domestic assets and sell foreign assets, leading to an appreciation in local currency. This approach thus assumes a negative relationship between stock prices and exchange rates (Ajayi and Maigoue, 1996:193-207).

Studies based on the portfolio-balance models can be traced back to the early works of Branson (1983) and Gavin (1989). These studies reveal that the increasing or decreasing stock prices induce capital flows from foreign investors who then exchange local or foreign currency for foreign or local currency. Bahmani-Oskooee and Sohrabian (1992) maintains that changes in stock prices affect exchange rates through firms' portfolio adjustments. Yu (1995) presents a similar argument that capital outflow affects exchange rates if changes in stock prices are sufficiently persistent to generate or to destroy the confidence of stock market investors. Essentially, the portfolio approach proposes that the stock price influences the exchange rate and has a negative relationship.

3.8.3. Asset Approach

The asset market approach suggests that there is weak or no correlation between both variables. This approach suggests that stock prices and exchange rates may be individually driven by other factors. The factors that causes changes in exchange rates may be different from the factors that causes changes in stock prices. This implies that there is a weak or no link at all between the stock prices and exchange rates (Muhammad and Rasheed, 2002: 536-539).

3.9. CHAPTER SUMMARY

This chapter presented the general theories and models that explain the oil market prices, the exchange rate and the stock market prices. This section discussed the four key prevailing views of the oil market. Firstly, the view that the supply of oil is constrained, and that depletion forces will dominate the future of oil supply. Secondly, the viewpoint that the supply of oil is elastic, and future oil demand will be satisfied without a large and sustained increase in the real price of oil thanks to improvements in oil exploration and extraction technology.

Thirdly, the business cycle view which suggests that the business cycle will drive future oil demand, and oil prices will start rising when the global economy starts to pick up. Lastly, the substitution and conservation view which suggest that the efficiency and availability of alternatives in the oil market has been improving and will continue to improve, and this will help offset the increase in the demand for oil from fast growing emerging market economies.

The section that followed, showed the various models and how the exchange rates are determined in South Africa, firstly, the monetary approach model which suggests that exchange rates are the relative prices of assets, which are determined in organised markets where prices can adjust instantaneously. One important assumption of the monetary model is the purchasing power parity (PPP), which assumes that when there is a fluctuating exchange rate, the rate of exchange between two currencies will be fixed in the long run by their respective purchasing powers in their own nations.

Secondly, the balance of payment approach which suggests that, a deficit in the balance of payments leads to a fall or depreciation in the rate of exchange, while a surplus in the balance of payments strengthens the foreign exchange reserves, causing an appreciation in the price of home currency in terms of foreign currency. Lastly, the non-macroeconomic determinants of exchange rate volatility which identified the role of non-macroeconomic determinants of exchange rate volatility. This includes microstructure factors like the aggregation of a large number of news sources of scheduled and unscheduled news announcements.

The section that followed, explained the capital asset pricing model that described the relationship between systematic risk and expected return for assets, particularly in determining stock prices. Furthermore, this chapter presented the theoretical literature of the relationship between oil prices and stock returns, the relationship between oil prices and exchange rate, and finally the relationship between exchange rate and stock prices. The studies are inconclusive with regards to the relationship and direction of causality between oil prices, exchange rates and stock prices. However, the theoretical evidence generally suggests that, in oil importing countries, prices on the stock markets respond negatively to any increase in oil prices i.e. when the oil price increases, the currency depreciates.

Studies on the relationship between exchange rates and stock market prices suggest three approaches, the traditional approach (this approach assumes a positive relationship between stock prices and exchange rates), portfolio approach (this approach assumes a negative relationship between stock prices and exchange rates) and the asset approach (this approach assumes no relationship between stock prices and exchange rates). The next chapter will present the empirical evidence from prior studies regarding oil prices, exchange rates and stock market prices.

CHAPTER FOUR

EMPIRICAL EVIDENCE

4.1. INTRODUCTION

This section presents a discussion on the empirical evidence from studies on the association of crude oil price shocks, exchange rate and stock market prices. The empirical research is presented as follows: empirical studies on the relationship between oil prices and stock returns, oil prices and the exchange rate, and lastly on the relationship between the exchange rate and stock prices.

4.2. RELATIONSHIP BETWEEN OIL PRICES AND STOCK RETURNS

There is considerable literature to show the impact that oil price movements have on stock prices. The literature generates mixed views regarding the effect of oil-price shocks on stock prices. Among other studies on this relationship, Driesprong, Jacobsen and Maat (2008) investigated whether changes in oil prices can predict stock market returns worldwide. They used a basic regression model with monthly stock returns and monthly oil price data. Their findings showed that in both developed and emerging markets, oil price changes have a negative effect on stock price returns.

Similar to the study of Jacobsen and Maat (2008) mentioned above, Miller and Ratti (2009) analysed the long-run relationship between the world price of crude oil and international stock markets for the period 1971 to 2008. They used a cointegrated vector error correction model. The results reveal a clear long-run relationship between six OECD countries, suggesting that stock market indices respond negatively to increases in the oil price in the long run.

Basher, Haug and Sadorsky (2011) estimated a structural vector autoregressive model to investigate the dynamic relationship between oil prices and stock market prices. The model supports the notion that positive shocks to oil prices tend to depress emerging market stock prices and US Dollar exchange rates in the short run. This suggests that stock market prices respond negatively to oil price shocks.

Equally, Mohanty, Nandha, Turkistani and Alaitam (2011) assessed the link between changes in crude oil prices and equity returns in the Gulf Cooperation Council (GCC) countries using country-level as well as industry-level stock return data. Their data period spread from June 2005 to December 2009. They found that at the country level, except for Kuwait, stock markets have a positive relationship with oil price shocks.

Hammoudeh and Choi (2006) studied the behaviour of GCC stock markets and the impact of US oil on financial markets in a data span from 15 February 1994 to 28 December 2004. The study which employed the vector-error correction model, found that the short-run bilateral causal relationships among Gulf Cooperation Council's (GCC) weekly equity index returns are mostly unidirectional. The impulse response analysis further suggests that the S&P 500 shocks have a positive dynamic impact on all GCC markets over a 20-week forecast horizon. This implies that GCC stock markets rise with US markets.

However, Al-Janabi, Hatemi and Irandoust (2010) explored whether the Gulf Cooperation Council (GCC) equity markets had efficient information about oil and gold price shocks over the period 2006 to 2008. The study used a daily Dollar-based stock market indexes dataset for non-normality and ARCH model estimations. The results point to a weak relationship between the GCC stock markets and petrol and gold prices.

Angelidis, Degiannakis and Fills (2015) did a study on whether oil price shocks and volatility, predict stock market regimes. The study employed a Markov Regime Switching Regression using the monthly Dow Jones and Brent crude oil data from 1989 to 2011. The study also found that oil volatility does not have a significant effect on stock market volatility.

Maghyereh, Awartani and Bouri (2016) used the directional volatility connectedness technique between crude oil and equity markets. The study was conducted on Canada, India, Japan, Germany, Russia, USA, UK, Mexico, Sweden, South Africa, Switzerland. WTI daily data from 2008-2015 was used. The study found that oil volatility exercises a stronger effect to stock market volatilities, compared to the reverse.

Phan, Sharma and Narayan (2016) investigated the price volatility interaction between the crude oil and equity markets in the US using 5-min data over the period 2009-2012. The study employed the EGARCH model. The main findings were that E-mini S&P500 index futures, E-mini NASDAQ index futures and WTI futures have significant cross-market volatility effects.

Kang, Gracia and Ratti (2017) in their study, explored oil price shocks, policy uncertainty, and stock returns of oil and gas corporations. Using a structural VAR model. The study utilised monthly stock returns, policy uncertainty index and oil market data in the period from January 1985 to December 2015. The study found that the oil and gas index, as well as, the individual firms, react negatively to negative supply side shocks and to positive precautionary demand shocks, whereas they react positively to positive aggregate demand shocks.

Degiannakis, Stavros and Filis (2017) did a study titled, forecasting oil price realized volatility using information channels from other asset classes. They employed a Mixed Data-Sampling (MIDAS) method using both oil market fundamentals and high frequency data from 15 financial and commodities assets. The study used a Human Activity Recognition (HAR) framework and estimate forecasts for 1-day to 66-days ahead. The study found that the use of stock markets' high frequency data provides incremental predictive accuracy to oil price forecasts, as well as, incremental directional accuracy.

4.3. EMPIRICAL STUDIES: RELATIONSHIP BETWEEN OIL PRICES AND EXCHANGE RATE

The relationship between oil prices and exchange rate is ambiguous. One view focuses on oil as one of the determinants of the terms of trade. For oil- importing countries, an increase in oil prices will lead to a deterioration of the trade balance and subsequently to a depreciation of the local currency (Backus and Crucini, 2000:185- 213). On the other hand, since most oil benchmarks use the US dollar to price their oil, changes in the US Dollar exchange rate can negatively affect oil prices. Amano and Norden (1998) in their study of the relationship between oil price and real effective exchange rates in the US, employed a VECM. They concluded that during the post-Bretton Woods period there was a stable link between shocks in oil price and the US real effective exchange rates. Their results therefore indicate that oil prices may have been the primary source of real exchange rate persistent shocks and that the prices of energy may have a critical effect on the future movements of exchange rates.

However, according to Amano and Van Norden (1997:313) whose study focused on oil prices and the rise and fall of the US real exchange rate over the period 1972-1993. The movement in exchange rates has no effect on the crude oil price. This study employed an Error Correction Model (ECM). They found that the crude oil price is weakly exogenous, and the real exchange rate alters in relation to the crude oil price and not the other way around.

Andrew and Chen (2007) used monthly data from 1972-2005 to examine the long-run relationship between real oil prices and exchange rates across G7 economies. The study employed the VECM. Their findings show that real oil prices influence exchange rates in the long run. They also indicate that real oil prices forecast the future value of exchange rates, which applies to all the countries in the study.

Lizardo and Mollick (2010) used a univariate GARCH model. They investigated whether oil price fluctuations and the US Dollar exchange rates have a relationship. They examined the movements of the US Dollar against major global currencies for the period 1970-2008. Their study confirms that oil prices affect exchange rate dynamics in the long run. When oil prices increase, the value of the US Dollar in relation to oil exporter currencies such as those of Russia, Canada, and Mexico, it depreciates.

Basher, Haug and Sadorsky (2016) studied the impact of oil shocks on exchange rates using a Markov switching approach. The study employed monthly data from 1976-2014. The study found that oil demand shocks lead to significant exchange rate appreciation pressures in oil exporting economies. There was limited evidence that oil supply shocks affect exchange rates for either oil exporting or oil importing countries.

Jawadi, Louchi, Ameur and Cheffou (2016) employed a GARCH model in their study about the relationship of oil prices and the US exchange rate volatility. The study applied the intraday data of the USD/EURO exchange rate from 2014-2016. The study found a negative relationship between the US dollar/euro and oil returns, indicating that a US dollar appreciation decreases oil price.

Tiwari and Bhanja (2016) applied the Continuous Wavelet Transform (CWT) approach, Markov regime switching VAR (MRS-VAR), asymmetric multi-horizon Granger-causality test. Using various oil price benchmarks i.e. (average of Brent, Dubai, and WTI), and the India-US Dollar real exchange rate. The study used monthly data from 1980-2016. The study found that exchange rate granger-causes the oil price in the long run. In the short run it's the opposite. The relationship is nonlinear, asymmetric and indirect (exist only in the post-reform period).

4.4. RELATIONSHIP BETWEEN EXCHANGE RATE AND STOCK RETURN

The empirical literature that seeks to explain the relationship between stock prices and exchange rates is shaped into three main arguments: the traditional approach, the portfolio balance approach and the asset approach.

4.4.1. Traditional Approach

The traditional approach hypothesises is that changes in the exchange rate affect the competitiveness of a firm, which consequently influence the firm's profits and net worth and stock prices in general (Dornbusch and Fischer, 1980). This approach also assumes a positive relationship between exchange rates and stock prices. Many researchers have found this approach to be true. For instance, Aggarwal (1981) used error correction modelling to study the association between changes in the US Dollar exchange rate and changes in indices of stock prices by using monthly US stock price data and the effective exchange rate. The analysis covered the period 1974-1978. Aggarwal (1981) found a positive relationship between the stock prices and the US Dollar in both the short and the long run, with the exchange rate leading the stock prices change and a stronger relationship prevailing in the short run.

Ma and Kao (1990) used a VAR model to investigate the relationship between the exchange rate and stock prices by looking at six industrialised economies, namely: the UK, Canada, France, West Germany, Italy and Japan. Using data from 1973-1983, their analysis tested the degree to which changes in the exchange rate affected the stock price in the six countries. The study found that the stock price was influenced by the exchange rate, which is consistent with the flow-oriented model. Ma and Kao (1990) also concluded that the relationship between exchange rates and stock prices relied on the extent to which an economy was import- or export- dominant.

Later, Chow, Lee and Michael (1997) also conducted a study in the US. This time they tried to examine the exchange rate risk exposure of US stocks and bonds. No relationship was found for real exchange rates and stock price returns when using the VAR method. However, when the regression method was carried out with longer horizons, a positive relationship between a strong Dollar and stock returns was found.

Based on a granger causality test, Yu's 1997 findings showed that changes in the exchange rate granger- caused changes in the stock price in Tokyo and Hong Kong, with a bidirectional causality present in Tokyo. This means that the stock price can also influence the exchange rate. Yu (1997) also used a VAR Model to analyse a long-run relationship between the two financial variables in the aforementioned financial markets. A strong long-run relationship between stock prices and exchange rates was found for all three markets.

Yin (2000) investigated the asymmetric effects of four different exchange rates on Singapore stock prices in the 1990s using error correction modelling. The study found that Singaporean currency appreciation against the US Dollar and Malaysian Ringgit and depreciation against the Japanese Yen and the Indonesian Rupiah led to a long run increase in stock prices over most of the selected periods in the 1990s.

A study by Kuwornu and Owusu (2012) investigated how the Ghanaian stock market can be impacted by changes in some macroeconomic variables. Kuwornu used monthly data from 1992 to 2008 and also employed the Johansen co-integration technique in analysing the data. The macroeconomic variables involved in the study were consumer price index, exchange rate, 91-day Treasury bill rate, and crude oil price. The results of the study revealed that there exists a significant long-run equilibrium relationship between the four macroeconomic variables and stock returns in Ghana.

Anshul and Biswal (2016) conducted a study on the relationship between global prices of gold, crude oil, the USD – INR (Indian Rupee) exchange rate, and the stock market in India. Based on the 10-year daily data, they used the Dynamic Conditional Correlation DCC-GARCH model (2002) to study the relationship between the exchange rate and the Sensex30 Indian stock index, which indicates that there is a correlation between these two variables. Their results showed that a depreciation of the Indian Rupee causes a fall in Sensex30.

4.4.2. Empirical Studies: Portfolio Balance Approach

A multinational study by Ramasamy and Yeung (2001) investigated the correlation between the exchange rate and stock prices in Asia. Their study suggests that causality is distinctive within jurisdictions, within specific time periods and is sensitive to the frequency of the data which is utilised. They investigated the correlation between the exchange rate and stock prices in the same nine Asian economies examined by Granger *et al*. (2000), but during different periods. The results of Ramasamy and Yeung (2001) research differed from those of Granger *et al*. (2000). Granger *et al*. (2000) found a bidirectional causality for Malaysia, Singapore, Thailand and Taiwan, whilst, Ramasamy and Yeung (2005) found a unidirectional causality, with stock prices influencing the exchange rate for these countries. However, Granger *et al*. (2000) found that stock prices influenced exchange rates for Hong Kong which supports the portfolio approach, whilst Ramasamy and Yeung (2005) found a bi-causality for the same country.

Tabak (2006) examined the dynamic relationship between stock prices and exchange rates in Brazil by using data from the period 1994-2002. His study used co-integration tests that allowed for endogenous breaks, linear and nonlinear causality tests. The study found no long-run relationship but linear granger causality from stock prices to exchange rates, which confirms the portfolio approach.

Based on a co-integration and granger causality test, Yau and Neih (2006) explored the short-term and long-term interrelationships between the stock prices of Taiwan and Japan and the New Taiwan Dollar (NTD)/Yen exchange rate. Using data from 1991-2005, the study found that there was a negative relationship between stock prices of Taiwan and Japan and the New Taiwan Dollar (NTD)/Yen exchange rate. Which is consistent with the portfolio approach.

Charles, Adjasi, Nicholas, Kofi and Osei (2011) investigated the relationship between stock prices and exchange rate movement in seven African countries among Tunisia. They used VECM co-integration and impulse response analysis to determine the long and short-run linkages between stock prices and exchange rates. Co-integration analyses indicate a long-run relationship between stock prices and the exchange rate in Tunisia, where exchange rate depreciation drives down stock prices. A short-run error-correction model also shows similar results.

4.4.3. Asset Approach

Neih and Lee (2001) used the Engle, Granger and Johansen procedures to analyse the correlation between the exchange rate and stock prices over the period October 1993 to February 1996. They found that there was no long-run relationship between the two variables in the G-7 economies, which is consistent with the work of Bahmani Oskooee and Sohrabian (1992).

Between 1992 and 2002 Mishra (2004) used a granger causality test and a VAR technique to examine whether the stock market and foreign exchange markets were closely related to each other in India. The study found that there was no causality between the exchange rate return and stock return. These findings confirm the asset approach.

Smyth and Nandha (2003) used the engle and granger two-step and Johansen co-integration techniques to examine the interaction between the exchange rates and stock prices of Bangladesh, India, Pakistan and Sri Lanka, using daily data covering the period 1995 to 2001. The study concluded that there was no long-run relationship between the two financial variables in any of the four countries. The granger causality tests showed that there was unidirectional causality running from exchange rates to stock prices in India and Sri Lanka, with independent exchange rates and stock prices in Bangladesh and Pakistan (Morales, 2007).

Stavárek (2005) conducted a study to test the granger causality and long-run and short-run dynamics between stock prices and exchange rates of the EU countries and USA from 1969-2003. Neither the intensity nor the direction of causal relation is the same in the developed economies and the new EU-member countries. The results did not show any long-run or short-run relationship between stock prices and exchange rates.

Zhao (2010) analysed the relationship between the real effective exchange rate and the stock price, using both the VAR and the multivariate GARCH models for China. The general findings in a study conducted on China also showed no long-run equilibrium relationship between the exchange rate and the stock price.

Parsva and Lean (2011) investigated the relationship between stock returns and exchange rates before and during the 2007 global financial crisis for six Middle Eastern economies namely: Egypt, Iran, Jordan, Kuwait, Oman and Saudi Arabia. The researchers used co-integration testing and the VECM for causality for eliciting data over the period 2004 -2010. The results of the analysis revealed that before the crisis there was a bidirectional causality between the financial variables. In both the short run and long run for Egypt, Iran, and Oman, the exchange rate led stock prices in Kuwait. Furthermore, in Jordan and Saudi Arabia, the variables had no causal effect on each other in the short run.

4.4.4. Empirical Studies: Both the Portfolio and Traditional Approach

Bahmani-Oskooee and Sohrabian (1992) used co-integration and granger causality techniques to investigate the interaction between stock prices and exchange rate markets. They used the monthly Standard and Poor’s Composite Index data of 500 stocks and the effective exchange rates of the US Dollar for the period 1973- 1983. The study used granger and co-integration techniques and found a unidirectional causality from stock price to exchange rates.

Abdalla and Murinde (1997) employed a VECM which aimed at examining the stock price interaction with exchange rates in four countries. For the period 1985-1994, the findings were that exchange rates granger- caused stock prices to change in India, Pakistan and Korea, whilst no relationship was found between the exchange rate and stock prices in the Philippines. The results for India showed that the exchange rate influenced the stock prices, whilst the results for the Philippines showed that the stock prices influenced the exchange rate.

A multinational study of which includes Pakistan, India, Bangladesh and Sri- Lanka for the period 1994-2000, was undertaken by Muhammad and Rasheed (2002). The study utilised the co-integration, vector error correction modelling technique and granger causality tests to try to explain the long- run and short- run association between stock prices and exchange rates in these four countries. No short- run association between the said variables for all four countries was established. No long- run relationship between stock prices and exchange rates for Pakistan and India was established. However, for Bangladesh and Sri-Lanka, there appears to be a bidirectional causality between the stock markets and foreign exchange markets.

Broome and Morley (2003) conducted a study on Thailand, Malaysia, Korea, Indonesia and the Philippines for the period 1996- 1999. Their aim was to establish how significant stock price was as a leading indicator of the East Asian currency crisis. They used the granger causality test in a currency crisis model and found that the domestic stock price, Hong Kong stock price and particularly the US prices were significant leading indicators of the East Asian currency crisis. The results suggest evidence of a bi-causality between the stock markets and the foreign exchange markets.

Akdogu, kahraman and Birkan (2016) applied a series of non-causality tests to determine the direction of the relationship between stock price indices and exchange rates in emerging market economies. The data set included monthly observations for the 21 countries included in the emerging markets index between January 2003 and June 2013. The results indicate that there is a statistically significant causal interaction between the two variables in 13 of the 21 countries of the study. The direction of the causality varies from country to country and is subject to the joint effect of multiple factors depending on the particulars of the economy in question.

Abimbola and Olusegun (2017) researched the exchange rate volatility, stock market performance and aggregate output nexus in Nigeria between 1985 and 2015. They used quarterly time series data and applied, a GARCH model and granger causality model. The research work found that exchange rate and stock price are volatiles and the dwindling grossly affect the aggregate output. The study found a high degree of positive relationship between exchange rate, stock price movement and aggregate output. More so, exchange rate volatility granger cause stock price movement and aggregate output and vice versa.

4.5. CHAPTER SUMMARY

This section has provided an overview of both the theoretical and empirical studies relating to the various aspects of this study. The discussion was structured according to the research objectives. The empirical evidence generally, suggests that prices on the South African stock markets respond negatively to any increase in oil prices i.e. when the oil price increases, the currency depreciates. Studies on the relationship between exchange rates and stock market prices suggest three approaches to exchange rate determination namely: the traditional, portfolio and the asset approach. This study aims to establish whether South Africa follows the same trends and findings as the other studies.

Several studies examined above, applied the bivariate VAR or VECM method to investigate the relationship between the variables in question. As the literature suggests, where there is co-integration between the variables, the study applies the Granger causality test using the VECM; otherwise, the Granger causality test in a VAR model is appropriate. This research furthermore employs an Impulse response functions to show the effects of shocks on the adjustment path of the other variables and the variance decomposition to show which of the independent variables is stronger in explaining the variability in the dependent variables over time.

CHAPTER FIVE

RESEARCH METHODOLOGY

5.1. INTRODUCTION

The primary objective of this chapter is to establish the empirical analysis of the interaction between oil shocks, exchange rates and stock price performance from the various sectors of the South African economy, namely the resources, industrials and the financial sector. This section presents the research methodology. Section 5.2 provides information about data issues and variable description. Sections 5.3 to 5.5 present the process of model estimation as well as the relevant tests for validity of the models. Section 5.6 to 5.7 will specify the general econometric models used for determining the association of oil shocks, exchange rate and stock prices. Lastly, a summary will be given in the last section 5.8.

5.2. DATA ISSUES AND VARIABLE DESCRIPTIONS

This study used time-series data to investigate the interaction between oil price shocks, exchange rate and stock market prices from the various sectors of the South African economy. Monthly data was used, over a seven-year period from 1 January 2011 to 1 April 2018.

The oil price is proxied by the average monthly oil spot prices of the OPEC crude oil data. The data was obtained from the OPEC Information database. The unit price of oil is measured as Dollars per barrel. This study used the OPEC prices over the WTI and Brent crude oil prices because nearly half (45 per cent) of oil imports to South Africa come from Saudi Arabia. A further 23 per cent comes from Nigeria, 18 per cent from Angola, 4 per cent from Ghana, and the remaining 10 per cent from other sources (Fin24, 2014:2).

The symbol (SKP) is used to represent the South African stock market in its entirety i.e. (The All Share Index (ALSI), the JSE Resources Index (RESI-20), the JSE Industrials (INDI-25) and the JSE Financials (FIN). The data was obtained from the

Johannesburg Stock Exchange (JSE) site. The FTSE/ JSE All Share Index, is a major stock market index which tracks the performance of all companies listed on the JSE in South Africa. The index includes shares from all sectors of the stock market; it therefore gives the best indication of the general market direction (JSE, 2013).

The JSE resources index (RESI-20) tracks the performance of the 20 largest mining companies by market capitalisation (market value). The Resources index gives the best indication of the general market direction of companies listed on the JSE that belong to sub sectors of industries oil and gas and basic materials (JSE, 2015). The oil and gas sector include all listed companies that are oil and gas producers (e.g. Sasol), oil equipment, services and distribution and companies involved in alternative energy. The basic materials sector is a category of stocks that accounts for companies involved with the discovery, development and processing of raw materials.

The JSE industrials index (INDI-25) tracks the performance of the 25 largest industrial companies by market capitalisation (market value). SA Industrials includes all remaining JSE listed companies that do not belong to ICB (Industry Classification Benchmark) industries financials, oil and gas and basic materials. Therefore, the Industrials Index gives the best indication of the general market direction of consumer goods, health care, consumer services, telecommunications and the technology industries (JSE, 2015).

JSE financials include JSE listed companies that belong to ICB industry financials. The financial sector comes in third place, contributing about R1.5 trillion of the overall JSE capitalisation. This industry sector includes and gives the general market direction of listed banks, insurance providers, real estate and financial service i.e. equity and non-equity investment instruments (Sharenet, 2013).

This study employed the Rand/Dollar exchange rate since the US is one of South Africa’s major trading partners (Ocran, 2010:362-375). The Rand/Dollar exchange rate data was obtained from the Standard Bank Corporate and Investment site.

The macroeconomic factors to be used in the estimation models are presented in Table two below. These variables are expressed in natural logarithmic form.

Table 2: A Priori expectations and Variable descriptions.

	Variable Description	Expectations Direction	Relationship
OP	Log of the oil spot price	*OP→ SKP* (Rising Oil prices)	Negative (-)
ALSI *RESI* *INDI* *FIN*	Log of the all share price index Log of the Resources price index Log of the Industrials price index Log of the Financials price index	*SKP→ EX* (Stock Orientated)	Negative (-)
EX	Log of nominal exchange rates	*EX→ SKP* (Flow- orientated)	Positive (+)
ALSI; EX	Both are a function of their Log	*SKP ↔ EX* (Asset Approach)	Weak/ No Relationship

Notes: OP denotes Oil Prices, EX represents Exchange rate and SKP denotes Stock Prices.

5.3. STATIONARITY TESTS

The unit root tests have become standard in econometric practices when time series data are used. The stationarity of time series data is important because estimation and forecasts are only valid when using a stationary series. If the data is not stationary, there is the possibility of generating a spurious regression (Junkin, 2011). There are many tests that can be employed to determine the stationarity of a series. For this study, the Augmented Dickey-Fuller (ADF), the Phillips- Perron (PP) and the KPSS tests (Kwiatkowski, Phillips and Shin, 1992:159-178) were employed to investigate whether the time series data of oil prices, exchange rate and stock prices are stationary or not.

5.4. OPTIMAL LAG SELECTION

An important aspect of empirical research based on the Vector Autoregressive (VAR) model is the choice of the lag order, since all extrapolation in the VAR model depends on the correct model specification. The optimal lag order refers to the appropriate number of lags for each variable that forms part of the econometric model (Brooks, 2008: 293). The determination of the lag length is important because estimates of a VAR model whose lag length differs from the true lag length are inconsistent. The impulse response functions and variance decompositions derived from the estimated VAR model will also be inconsistent (Braun and Mittnik, 1993:319-410).

5.5. CO-INTEGRATION ANALYSIS

This study employs the co-integration test to see whether there is a long-run relationship between oil prices, exchange rates and stock prices. To check the existence of a co-integration relationship between any two of these variables, the study employs the Johansen co-integration procedure (Johansen and Juselius, 1990:169– 210). This study recommends the Johansen test because it is more reliable for larger sample data sizes, and the test is usually used for more than one cointegrating relationships. If there is no long run relationship found by the Johansen test, then this study will apply VAR model, but if there is long run relationship then VECM model is applied.

5.5.1. Johansen and Juselius Co-integration Technique.

The Johansen method applies maximum likelihood procedure to determine the presence of cointegrating vectors in a non-stationary time series. This approach assumes that all the variables in the system are endogenous. However, it is possible to include exogenous variables. The Johansen Co-integration test is based on the following Vector Autoregressive (VAR) equation:

$$\Delta Z_t = C + \sum_{i-1}^{k} \tau_i \, \Delta Z_{t-1} + \Pi Z_{t-1} + \theta_t \qquad (5)$$

Where ΔZ_t is a vector of non-stationary log variables, and *C* is the constant term. The coefficient matrix term Π is decomposed as, $\Pi = \alpha\beta'$ where the α matrix contains the adjustment coefficients and the β' matrix contains the cointegrating vectors. Johansen (1988, 1990) and Johansen and Juselius (1995) provide two likely ratio statistics to test for the number of cointegrating vectors: trace (λ-trace) statistic and maximum eigenvalue (L-max) statistic ratios. The trace statistic tests the null hypothesis of *r* cointegrating vectors against the alternative which is *k* co-integrating vector. (6). The maximum eigenvalue (L-max) statistic tests a null hypothesis of exactly *r* cointegrating vectors against the alternative r+1 vector as shown by equation (7) (Kekani, 2012).

$$\lambda_t = -T \sum_{i=r+1}^{k} \log(1 - \bar{\lambda}_i), \text{ r = 0, 1, 2 …, } k\text{ -1} \quad (6)$$

$$\lambda_{max} = -T \log(1 - \bar{\lambda}_{r+1}), \text{ r = 0, 1, 2 …, } k\text{ -1} \quad (7)$$

Where, *r* is the number of cointegrating vectors under the null hypothesis and $\bar{\lambda}_i$ is the estimated value for the *i* th ordered eigenvalue from the ∏ matrix. The larger $\bar{\lambda}_i$ is, the larger and more negative log (1 $-\bar{\lambda}_i$) will be and hence the larger the test statistic will be. A significantly non-zero eigenvalue indicates a significant cointegrating vector (Brooks, 2008:351).

5.6. MODEL SPECIFICATION

5.6.1. Granger Causality Test in a Bivariate VAR Model

This test helps to investigate the presence of bidirectional, no relationship and one-way causality between variables (Ocran, 2010). Causality tests attempt to determine whether changes in the independent variable (x) represented as (*OP, SKP or EX*) cause changes in the dependent variable (y) which can also be represented as either (*OP, SKP or EX*) in this study. If there is no co-integration relationship between any considered variables, the standard granger causality tests in VAR model would be applied.

The following bivariate VAR models can be employed to test for the linear causality:

$$\Delta OP_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \, \Delta EX_{t-i} + \sum_{i=1}^{p} \beta_{2i} \, \Delta SKP_{t-i} + \mu_{1i} \quad (8)$$

$$\Delta EX_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \, \Delta OP_{t-i} + \sum_{i=1}^{p} \beta_{2i} \, \Delta SKP_{t-i} + \mu_{2i} \quad (9)$$

$$\Delta SKP_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \, \Delta OP_{t-i} + \sum_{i=1}^{p} \beta_{2i} \, \Delta EX_{t-i} + \mu_{3i} \quad (10)$$

Where, SKP_t, OP_t and EX_t represent stock prices, oil prices and exchange rate, respectively. The term *t* denotes the time. The white noise disturbance terms μ_{1i} and μ_{2i} are assumed to be uncorrelated. The linear causality equation (8) suggests that current oil prices O are respectively related to past exchange rate values EX_{t-1} as well as stock prices SKP_{t-1}. Equally, equations (9) and (10) suggest that the current exchange rate E and current SKP_t are respectively related to the past (OP_{t-1} , SKP_{t-1}), (OP_{t-1} , EX_{t-1}) and (EX_{t-1}, SKP_{t-1}). All log level series are presented in first difference form. The first difference operator is marked by Δ.

Once the granger test has been applied to oil prices, exchange rates and stock prices, we expect four possible outcomes: (i) unidirectional causality from (*OP* to *SKP)*, (*OP* to *EX)* or (*SKP* to *EX)* (ii) unidirectional causality from (*SKP* to *OP)*, *(EX* to *OP)* or (*EX* to *SKP)* (iii) bilateral causality, suggesting that (*OP* to *SKP)*, (*OP* to *EX)* or (*SKP* to *EX)* granger-cause each other and lastly; (iv) (*OP* to *SKP)*, (*OP* to *EX)* or (*SKP* to *EX)* are independent from each other. If oil prices have no effect on stock prices or exchange rates, then we fail to reject the null hypothesis.

5.6.2. Granger Causality Test in the Vector Error Correction (VEC) Model

The Vector Error Correction Model (VECM) is like the VAR model in first difference with the addition of a vector of cointegrating residuals. This method is relevant if the variables are cointegrated. It is represented by the following equations:

$$\Delta OP_t = \alpha_0 + \delta_1(OP_{t-1} - \gamma EX_{t-1}) + \sum pi{-1}\, \alpha_{1i}\, \Delta SKP_{t-1} + \sum pi{-1}\, \alpha_{2i}\, \Delta EX_{t-1} + \nu_{1t} \quad (11)$$

$$\Delta EX_t = \beta_0 + \delta_2(EX_{t-1} - \gamma OP_{t-1}) + \sum_{i-1}^{p} \beta_{1i}\, \Delta SKP_{t-1} + \sum_{i-1}^{p} \beta_{2i}\, \Delta OP_{t-1} + \nu_{2t} \quad (12)$$

$$\Delta SKP_t = \alpha_0 + \delta_1(SKP_{t-1} - \gamma OP_{t-1}) + \sum_{i-1}^{p} \alpha_{1i}\, \Delta EX_{t-1} + \sum_{i-1}^{p} \alpha_{2i}\, \Delta OP_{t-1} + \nu_{3t} \quad (13)$$

Where, the first difference term is denoted byΔ and the symbols δ_1 and δ_2 represent the error coefficients which captures the adjustments of ΔSKP_t, ΔOP_t and ΔE towards long run equilibrium. $OP_{t-1} - \gamma EX_{t-1}$ is the error correction term obtained from the cointegrating equation (7). The terms,$_{1i}$, α_{2i}, β_{1i} and β_{2i} of ΔSKP_t and ΔEX_t are expected to capture the short-run dynamics of the equation.

Once this model has been employed, if either δ_1 (the long-run causality) is statistically significant or the $_{2i}$ `s (short- run causality) are jointly significant, we can conclude that (*OP* causes *SKP*), (*OP* causes *EX*) or *(EX* causes *SKP)*. Equally, (*SKP* causes *OP*), (*EX* causes *OP*) and (*SKP* causes *EX*) if $\delta_2$ (the long-run causality) is statistically significant or if the $\beta_{2i}$`s (the short-term causality) are jointly significant. Granger (1983) argues that even if the coefficients on lagged changes in oil prices are not jointly significant, the error correction approach allows for the conclusion that oil prices have an impact on either exchange rates or stock prices due to the presence of the long-run causality.

5.7. IMPULSE RESPONSE AND VARIANCE DECOMPOSITION

Impulse response functions show the effects of a variable shock on the adjustment path of another variable. Forecast error variance decompositions measure the contribution of each type of shock to the forecast error variance. Both calculations are useful in assessing how shocks to economic variables reverberate through a system. Impulse Response Functions help to explain the symptoms of the relationship between the variables in the model as well as how long the effects of the shock will take to disappear from the system (Brooks, 2008: 229). The difference between these methods is that the variance decomposition determines the portion of the future forecast error variance of a given variable due to changes to each of the other explanatory variables in the model

(Ocran, 2010). An Impulse Response Function (IRF) tracks the effect that a shock on one endogenous variable has on the other variables in the VAR (Ocran, 2010).

5.8. CHAPTER SUMMARY

The previous sections above have presented the research methodology which included data issues and the model specification. The unit roots were tested using the Augmented Dickey-Fuller (ADF), Philips-Perron (PP), and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests. The Johansen co-integration test is employed to investigate the existence of co-integration of these variables.

The standard granger causality tests in a bivariate VAR model is employed because of the integration results. If there is no long run relationship then VAR model is applied, but if there is long run relationship then VECM model is applied. The impulse response functions and the variance decomposition is also applied. This shows the effects of shocks on the adjustment path of the other variables and also shows which of the independent variables is stronger in explaining the variability in the dependent variables over time.

CHAPTER SIX

EMPIRICAL RESULTS

6.1. INTRODUCTION

The main objective of this study is to examine the interaction of oil price movements, the exchange rate and the stock market price movements in South Africa. In the previous section, the study outlined the framework and reviewed the chosen models that are employed to address the objective of the study. This chapter presents the main findings of the study.

This chapter is structured as follows: section 6.2 provides the results of the unit root tests, section 6.3 presents the optimal lag order selection, and section 6.4 provides the results of the Johansen co-integration test. Sections 6.5 shows the results of the VAR Granger Causality Test, section 6.6 and 6.7 specifies the results of the generalised impulse response function and the forecast error variance decomposition, respectively. Lastly, section 6.8 gives a summary and conclusion of the chapter.

6.2. UNIT ROOT TEST

This section examined the statistical properties of the natural logarithms of all the variables under consideration, namely the OPEC oil prices, the South African stock prices i.e. (JSE All Share Index, JSE Resources Index, JSE Industrials Index, JSE Financials Index) and the Rand/US Dollar exchange rate. The results of the, ADF, PP and KPSS unit root tests are summarized in Table three below.

The null hypothesis states that there is a unit root in the data series, while the alternative hypothesis states that the series does not have a unit root. The tests are first employed on the variables in level form and then in first difference.

The results in (levels) show that the null hypothesis could not be rejected. This implies the presence of a unit root, and the variables are non-stationary in levels for all three time series. However, after first differencing the variables. The null hypothesis in each of the data sets was rejected at 1 per cent, 5 per cent and 10 per cent level of significance. Therefore, it can be concluded that all the variables are integrated of order 1, and for model estimation the values must be differenced at first order.

Table 3: Results of unit root tests.

		(ADF) test		**(PP) test**		**(KPSS) test**	
Variables	Test Statistics	level	First difference	level	First difference	Level	First difference
OP	t- Statistic: Probability:	-1.934212 (0.6280)	**-6.307938***** **(0.0000)*****	-1.880802 (0.6560)	**-6.063332***** **(0.0000)*****	0.150729 (0.0000)	**0.161523***** **(0.7673)*****
(SKP):							
ALSI	t- Statistic: Probability:	-2.358591 (0.3984)	**-11.31475***** **(0.0000)*****	-2.196717 (0.4851)	**-11.31475***** **(0.0000)*****	0.245660 (0.0000)	**0.056648***** **(0.2286)*****
RESI	t- Statistic: Probability:	-1.967751 (0.6103)	**-10.54984***** **(0.0000)*****	-2.074331 (0.5524)	**-10.86677***** **(0.0000)*****	0.113118 (0.0000)	**0.075171***** **(0.4428)*****
INDI	t- Statistic: Probability:	-1.846656 (0.6733)	**-10.54984***** **(0.0000)*****	-1.727415 (0.7307)	**-10.56424***** **(0.0000)*****	0.266046 (0.0000)	**0.056047***** **(0.0618)*****
FIN	t- Statistic: Probability:	-1.794680 (0.6990)	**-10.28581***** **(0.0000)*****	-1.698812 (0.7436)	**-10.34655***** **(0.0000)*****	0.209579 (0.0000)	**0.092843***** **(0.2596)*****
EX	t- Statistic: Probability:	-0.454507 (0.9839)	**-7.321593***** **(0.0000)*****	-0.688163 (0.9705)	**-7.146291***** **(0.0000)*****	0.186111 (0.0000)	**0.111826**** **(0.044)*****

*Notes: OP represents the oil prices, SKP denotes the stock prices, ALSI =All share Index, RESI = Resources, INDI = Industrials Index, FIN = Financials Index, while EX shows exchange rates. The symbol *** denotes rejection of null hypothesis at 10% significance level, ** denotes rejection at 5% significance level, *denotes rejection at 1% significance level. The max lag length for the ADF test is (Automatic – based on SIC, max lag =11). For both the PP and KPSS tests the bandwidth is determined by, (Newey-West automatic) using Bartlett kernel.*

Source: Computed by Author.

6.3. OPTIMAL LAG ORDER SELECTION

The building of a VAR model requires the appropriate lag length to be used (Brooks, 2008: 310). According to Lutekepohl (1993) the selection of a higher order lag length than the true lag length causes an increase in the mean-square forecast errors of the VAR, this is known as overfitting. On the other hand, underfitting the lag length often generates autocorrelated errors in a model. For the Johansen and Juselius (1990) tests to be executed successfully, the appropriate lag length and a governing set of assumptions must be specified.

Table four below, presents the results of the VAR model lag order selection criteria using bivariate generalization of Likelihood Ratio (LR) sequential modified Likelihood Ratio (LR) test statistic, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and the Hannan-Quinn Information Criterion (HQ). The test found lag two to be the optimal lag length for the estimations.

Table 4: VAR lag order selection criteria.

Scenario 1: ASLI (All Share Index) is representing SKP						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1257.939	NA	1.4710	31.92250	32.01248	31.95855
1	-1955.7901	573.7001	8776991	24.50102	**24.86093***	24.64521
2	-939.9557	28.8672	**7390893***	**2432799***	24.95785	**24.58033***
Scenario 2: RESI (Resources Index) is representing SKP						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-703.7665	NA	1183949	17.89282	17.98280	17.92887
1	-456.4275	469.6309	2837628	11.85892	12.21884	12.00312
2	-436.7516	35.86500	**21.68053***	**11.58865***	**1221850***	**11.84099***
Scenario 3: INDI (Industrials Index) is representing SKP						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-746.4678	NA	34899.99	18.97387	19.06385	19.00992
1	-441.5567	578.9452	19.47392	11.48245	**11.84236***	**11.62664***
2	-429.4439	22.07904	**18.01868***	**11.40364***	12.03350	11.65598
Scenario 4: FIN (Financials Index) is representing SKP						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-635.8518	NA	2121.410	16.17346	16.26344	16.20951
1	-329.9959	580.7391	1.155753	8.658123	9.018039	8.802316
2	-307.8978	**4027998***	**0.830518***	**8.326527***	**8.956380***	**8.578865***

*Notes: * 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, and HQ: Hannan-Quinn information criterion.*

Source: Computed by Author

6.4. JOHANSEN CO-INTEGRATION

Section 6.4 presents the Johansen co-integration results. Table five below shows results for Scenario 1, where the All Share Index (ASLI) is representing Stock Prices (SKP).

Both the Trace test and the Maximum Eigenvalue test failed to reject the null hypothesis which states that there are no cointegrating equations. The tests examined p-values at 5 per cent level of significance. The optimal lag of two was selected according to SIC criterion. These test results suggest that there is no long-run relationship between exchange rates, the all share index and oil prices that exist in the model. This implies that the study should use a VAR model.

Table 5: Bivariate Johansen Co-integration Results.

Scenario 1 : ASLI (All Share Index) is representing SKP				
Co-integration Rank Trace Test				
Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical Value	Prob. **
None	0.111276	16.42408	29.79707	0.6822
At most 1	0.053964	6.396789	15.49471	0.6486
At most 2	0.019588	1.681462	3.841466	0.1947
Notes: Trace test indicates no co-integration at the 0.05 level,* denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values.				
Co-integration Rank Maximum Eigenvalue test				
Hypothesized No. of CE(s)	Eigenvalue	Maximum Eigenvalue statistic	0.05 Critical Value	Prob. **
None	0.111276	10.02729	21.13162	0.7421
At most 1	0.053964	4.715326	14.26460	0.7773
At most 2	0.019588	1.681462	3.841466	0.1947
Notes: Max-eigenvalue test indicates no co-integration at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values. ***Source:*** *Computed by Author*				

The test results of Table 6 below suggest that there is no long-run relationship between exchange rates, the resources index and oil prices. The results present outcomes for Scenario 2, where Resources Index (RESI) is used as a proxy for Stock Prices (SKP). This result is consistent with the results of Table 5 (Scenario 1) above, where the all share index was the proxy of stock prices.

Table 6: Bivariate Johansen Co-integration Results.

Co-integration Rank Trace Test				
Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical Value	Prob. **
None	0.152070	25.04982	29.79707	0.1597
At most 1	0.095872	11.02851	15.49471	0.02098
At most 2	0.028547	2.461812	3.841466	0.1166
Notes: Trace test indicates no co-integration at the 0.05 level,* denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values.				
Co-integration Rank Maximum Eigenvalue test				
Hypothesized No. of CE(s)	Eigenvalue	Maximum Eigenvalue statistic	0.05 Critical Value	Prob. **
None	0.152070	14.02131	21.13162	0.3633
At most 1	0.095872	8.566699	14.26460	0.3240
At most 2	0.028547	2.461812	3.841466	0.1166
Notes: Max-eigenvalue test indicates no co-integration at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values. ***Source***: *Computed by Author*				

Scenario 3, where the Industrials Index (INDI) is representing Stock Prices (SKP) is presented below in Table 7. The Johansen test failed to reject the null hypothesis that states that there are no co-integrating equations. The test results suggest that exchange rates, the industrials index and oil prices are not co-integrated in the long-run.

Table 7: Bivariate Johansen Co-integration Results.

Scenario 3 : When INDI (Industrials Index) is representing SKP				
Co-integration Rank Trace Test				
Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical Value	Prob. **
None	0.096422	14.24625	29.79707	0.8265
At most 1	0.047031	5.627834	15.49471	0.7390
At most 2	0.017875	1.533101	3.841466	0.2156
Notes: Trace test indicates no co-integration at the 0.05 level,* denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values.				
Co-integration Rank Maximum Eigenvalue test				
Hypothesized No. of CE(s)	Eigenvalue	Maximum Eigenvalue statistic	0.05 Critical Value	Prob. **
None	0.096422	8.618421	21.13162	0.8619
At most 1	0.047031	4.094733	14.26460	0.8492
At most 2	0.017875	1.533101	3.841466	0.2156

Notes: *Max-eigenvalue test indicates no co-integration at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values.* ***Source:*** *Computed by Author*

The results in Tables 5, 6 and 7 are similar to those of Table 8 below. The results suggest that there is no long-run relationship between exchange rates, the financials index and oil prices in the model. This implies that the study should use a VAR Model. The next step is to test causality using the granger causality test.

Table 8: Bivariate Johansen Co-integration Results.

Scenario 4 : When FIN (Financials Index) is representing SKP				
Co-integration Rank Trace Test				
Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical Value	Prob. **
None	0.153398	24.14142	29.79707	0.1945
At most 1	0.096313	9.986777	15.49471	0.2817
At most 2	0.016088	1.378609	3.841466	0.2403
Notes: Trace test indicates no co-integration at the 0.05 level,* denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values.				
Co-integration Rank Maximum Eigenvalue test				
Hypothesized No. of CE(s)	Eigenvalue	Maximum Eigenvalue statistic	0.05 Critical Value	Prob. **
None	0.153398	14.15464	21.13162	0.3525
At most 1	0.096313	8.608168	14.26460	0.3202
At most 2	0.016088	1.378609	3.841466	0.2403
Notes: *Max-eigenvalue test indicates no co-integration at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values.* ***Source:*** *Computed by Author*				

6.5. VAR MODEL GRANGER CAUSALITY TEST

Table 9 below shows the VAR granger causality test for Scenario 1: where Stock Prices (SKP) are represented by the All Share Index (ALSI). The test found that, the all share index does not granger cause exchange rates, exchange rates do not cause the all share index, oil prices have no effect on exchange rates, exchange rate do not impact oil price, and oil prices do not affect the all share index. These results are consistent with the asset market approach. This approach suggests that there is weak correlation between both variables. This approach suggests that stock prices and exchange rates may be driven by other factors.

However, the granger causality test also found that, the all share index has an influence on oil prices. The p value = 0.0128*, suggest that the all share index is a significant variable to explain oil prices. These results are consistent with the business cycle view, which states that oil price fluctuations are mainly driven by demand factors. According to Hamilton (1996: 215), strong world output growth trends, especially in emerging markets could result in an upward surge in oil prices.

Table 9: Pairwise VAR Granger Causality Tests.

Scenario 1 : When ASLI (All Share Index) is representing SKP (85) Observations				
Null hypothesis:	**F-Static**	**Probability**	**Lag**	**Decision**
ALSI does not Granger Cause *EX*	0.66333	0.5179	2	Do not reject Null
EX does not Granger Cause ALSI	1.14359	0.3238		Do not reject Null
OP does not Granger Cause EX	1.58190	0.2119		Do not Reject Null
EX does not Granger Cause *OP*	1.24893	0.2923	2	Do not Reject Null
OP does not Granger Cause ALSI	0.21930	0.8036		Do not reject Null
ALSI does not Granger Cause OP	**4.60314**	**0.0128***	**2**	**reject Null**

Notes: ALSI denotes the stock prices while EX denotes exchange rates and OP denotes Oil Prices. The Lag two results in bold indicates the optimal lag length selected by SIC. *denotes rejection of null hypothesis where (P ≤0.05).

Source: Computed by Author

The test results for Scenario 2: where Stock Prices (SKP) are represented by the Resources Index (RESI) are presented below in Table 10. These results are consistent with Table 9 results above. The findings suggest that the resources index has an effect on oil price. The resources index is a considerable variable to explain changes in oil prices. These results are also consistent with the business cycle view, which suggest that oil price fluctuations are mainly driven by demand factors. The rest of the findings found that, the resources index has a weak correlation with exchange rates, exchange rates do not affect the resources index, oil prices do not influence exchange rates, exchange rates do not cause oil prices and oil prices have no effect on the resources index.

Table 10: Pairwise VAR Granger Causality Tests.

Scenario 2 : When RESI (Resources Index) is representing SKP (85) Observations				
Null hypothesis:	**F-Static**	**Probability**	**Lag**	**Decision**
RESI does not Granger Cause *EX*	1.01311	0.3677	2	Do not reject Null
EX does not Granger Cause RESI	0.27977	0.7567		Do not reject Null
OP does not Granger Cause EX	1.58190	0.2119		Do not Reject Null
EX does not Granger Cause *OP*	1.24893	0.2923	2	Do not Reject Null
OP does not Granger Cause RESI	2.38263	0.0988		Do not reject Null
RESI does not Granger Cause OP	**5.27968**	**0.0070***	**2**	**reject Null**

Notes: *RESI denotes the stock prices while EX denotes exchange rates. The Lag two results in bold indicates the optimal lag length selected by SIC. *denotes rejection of null hypothesis where (P ≤0.05).*

Source: *Computed by Author.*

Table 11 below presents slightly different findings from those of Table 9 and Table 10 above. Scenario 3 below: where Stock Prices (SKP) are represented by the Industrials Index (INDI), suggests that the industrials index has a weak correlation with oil prices. This is contrary to the above tables findings that suggest that the stock prices are a significant variable in explain oil prices. The test also found that, the industrials index does not cause exchange rates, exchange rate has no effect on the industrials index, oil prices have no impact on exchange rates, exchange rates do not influence oil prices, and oil prices do not explain changes in the industrials index. These results are consistent with the asset market approach which suggests a weak or no correlation between both variables, therefore suggesting that changes in oil prices, stock prices and exchange rates may be driven by other factors.

Table 11: Pairwise VAR Granger Causality Tests.

Scenario 3 : When INDI (Industrials Index) is representing SKP (85) Observations				
Null hypothesis:	**F-Static**	**Probability**	**Lag**	**Decision**
INDI does not Granger Cause *EX*	1.44675	0.2414	2	Do not reject Null
EX does not Granger Cause INDI	0.23628	0.7901		Do not reject Null
OP does not Granger Cause EX	1.58190	0.2119		Do not Reject Null
EX does not Granger Cause *OP*	1.24893	0.2923	2	Do not Reject Null
OP does not Granger Cause INDI	0.52818	0.5917		Do not reject Null
INDI does not Granger Cause OP	2.92685	0.0593	2	Do not reject Null

***Notes**: INDI denotes the stock prices while EX denotes exchange rates. The Lag two results in bold indicates the optimal lag length selected by SIC. *denotes rejection of null hypothesis where (P ≤0.05).*

Source: Computed by Author.

The granger causality test for Scenario 4: where Stock prices (SKP) are represented by the Financials Index (FIN) are presented below in Table 12. These results are consistent with those of Table 9 and Table 10 results above. The granger causality test also found that, the financials index does granger cause oil prices. This suggests that the financials index is a significant variable to explain oil prices. This outcome is consistent with the business cycle view, which states that oil price fluctuations are mainly driven by demand factors.

The test also found that, the financials index has no influence on exchange rates, exchange rates do not cause the financials index, oil prices have no impact on exchange rates, exchange rates do not explain oil prices, and oil prices do not cause the financials index, these results are also consistent with the asset market approach, that suggest a weak or no correlation between both variables.

Table 12: Pairwise VAR Granger Causality Tests.

Scenario 4 : When FIN (Financials Index) is representing SKP (85) Observations				
Null hypothesis:	**F-Static**	**Probability**	**Lag**	**Decision**
FIN does not Granger Cause *EX*	10.8386	7.0005	2	Do not reject Null
EX does not Granger Cause FIN	0.12387	0.8837		Do not reject Null
OP does not Granger Cause EX	1.58190	0.2119		Do not Reject Null
EX does not Granger Cause *OP*	1.24893	0.2923	2	Do not Reject Null
OP does not Granger Cause FIN	0.23881	0.7881		Do not reject Null
FIN does not Granger Cause OP	**7.28742**	**0.0012***	**2**	**Reject Null**

Notes: *FIN denotes the stock prices while EX denotes exchange rates. The Lag two results in bold indicates the optimal lag length selected by SIC. *denotes rejection of null hypothesis where (P ≤0.05).*

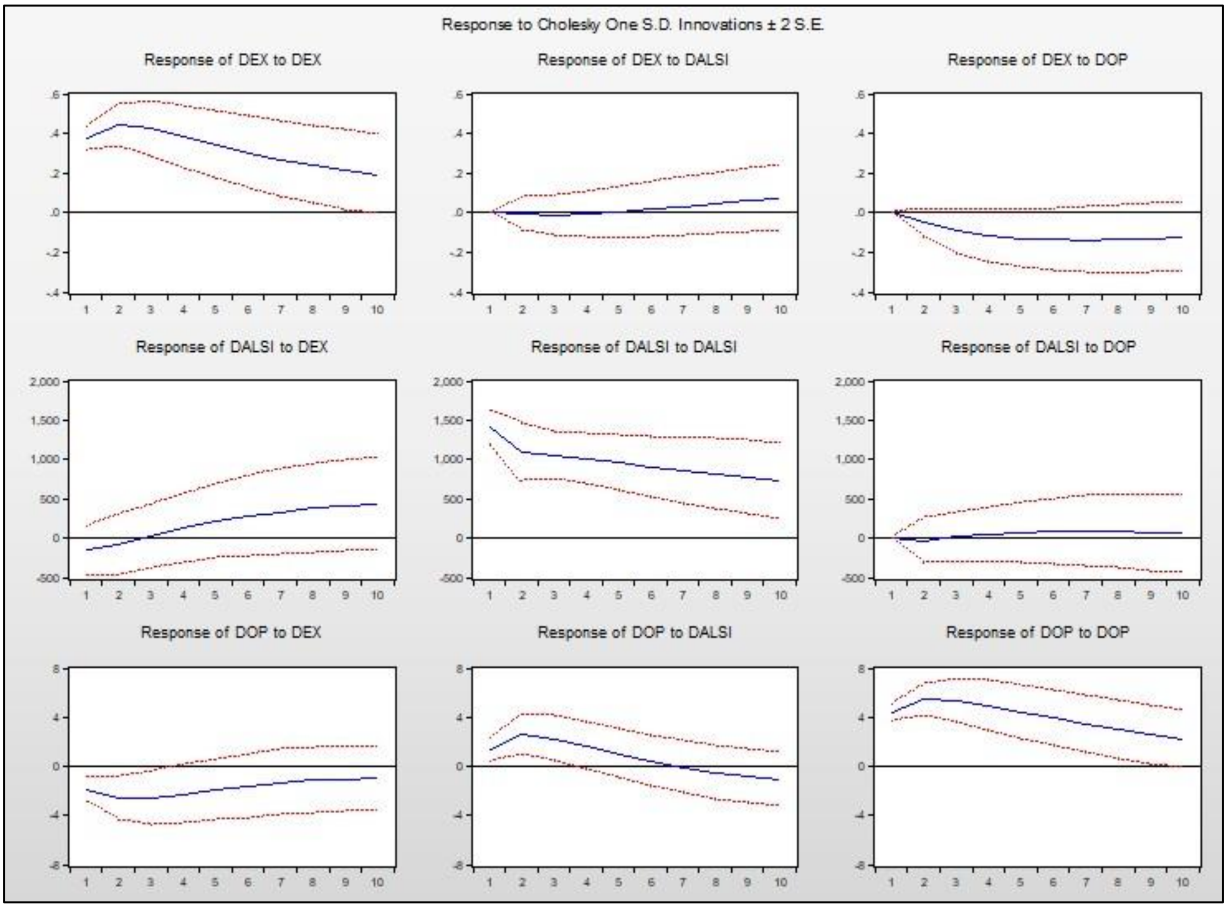
Source: Computed by Author.

6.6. IMPULSE RESPONSE

Figure eight below shows the impulse response results of Scenario 1: where the All Share Index (ALSI) is representing Stock Prices (SKP). The results show that the own shock of the exchange rate, the all share index and oil price maintain a positive variation throughout the 10 periods. Exchange rate has a negative relationship with the all share index in the first 3 months period but thereafter, the relationship become positive until the 10 months period. The all share index has a negative correlation to exchange rates in the first 3 months period or short run period, but the correlation becomes positive until the 10 months period or long run period.

Furthermore, if there is one standard deviation shock to the residual of either exchange rates or oil prices, the shock causes a negative response to oil prices and exchange rates subsequently throughout the 10 periods. The all share index has a positive variation to oil prices throughout the 10 months period. The oil price has a positive correlation to the all share index in the first 6 months, but the relationship becomes negative until the 10 months period.

Figure 8: Scenario 1: Impulse Response results when ALSI is representing SKP.

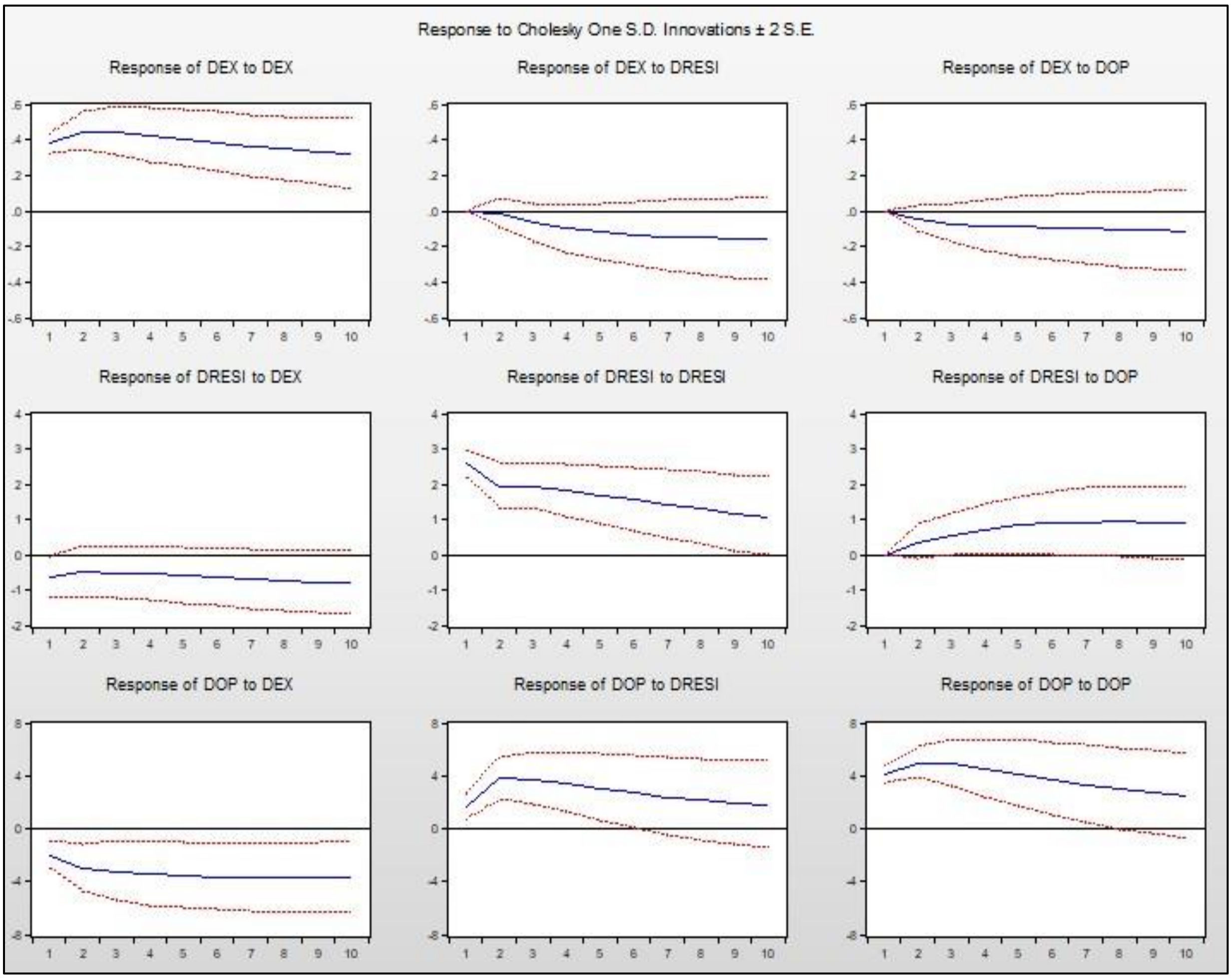


Source: Computed by Author

The impulse response results for Scenario 2: where the Resources Index (RESI) is representing Stock Price (SKP) are presented below in Figure nine. The results show that exchange rates have a negative correlation with the resources index across the 10 months period. The resources index has a negative relationship to the exchange rate throughout the 10 months period or long run period.

Moreover, similar to results in Figure 8 above, if there is one standard deviation shock to the residual resources index, the shock causes a positive response of oil prices throughout the 10 months period. Lastly the results also show that oil price has a positive variation to the resources index throughout the 10 months long run period.

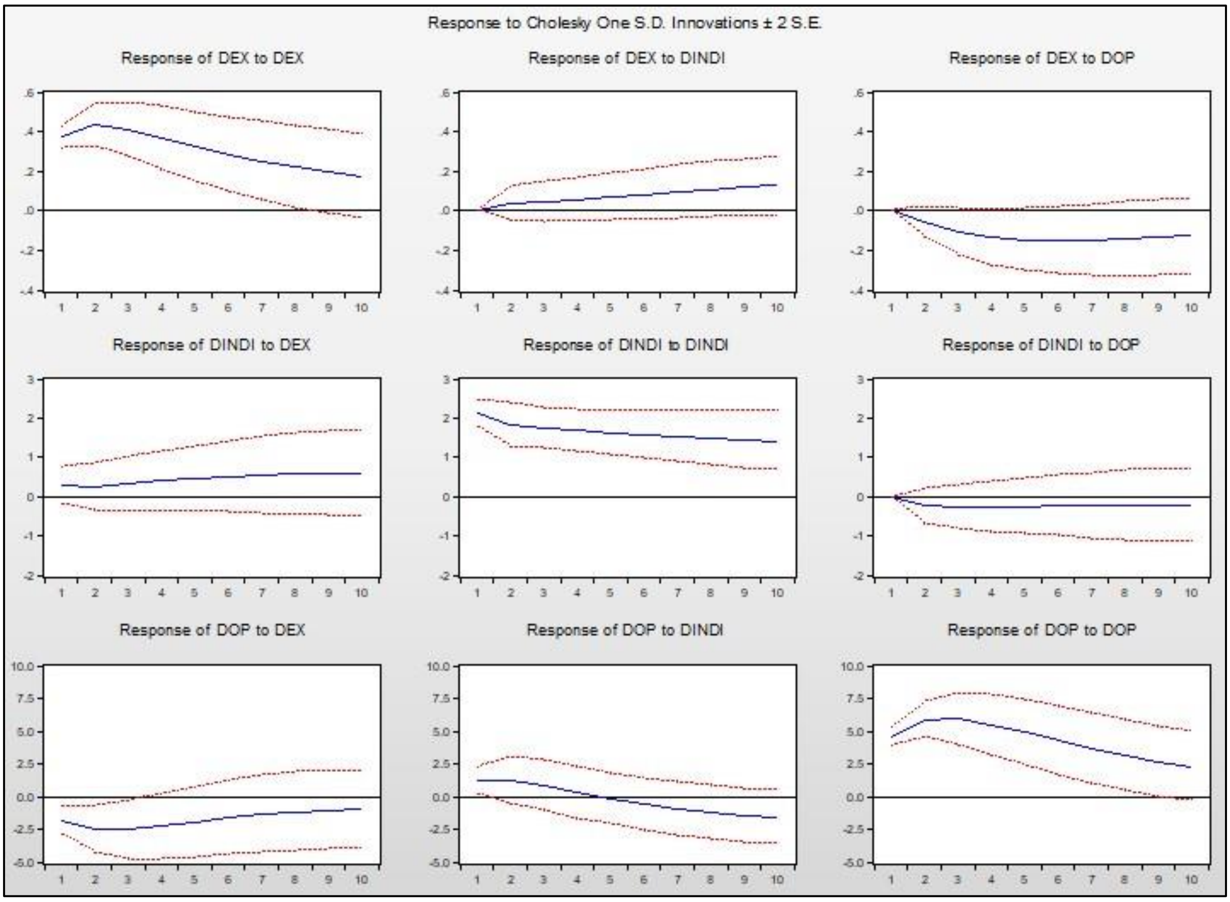
Figure 9: Scenario 2: Impulse Response results when RESI is representing SKP.



Source: Computed by Author

Below is Figure 10 which presents the impulse response results for Scenario 3: where the Industrials Index (INDI) is representing Stock Price (SKP). These results show a finding to that is different to that in Figure 8 and Figure 9 above. The results show that if there is one standard deviation shock to the residual industrial index, the shock causes a negative response of oil prices throughout the 10 months period. Moreover, oil prices have a positive relationship to the industrials index in the first 5 months period (short-run), but the correlation becomes negative until the 10 months period (long run). The results also show that exchange rates have a positive variation with the industrials index throughout the 10 months period. Lastly, the industrials index has a positive correlation to exchange rates throughout the 10 months period or long run period.

Figure 10: Scenario 3: Impulse Response results when INDI is representing SKP.

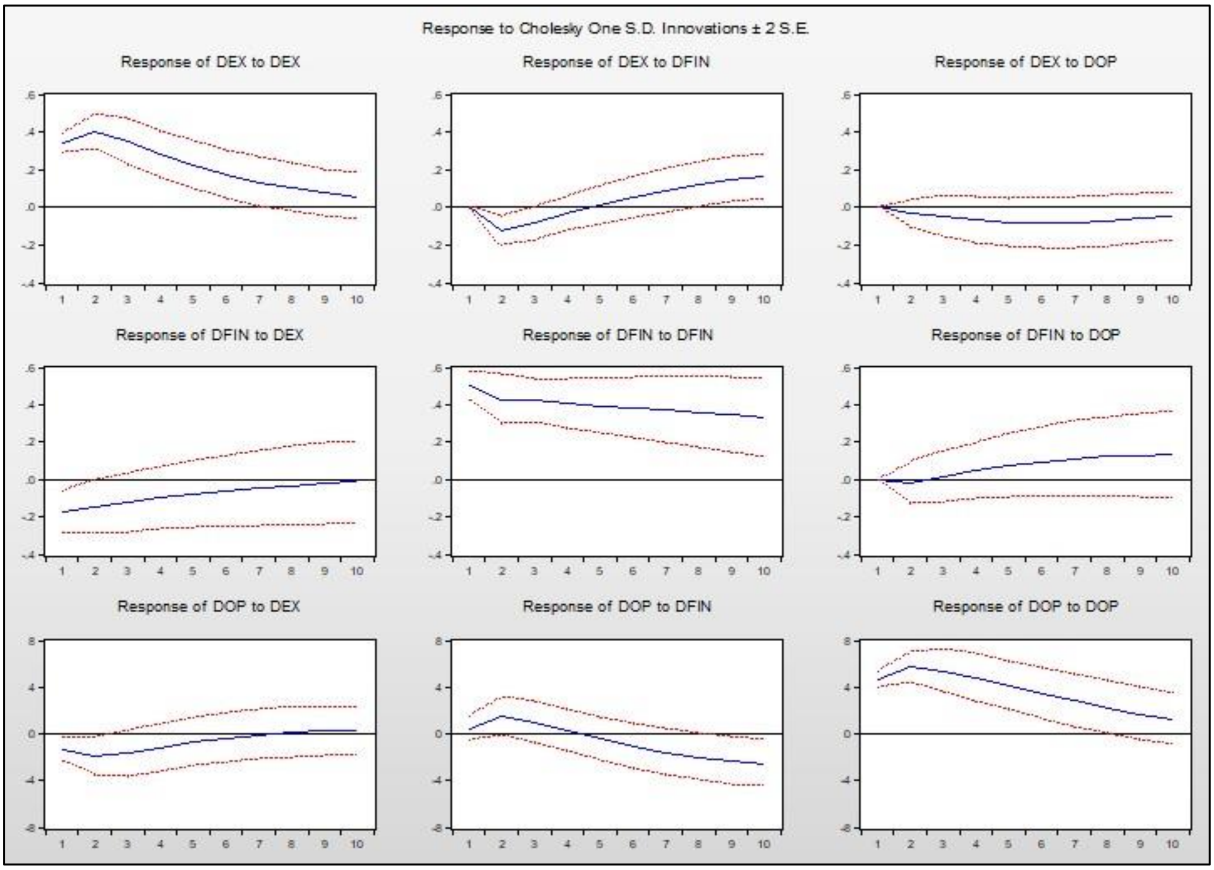


Source: Computed by Author

The impulse response results of Scenario 4: where the Financials Index (FIN) is representing Stock Prices (SKP) are presented below in Figure 11. The results suggest that exchange rates have a negative correlation with the financials index in the first 5 months period, but the relationship becomes positive over the 10 months period. The financials index has a negative variation to exchange rates though out the 10 months period or long run period.

However, similar to the results in Figure 8 and Figure 9, the financials index has a positive variation to oil prices throughout the 10 months period. Lastly, oil prices have a positive correlation to the financials index in the first 5 months (short-run), but the trend becomes negative until the 10 months period (long run).

Figure 11: Scenario 4: Impulse Response results when FIN is representing SKP.



Source: Computed by Author

6.7. VARIANCE DECOMPOSITION

Table 13, Table 14 and Table 15 below show results of the variance decomposition of Scenario 1: when the All Share Index (ALSI) is representing Stock Prices (SKP). Table 13 presents the variance decomposition of exchange rates. The results suggest that in the short run, this is to say in the first quarter or 3rd month, the own impulse shock of exchange rates was about 97.83 per cent. The innovation/shock of exchange rates also causes a 0.05 per cent fluctuation in the all share index and a 2.12 per cent fluctuation in oil prices in the short run. In the long run, this is to say in the Last quarter or 10th month, the own impulse shock of exchange rates accounted for about 88.34 per cent. The innovation/shock of exchange rates also causes a 1.01 per cent fluctuation in the all share index and a 10.65 per cent fluctuation of oil prices. This suggests that a shock to exchange rates significantly affects the oil prices in the long run.

Table 13: Scenario 1: (ALSI = SKP) Variance Decomposition of EX.

Variance Decomposition of EX:				
Period	S.E.	EX	ALSI	OP
1	0.38	100.00	0.00	0.00
2	0.58	99.19	0.02	0.79
3	0.73	97.83	0.05	2.12
4	0.83	96.34	0.05	3.61
5	0.91	94.84	0.04	5.11
6	0.96	93.41	0.07	6.53
7	1.01	92.04	0.15	7.81
8	1.05	90.74	0.33	8.93
9	1.08	89.51	0.61	9.88
10	1.11	88.31	1.01	10.65

Source: Computed by Author.

The variance decomposition of the All Share Index (ALSI) of Scenario 1**:** where (ALSI) is representing (SKP) is presented in Table 14 below. In the short run, the own impulse shock of the all share index was about 99.23 per cent. The innovation/shock of the all share causes a 0.74 per cent fluctuation in exchange rates and a 0.02 per cent fluctuation in oil price. In the long run the own impulse shock of the all share index accounted for about 92.06 per cent. Furthermore, an innovation/shock of the all share index also causes a 7.58 per cent fluctuation in exchange rates and a 0.36 per cent fluctuation of oil prices. This suggests that a shock to the all share index significantly affects the exchange rate in the long run.

Table 14: Variance Decomposition of ALSI.

Variance Decomposition of ALSI:				
Period	S.E.	EX	ALSI	OP
1	1425.52	1.19	98.81	0.00
2	1792.39	0.97	98.99	0.03
3	2078.65	0.74	99.23	0.02
4	2311.56	0.89	99.0	0.06
5	2510.60	1.45	98.41	0.14
6	2684.65	2.33	97.44	0.21
7	2839.15	3.46	96.25	0.28
8	2977.75	4.76	94.91	0.32
9	3103.07	6.15	93.49	0.3
10	3217.11	7.58	92.05	0.35

Source: Computed by Author.

Below is Table 15, which shows the variance decomposition of oil prices. The results suggest that a shock to oil prices notably affects the exchange rate. The innovation/shock of oil prices causes a 15.82 per cent fluctuation of exchange rates in the short run and 15.22 per cent fluctuation in exchange rates in the long run. This result is similar to that of Table 13 and suggests a bidirectional effect of shocks in the oil price market and those in the exchange rate market. Furthermore, the table shows that in the first quarter, the own impulse shock of oil prices was about 71.57 per cent and 75.89 per cent in the last quarter. The innovation/shock of oil prices also causes a 12.61 per cent fluctuation in the all share index in the short run and an 8.89 per cent fluctuation of all share index in the long run.

Table 15: Variance Decomposition of OP.

Variance Decomposition of OP: S.E.				
Period	S.E.	EX	ALSI	OP
1	4.98	13.72	7.92	78.3
2	8.26	15.11	12.8	72.02
3	10.42	15.81	12.60	71.57
4	11.87	15.93	11.58	72.48
5	12.85	15.81	10.47	73.70
6	13.54	15.64	9.54	74.81
7	14.03	15.48	8.89	75.62
8	14.39	15.356	8.56	76.07
9	14.68	15.27	8.577	76.15
10	14.91	15.22	8.89	75.88

Source: Computed by Author.

Scenario 2: where the Resources Index (RESI) is representing Stock Price (SKP) is presented below in Table 16, Table 17 and Table 18. Below is Table 16 which shows the results of the variance decomposition of exchange rates. The results suggest that in the short run, the own impulse shock of exchange rates was about 97.69 per cent. The innovation/shock of exchange rates causes a 0.96 per cent fluctuation in the resources index and a 1.36 per cent fluctuation in oil prices in the short run. In the long run, this is to say in the Last quarter or 10th month, the own impulse shock of exchange rates accounted for about 87.25 per cent. Moreover, one-unit shock of the exchange rates causes a 4.57 per cent fluctuation of the oil price and about 8.18 per cent fluctuation in the resources index which is a modest effect in the long run.

Table 16: Scenario 2: (RESI = SKP) Variance Decomposition of EX.

Variance Decomposition of EX:				
Period	S.E.	EX	RESI	OP
1	0.37	100.00	0.00	0.00
2	0.58	99.24	0.08	0.67
3	0.74	97.68	0.95	1.35
4	0.86	96.01	2.05	1.9
5	0.96	94.36	3.19	2.43
6	1.05	92.80	4.30	2.88
7	1.13	91.30	5.37	3.31
8	1.19	89.88	6.37	3.73
9	1.25	88.53	7.31	4.15
10	1.31	87.25	8.17	4.56

Source: Computed by Author.

Table 17 below shows results of the variance decomposition of the Resources Index (RESI) of Scenario 2: where (RESI) represents Stock Prices (SKP). The table indicates that in the 3rd month, the own impulse response shock of the resources index was about 91.47 per cent and 74 per cent in the 10th month. An innovation/shock of the resources index causes a 5.72 per cent fluctuation in exchange rates and a 2.81 per cent fluctuation in oil prices in the short run. Furthermore, in the long run an innovation/shock of the resources index causes a 11.04 per cent fluctuation in exchange rates and a 14.88 per cent fluctuation of oil prices. This suggests that a shock to the resources index significantly affects the oil price and the exchange rate in the long run.

Table 17: Variance Decomposition of RESI.

Variance Decomposition of RESI:				
Period	S.E.	EX	RESI	OP
1	2.64	5.52	94.47	0.00
2	3.33	5.48	93.39	1.12
3	3.93	5.72	91.46	2.80
4	4.42	6.12	89.01	4.85
5	4.83	6.68	86.36	6.95
6	5.19	7.37	83.67	8.95
7	5.50	8.17	81.05	10.77
8	5.77	9.06	78.56	12.36
9	6.01	10.02	76.23	13.73
10	6.22	11.04	74.08	14.87

Source: Computed by Author.

The variance decomposition of oil prices for Scenario 2: where the (RESI) represents Stock Prices (SKP) is presented in Table 18 below. A unit shock of oil prices causes a 19.71 per cent fluctuation in exchange rates and a 25.80 per cent fluctuation in the resources index in the short run. This suggests that oil prices have a significant effect in determining shocks of the resources index in the short- run. The own impulse shock of oil prices was about 54.49 per cent in the short run about 43.73 per cent in the long run. The own shock of oil prices in both the short run and long run suggest that other factors other than factors originating from the oil market significantly affect the oil prices. Furthermore, the innovation/shock of oil prices also causes a 33.84 per cent fluctuation in exchange rates and a 22.43 per cent fluctuation of the resources index. This suggests that a shock to oil prices considerably affect both exchange rates and the resources Index in both the short run and long run.

Table 18: Variance Decomposition of OP.

Variance Decomposition of OP:				
Period	S.E	EX	RESI	OP
1	4.85	17.36	11.10	71.52
2	8.44	18.30	23.71	57.98
3	10.96	19.71	25.79	54.49
4	12.83	21.60	26.09	52.30
5	14.27	23.73	25.66	50.59
6	15.43	25.92	25.01	49.06
7	16.39	28.08	24.30	47.61
8	17.20	30.14	23.61	46.24
9	17.90	32.06	22.98	44.94
10	18.52	33.83	22.42	43.73

Source: Computed by Author.

The next three Tables that follow below, this is to say Table 19, Table 20 and Table 21 show results for Scenario 3: where the Industrials Index (INDI) is representing Stock Prices (SKP). Table 19 below shows results of the variance decomposition of exchange rates. In the first quarter or 3rd month, the own impulse shock of exchange rates was about 96.37 per cent. The innovation/shock of exchange rates causes a 0.66 per cent fluctuation in the industrials index and a 2.96 per cent fluctuation in oil prices. In the Last quarter or 10th month, the own impulse shock of exchange rates accounted for about 81.56 per cent. The innovation/shock of exchange rates also causes a 5.62 per cent fluctuation in the industrials index and a 12.81 per cent fluctuation of oil prices. This implies that a shock to the exchange rates notably affects the oil price in the long run. This result is also consistent with the previous Scenario 1: where (ALSI) represents (SKP) and Scenario 2: where (RESI) represents (SKP), which suggest a bidirectional shock effect between oil prices and the exchange rate.

Table 19: Scenario 3: (INDI = SKP) Variance Decomposition of EX.

Variance Decomposition of EX:				
Period	S.E.	EX	INDI	OP
1	0.372693	100.0000	0.000000	0.000000
2	0.575532	98.55801	0.386756	1.055230
3	0.715561	96.37134	0.663802	2.964854
4	0.817477	93.98581	0.995471	5.018724
5	0.894453	91.62926	1.439464	6.931280
6	0.954389	89.37674	2.017894	8.605367
7	1.002367	87.24686	2.735385	10.01775
8	1.041794	85.23908	3.585448	11.17547
9	1.075008	83.34688	4.554079	12.09904
10	1.103643	81.56246	5.622488	12.81505

Source: Computed by Author.

The Variance decomposition of the Industrials Index (INDI) for Scenario 3: where (INDI) is a proxy for (SKP) is presented below in Table 20. The results indicate that a unit shock of the industrials index causes a 7.32 per cent variation in the exchange rates in the long run and a 2.27 per cent in the short run. This implies that a shock to the industrials index considerably affects the exchange rates in the long run rather than in the short run. The own impulse shock of the industrials index was about 96.50 per cent in the short run and about 90.92 per cent in the long run. Lastly, an innovation/shock of the industrials index also causes a 1.23 per cent variation in oil prices in the short run and 1.76 per cent fluctuation in the long run.

Table 20: Variance Decomposition of INDI.

Variance Decomposition of INDI:				
Period	S.E.	EX	INDI	OP
1	2.13	1.89	98.10	0.00
2	2.83	1.82	97.42	0.75
3	3.35	2.27	96.49	1.23
4	3.78	2.93	95.58	1.47
5	4.15	3.68	94.71	1.60
6	4.48	4.45	93.87	1.66
7	4.77	5.21	93.08	1.69
8	5.04	5.95	92.32	1.72
9	5.28	6.65	91.60	1.74
10	5.50	7.31	90.92	1.76

Source: Computed by Author.

Table 21 below presents results of the variance decomposition of oil prices for Scenario 3: where the Industrials Index (INDI) represents Stock Prices (SKP). In the first quarter or 3rd month, the own impulse shock of oil prices was about 82.20 per cent and 81.51 per cent in the last quarter or 10th month. A unit shock of oil prices causes a 14.56 per cent fluctuation in exchange rates and a 3.24 per cent variation in the industrials index in the short run. In the long run the innovation/shock of oil prices also causes a 13.75 per cent fluctuation in exchange rates and a 4.74 per cent fluctuation of the industrials index. This implies that a shock to oil prices considerably affects the exchange rate in the long run. This result is also consistent with the results from Scenario 1 and Scenario 2.

Table 21: Variance Decomposition of OP.

Variance Decomposition of OP:				
Period	S.E.	EX	INDI	OP
1	5.08	12.64	5.77	81.57
2	8.26	14.05	4.32	81.61
3	10.51	14.56	3.23	82.19
4	12.08	14.64	2.50	82.84
5	13.17	14.54	2.13	83.32
6	13.95	14.37	2.09	83.53
7	14.53	14.19	2.37	83.42
8	14.96	14.03	2.94	83.02
9	15.30	13.88	3.74	82.37
10	15.59	13.74	4.74	81.51

Source: Computed by Author.

Table 22, Table 23 and Table 24, below shows results of the variance decomposition of Scenario 4: where the Financials Index (FIN) is representing Stock Prices (SKP). Table 24 below presents the variance decomposition of the exchange rate. The results reveal that a unit innovation/ shock of the exchange rate bring about a 5.40 per cent fluctuation in the financials index in the short run and a 13.56 per cent variation in the financials index in the long run. This indicates that a shock to exchange rates significantly affects the financials index in the long run rather than is the short run. The own impulse shock of exchange rates was about 93.73 per cent in the first quarter and about 81.13 per cent in the last quarter. Furthermore, an innovation/shock of exchange rates also caused a 0.86 per cent fluctuation in oil prices in the short run and 5.31 per cent fluctuation of oil prices in the long run.

Table 22: Scenario 4: (FIN = SKP) Variance Decomposition of EX.

Variance Decomposition of EX:				
Period	S.E.	EX	FIN	OP
1	0.34	100.00	0.00	0.00
2	0.54	94.19	5.42	0.37
3	0.65	93.73	5.40	0.86
4	0.71	93.61	4.74	1.64
5	0.75	93.09	4.30	2.60
6	0.77	91.92	4.49	3.57
7	0.79	90.06	5.53	4.39
8	0.81	87.57	7.45	4.96
9	0.83	84.55	10.19	5.25
10	0.85	81.13	13.56	5.30

Source: Computed by Author.

Below is Table 23 which shows results of the variance decomposition of the Financials Index (FIN) for Scenario 4: where FIN is a proxy for Stock Prices (SKP). The table suggests that in the 3rd month, the own impulse shock of the financials index was about 89.96 per cent. The innovation/shock of the financials index also bring about a 9.97 per cent change in exchange rates and a 0.06 per cent fluctuation in oil prices in the short run. In the long run, the own impulse shock of the financials index accounted for about 90.26 per cent. Moreover, the shock of the financials index also causes a 5.28 per cent fluctuation in exchange rates and a 4.45 per cent fluctuation of oil prices. This implies that a shock to the financials index considerably affects the exchange rate in the short run rather than in the long run.

Table 23: Variance Decomposition of FIN.

Variance Decomposition of FIN:				
Period	S.E.	EX	FIN	OP
1	0.532829	10.81641	89.18359	0.000000
2	0.699397	10.80281	89.14513	0.052062
3	0.825924	9.974779	89.96200	0.063221
4	0.926923	9.057658	90.65959	0.282751
5	1.013092	8.190054	91.06280	0.747142
6	1.088712	7.416823	91.18981	1.393372
7	1.156086	6.746166	91.11100	2.142833
8	1.216599	6.173683	90.89586	2.930459
9	1.271226	5.689929	90.59970	3.710372
10	1.320715	5.283776	90.26290	4.453319

Source: Computed by Author.

The variance decomposition of oil prices for Scenario 4: where the Financials Index (FIN) is representing Stock Prices (SKP) is presented in Table 24 below. The table suggests that in the short run, an innovation/shock of oil prices brings about a 3.48 per cent fluctuation in the financials index in the Short run and a 12.55 per cent fluctuation in the financials index in the long run. This indicates that a shock to oil prices noticeably affects the financials index in the long run rather than in the short run. An innovation/shock of oil prices also causes an 8.66 per cent variation in exchange rates in the short run and about 5.68 per cent fluctuation in exchange rates in the long run. The own impulse shock of oil prices was about 87.87 per cent in the short run and accounted for about 81.82 per cent in the long run.

Table 24: Variance Decomposition of OP.

Variance Decomposition of OP:				
Period	S.E.	EX	FIN	OP
1	4.848460	7.372231	0.776274	91.85149
2	7.856196	8.763172	3.756901	87.47993
3	9.723787	8.656079	3.478456	87.86546
4	10.90359	8.080522	2.827687	89.09179
5	11.68060	7.428480	2.616107	89.95541
6	12.22799	6.859857	3.172414	89.96773
7	12.64700	6.415812	4.562814	89.02137
8	12.99728	6.084009	6.703886	87.21211
9	13.31386	5.833813	9.431382	84.73481
10	13.61661	5.633900	12.54904	81.81706

Source: Computed by Author

6.8. CHAPTER SUMMARY

This chapter presented the estimations and findings based on the methodology. Concisely, a VAR model was estimated to study the relationship between the (OPEC) oil prices, Rand/Dollar exchange rate and the various sector stock prices. These sectors include data of the all share index, the resources index, the industrials index, and the financials index as the proxy for stock market. The Augmented Dickey–Fuller test (ADF), Phillips–Perron test (PP) and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root tests all concluded that oil prices, stock prices and exchange rate were individually non-stationary in level form, but stationary at first difference. The optimal lag length of two was selected and used for the construction of the VAR model.

The Johansen co-integration test was employed for this study. The Johansen test is recommended for this study because the test is used for more than one cointegrating relationships and is more reliable when using large data samples. The Johansen test results suggested that there is no long-run or short run relationship for all scenarios between exchange rates, stock prices and the oil price.

The granger causality test was employed for scenario 1, 2, 3 and 4, where stock prices is represented by the all share index, resources index, industrials index and financial index respectively. The results are consistent with the asset market approach. This approach suggests that there is a weak or no correlation between both variables. This approach suggests that stock prices and exchange rates may be driven by other factors. The test found that, the all share index, resources index, industrials index, financials index have a weak effect on exchange rates. Inversely, the exchange rate has no influence on the all share index, the resources index, the industrials index, the financials index. Oil prices do not cause exchange rates. Exchange rates have a weak effect on oil prices and lastly, oil prices have a weak a relationship with the all share index, the resources index, the industrials index, and the financials index.

Furthermore, the granger causality test also found that, the industrials index also has a weak correlation with oil prices, however the all share index, the resources index, the financials index does not cause oil prices. Therefore, the all share index, resources index, and the financials index are significant variables to explain oil prices. This result is consistent with the business cycle view, which states that oil price fluctuations are mainly driven by demand factors. The view further explains that, strong world output growth trends, could result in an upward surge in oil prices especially in emerging markets.

The impulse response functions revealed that exchange rates have a negative variation with the all share index, resources index, and the financials index in the short run period, but the variation become positive in the long run period. However, exchange rates have a positive correlation with the industrials index. The all share index, the resources index had a negative variation to exchange rates in the short run period, but the variation becomes positive in the long run period.

However, the industrials index has a positive variation to exchange rates and the financials index has a negative variation to exchange rates. The impulse response functions also found that, if there is one standard deviation shock to the residual of exchange rate or oil prices, the shock causes a negative response of oil prices or exchange rates subsequently throughout the short and long run period. The all share index, the resources index, and the financials index have a positive variation to oil prices throughout the short run and Long run period. However, the industrials index has a negative variation to oil prices. Lastly, the oil prices have a positive variation to the, all share index, industrials index, resources index, and financials index in the short-run but the variation becomes negative in the long run period.

The variance decomposition showed that a portion of the exchange rate can be explained by changes in the oil prices, the resources index, and the financials index in the long run. The financials index also considerably affecting the exchange rate in the short run. A unit shock to the all share index and the industrials index considerably affects the exchange rate in the long run. Moreover, a shock to the resources index significantly affects the oil price in the long run. The results also indicate that, oil prices significantly affect the exchange rates, or all share index, and the resources index in both the short and long run. However, oil prices notably affect the financials index only in the long run.

Lastly, the own shock of oil prices in both the short run and long run was low, this suggests that there are other factors other than those originating from the oil market which significantly affect the oil price. These finding are in-line with the granger causality test findings. The following chapter of this study will present an overview of all the findings is this study, conclude the study as well as makes recommendations based on the findings.

CHAPTER SEVEN

SUMMARY, CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

7.1. SUMMARY AND CONCLUSION

This study examined the empirical relationship between the OPEC oil prices, Rand/US Dollar exchange rate and the stock prices for the various sector indexes namely (The JSE All Share, JSE Resources, JSE Industrials, and JSE Financials Index) of South Africa. The study covers the period from 1 January 2011 to 1 April 2018. This research started by presenting an introduction, a problem statement, the objectives and motivation of study, as well as the scope of study. The study then discussed the historic considerations and trend overview of the oil market, the exchange rate in South Africa and the stock market of South Africa. The study then presented the general theoretical literature concerning the prevailing views and the pricing models that determine oil prices, exchange rates and stock markets. The methodology of the research was then discussed, and the results were presented.

There are five major oil price shocks that considerably affected the global price of oil in the post-war era. The price shocks have occurred particularly during the global oil crises of 1971-74, 1979-80, 1990, 2003-06 and the economic developments of 2014 to 2016 (Planet Energies, 2011:1). This prompted many central banks including the South African Reserve Bank (SARB) to initiate an interest rate tightening cycle (Wakeford, 2006:15). Fin24, 2014:2 reported that nearly half (45 per cent) of oil imports to South Africa come from Saudi Arabia. A further 23 per cent comes from Nigeria, 18 per cent from Angola, 4 per cent from Ghana, and the remaining 10 per cent from other sources. Therefore, this study employs the OPEC oil price benchmark data over the WTI and Brent oil price benchmark data.

This study also explained that Post 1994, South Africa’s exchange rate regime that has evolved from being fixed, to managed floating and finally to free floating in the year 2000. Since the early 1980’s the Rand has been quite stable, but the general trend over the past decades has seen the rand weaken. However, the Rand has also experienced periods of strengthening especially after significant major blowouts in 1985, 1998, 2002, 2008, 2013 and 2015.

The South African stock market was also examined, and the study found that the stock market had a significant impact on the South African economy. The stock market of South Africa is worth almost twice the country's gross output at 187 per cent larger, only exceeded by Hong Kong at 908 per cent and Singapore at 217 per cent larger.

There has not been much movement in terms of which companies make up the top 25 of the all share index since 2013, with the likes of British American Tobacco, BHP Billiton, Richemont and Naspers retaining their titles as SA's biggest companies. The South African banking sector as well is highly concentrated, with four banks accounting for over 80 per cent of total banking assets (Standard Bank, Capitec, ABSA Bank and First National Bank). The South African telecommunication market is also dominated by four companies since 2011 namely, Vodacom with about 42.1 per cent of the entire market share, MTN 34.9 per cent, Cell C 17,3 per cent and Telkom with 4.5 per cent. This is a sure sign of concentrated dominant market power in the South African economy (JSE, 2013).

The study adopted a VAR model to determine causality between these financial variables. The Johansen Co-integration test was employed to investigate the existence of a long run relationship among these variables. Furthermore, an impulse response function and variance decomposition were employed to show the effects of shocks of one variable on the adjustment path of the other variables and to show which of the independent variables is stronger in explaining the variability in the dependent variable over time.

The Johansen test found no long-run relationship existing in the model between exchange rates, oil prices and the stock market prices for all the scenarios: where stock prices were proxied by, the JSE All Share Index, JSE Resources Index, JSE Industrials Index, or the JSE Financials Index.

The granger causality test in VAR model had two major findings. The first one was that, there exists a weak correlation between the exchange rate and the various stock price indexes. Moreover, oil price has no influence on exchange rates and the stock prices. These results are consistent with the asset market approach. This approach suggests that stock prices and exchange rates may be driven by other factors because they have weak correlation.

The second major VAR granger causality test finding was that, the all share index, resources index, and the financials index have a correlation with oil prices. Therefore, stock prices are a significant variable to explain oil prices with stock prices leading the oil prices in South Africa. These results are consistent with the business cycle view, which states that oil price fluctuations are mainly driven by demand factors and strong world output growth trends, especially in emerging markets it could result in an upward surge in oil prices.

The impulse response functions revealed that, exchange rates have a negative relationship with the stock prices namely, the all share index, resources index and the financials index in the short run period but the relationship becomes positive in the long run period. However, exchange rates had a positive correlation with the industrials index in both the short and long run. The oil prices and the exchange rate had a negative correlation throughout the short and long run period. Moreover, the all share index, resources index and the financials index had a positive variation to oil prices throughout the short run and long run period. However, the industrials index has a negative influence on oil prices. The type of relationship between these variables is important especially for forecasting and predicting future crises before they happen, thereafter implement policies to eliminate or minimise the impact of a crises.

Considering the generalized variance decomposition outcomes, the results showed that a significant portion of exchange rates can be explained by changes in the oil prices, resources index and the financials index in the long run. The financials index also considerably affects the exchange rates in the short run. A shock to the all shares index, the industrial index considerably affects the exchange rates in the long run. Moreover, a shock to the resource index significantly affects the oil prices in the long run. Lastly, a shock to oil prices significantly affects the exchange rate, the all share index, and the resources index in both the short and long run and oil prices considerably affects the financials index only in the long run.

7.2. POLICY IMPLICATIONS AND RECOMMENDATIONS

The results of these tests have implications for business, researchers and government. For government, rising energy prices have a significant impact on the South African economy especially for the exchange rate and the resources sector. These energy price fluctuations have, for instance, the potential to undermine the government's attainment of the economic growth target (National Treasury, 2016:2). The South African Reserve Bank (SARB) also considers oil price movements to be one of the major threats to currency volatility and the continued attainment of its inflation targets of about (3-6, per cent), as evidenced by numerous statements by its monetary policy committee (SARB, 2016:5-13).

For researchers, the study shows that the performance of the stock prices and exchange rate also explain oil prices because of demand factors. Therefore, stock market prices and the exchange rates need to be considered in modelling oil prices. Findings in this study add to the already largely debated theories that seek to explain the relationship of these financial variables. Investment bankers or fund managers who trade these instruments, may have to consider the role of the oil prices in their models for forecasting the path of the stock prices in the different sectors and the Rand/US Dollar exchange rate.

7.3. POSSIBLE AREAS FOR FURTHER RESEARCH

In conclusion, this study has managed to investigate the relationship between oil prices, exchange rate and the various sector stock prices of South African in the specified time framework. However, future studies on this notion could be improved by using daily or weekly data as opposed to monthly data to better capture the dynamics of the interaction between the exchange rate and stock prices for the South African economy. In future, more studies for developing countries must be done because most literature relating to this topic is mostly on developed countries and this makes comparing pervious finds of developing countries a challenge.

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