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# Crude oil shocks and stock returns in African stock markets.

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**MASTER OF MANAGEMENT IN FINANCE AND INVESTMENTS**

**A RESEARCH REPORT ON**

# Crude oil shocks and stock returns in African stock markets.

Submitted to

Wits Business School

University of the Witwatersrand

Johannesburg, South Africa

Submitted by:

Precious Adaku Enwereuzoh

April 2019

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**ABSTRACT**

Considering that Africa's energy consumption per capita is growing faster than those of most continents in the world, driven by improved infrastructure and inflow of investment which have made Africa a major player in the international oil market, the need to study the impact of changes in oil prices on the stock market is of great importance. The stock Market is important as it acts as an economic barometer and reflects activities in the economy. The study investigates the impact of crude oil shocks on selected African stock markets. The countries selected are classified into two; with Nigeria, Tunisia, and Egypt as net oil-exporters, and Botswana, South Africa, Kenya, and Mauritius as Oil-importers. Using a Structural Vector Autoregressive model and a two-state regime Markov-switching framework, the study analyzed the impact of crude oil shocks on real stock returns over the period January 2000 to July 2018 at monthly frequency. Empirical findings from the study suggest that oil supply shock is statistically insignificant for most countries with the exception of Kenya; oil demand shock is positive in at least one regime for all countries and oil specific shock is statistically significant for oil-exporters with Nigeria having a negative impact on their stock returns, Tunisia having a negative and positive impact at different regime and a positive impact for Egypt. For oil-importers, oil specific shock has a positive impact on the stock returns of all countries except for Kenya. The findings from this study has important implications for investors whose portfolio may comprise of asset from African stock markets and crude oil. Given the phenomenal importance of oil in the global market one would typically avoid equities that suffer from its shock. This study provides the indicators to inform that decision.

## DECLARATION

I, Precious Enwereuzoh, with student Number: 1776186, declare that this research report is my own work except where indicated in references and acknowledgments. It is submitted in partial fulfillment of the requirements for the degree of Master of Management in Finance and Investment at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination in this or any other university.

Signature:……

Precious Enwereuzoh

Signed at…….. on the ……day of …….2019

**DEDICATION**

To

God Almighty,

My husband: Mr. Uzochukwu Enwereuzoh

And

My angel: Chizaram Elsa Enwereuzoh

## ACKNOWLEDGEMENTS

**To God Almighty**, the source of my strength, inspiration, wisdom, knowledge, and understanding, **I give you my humble and sincere appreciation**.

My utmost gratitude goes to my supervisor, Dr. Jones Odei Mensah, whose priceless support has been with me all through the period of this research project. His patient, contribution and constructive criticism pushed me to put in as much effort as possible to see that my work is as original as possible. I have experienced true research and my knowledge on the subject matter has broadened due to his effort. Thanks, Dr.

My unquantifiable thanks go to my irreplaceable family, My Hubby Uzochukwu Enwereuzoh, for his love, support and encouragement to see that I complete that which I started, and my adorable Daughter Chizaram, You all are superb. Thanks for believing and sticking with me throughout the entire program. You endured my late nights and reduced attention. May your blessings know no bounds. To my ever-loving parents, Mr. and Mrs. E.E Obi who laid a solid foundation in my life that has shaped me to what I am today, thank you for your unfailing love, prayers, support, and encouragement. You both rock my world. To my siblings, Kachi, Onyie, Ezinne and Obinna, your love and prayers kept me going and I am eternally grateful. My parent-in-law, Mr. and Mrs. C.C Enwereuzoh, I could not have wished for a better second family. Thanks for your love, prayers, support, and encouragement. You are the best. Special thanks to my in-laws, Lampard, Chichi, Neka, Nma, Uche, Kaka, and Ozioma, your encouragement was endless. God bless you all. This accomplishment will not have been possible without you all.

To great friends that turned family, how can I forget you? A special thanks to Peterson Owusu Jnr for his guidance, assistance, and encouragement during the course of my research. You are indeed God-sent and I appreciate all your effort. Dr. Euphemia Akpomiemie, Dr & Mrs. Bodurin, Dr & Mrs. Onifade, Onyekachi Anyanwu, Nana, Maurice, You all played a large role in prolonging my ‘agony’ with your encouragement and support. Endlessly blessings I pray for you all.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of Study

Among the number of factors countries depend on to achieve sustainable growth, oil plays an integral part, be it an oil-producing or oil-consuming Country. Oil is a basic global commodity due to the important role it plays in the industrial, transportation, residential and commercial sectors of an economy. This is why most economies are concerned about oil price fluctuations and monitor the Organization of the Petroleum Exporting Countries (OPEC) and large oil producing countries closely to check levels of production as it contributes largely to the determination of oil prices.

Within the past 45 years, there has been an unstable price movement in the oil market which has attracted the attention of researchers, policymakers, investors, media houses and the general public. A large body of literature has investigated the impact of oil prices on different macroeconomic variables including inflation, the balance of trade, employment rate, economic activities, among others, using different samples and estimation methods. (See Berument, Ceylan, & Dogan 2010, Cunado & Gracia 2005, Papapetrou 2001, Zhao, Zhang, Wang, & Xu 2016) using different samples and estimation method.

It took over a decade for studies to emerge on the effect of Oil price shock on the stock market. Particularly, the seminal paper by Jones and Kaul (1996) and Huang, Masulis, and Stoll (1996) captured the interest for further research on this study. While Jones and Kaul (1996) finds a negative impact of oil price shocks on stock markets using the standard dividend model, Huang et al. (1996) find no evidence in support of Jones and Kaul (1996) findings. Literature has shown that Oil price shocks have a dominant impact on financial variables, such as; stock returns and exchange rate ( see Syed Abul Basher, Haug, & Sadorsky 2016, Ciner 2013, Cunado & Gracia 2014, Abhyankar, Xu, & Wang 2013, Elyasiani, Mansur, & Odusami 2011, Huang, Masulis, & Stoll 1996, Jones & Kaul 1996, Kilian & Park 2009, Nandha & Faff 2008, Papapetrou 2001, Sadorsky 1999). There is evidence that it can also be used to make economic forecasts ( Cunado & Gracia 2014).

Although there is a wide range of research on the impact of oil price shocks on stock market returns, the results have been inconclusive. Several studies have used the traditional linear and asymmetric model of oil price shock treating oil shocks as an exogenous supply side of the crude market and ignoring the cause and effect of each shock on the stock market. Moreover, most of the studies on oil price shocks and stock markets were conducted on developed economies. There are limited studies on emerging economies (Asia, Middle East, Latin America, and BRICS countries). Studies on African countries remain relatively sparse. This is despite the fact that Africa is home to emerging and frontier markets which heavily rely on crude oil and its derivatives. With its developing markets, Africa has become a major player in the international market making it important to study the relationship (or lack thereof) between oil prices shocks and African stock markets.

Guided by the work of Kilian & Park (2009), which reveals that financial markets react differently depending on the source of oil price shocks, this study investigates if the same is applicable in the African context. Oil shock is decomposed into aggregate demand shock, precautionary demand (oil-specific) shock, and supply shocks; treating it as an endogenous variable and investigate its impact, using Markov-switching model, on selected African Emerging and Frontier markets. To the extent that such a study on African countries lacks in the extant literature, the importance of this study cannot be overemphasized.

The Financial Times Stock Exchange (FTSE) Russell defines an emerging market as a market that has become increasingly investable, is large in size and less illiquid as compared to the Frontier market. African countries in this category and selected for our study are South Africa for Advanced Emerging Markets, Egypt among the Secondary Emerging Markets, and for the Frontier markets, Nigeria, Botswana, Kenya, Mauritius, and Tunisia are selected ( FTSE Russell,2018). Countries selected satisfy three main concerns. Firstly, the study is related to the African continent, which has not been extensively studied in the past. In addition, the study allows for a thorough comparison of the responses of stock markets to oil price shocks as the market is distinguished between two samples; oil-importers (Nigeria, Tunisia, and Egypt) and oil-consumers (South Africa, Botswana, and Mauritius). This study also considers large markets from regional blocs.

African countries are known for their high dependence on the importation of finished goods due to the limited number of manufacturing companies and their dependence on oil and other

commodities in the global market. An increase in the price of oil mounts upward pressure on exchange rate as oil is priced in hard currency and this will increase inflation. Oil price shocks affect African markets through its cost effect on production which leads to an increase in the cost of finished goods.

It is important to note that African stock markets have become attractive to potential investors to invest due to their high growth rate and relatively low integration with the global market. The markets have also yielded a great deal of return in the past.

This study contributes to the existing literature on the impact of Oil Price shocks in African emerging and frontier stock Markets. It serves as a guide for both domestic and international investors, market participants and policy-makers in making investment decisions.

### 1.2 Problem Statement

There is an extensive literature that investigates the impact of Oil price shocks on the stock market. Most of these studies focused on developed countries, to mention a few Basher, Haug, and Sadorsky (2018), Cuñado and Gracia (2003), Diaz, Molero, and Gracia (2016), El-Sharif, Brown, Burton, Nixon, and Russell (2005), and Kang, Ratti, and Vespignani (2016).

Considering how fast stock markets are developing in emerging economies and their involvement in the international oil market, studies have examined the impact of oil price shocks on their stock markets. Most of these investigations were on the Asian, Middle East, Latin America and the BRICS economies, the likes of Cong, Wei, Jiao (2008), Fang and You (2014), Ghosh and Kanjilal (2016) are about a few to mention, leaving a gap in the literature on Africa. This study fills the gap by examining the relationship for selected African countries (oil-exporters and oil-importers) with current data.

The study examines the impact of oil price shocks; disentangling the shocks described by Kilian and Park (2009) using the Structural VAR approach and the Markov-switching model to investigate the nonlinear relationship between oil price shocks and African stock returns.

This study contributes to the literature on the impact of Oil price shocks on African stock markets, with stock markets from regional blocs and serves as a guide to institutional and individual investors interested in African markets in making investment decisions.

## 1.3 Objectives of the study

The study achieves the following objectives:

- Disentangle oil price shocks into demand and supply shocks
- Examine the impact of different oil price shocks on stock returns.
- Investigate if the linkage is the same for oil-importing and Oil-exporting economies

## 1.4 Research Questions

Consistent with the research objectives, this research answers the following questions

- How important are oil price shocks to the financial markets?
- Do all stock market respond similarly to specific oil price shock?
- Are the linkages between different oil price shocks and stock market the same for oil importing and oil exporting countries in Africa?

## 1.5 Oil Price fluctuations

Before the 1970s, the price of Oil was relatively stable. The first major Oil crisis began in 1973, which was identified as the first Oil price shock. Degiannakis, Filis, and Arora (2017) defines Oil price shock as the difference in the expected price of oil due to an unexpected change in oil market basic principles (i.e. the demand and supply of oil).

It is a widespread belief that the source of the 1973 crisis was political instability (which disrupted Supply of oil) in the Middle East that resulted in an embargo by the Organization of Petroleum Exporting Countries (OPEC) on the industrialized Countries (United States, United Kingdom, Canada, Portugal, Netherland, Japan, South Africa) supporting Israel during the Yom Kippur war. OPEC has such authority to influence the global supply of oil considering OPEC countries hold a large percent of the World's oil reserves, and there was a high dependency by industrialized

Countries on the importation of oil to increase production after World War 11(Hamilton, 1983a). A simple demand and supply model in figure 1 will help understand the changes in oil prices.

By the end of the trade ban in 1974, the price of oil had quadrupled from US$3 per barrel to US$12 per barrel due to a left shift in supply.

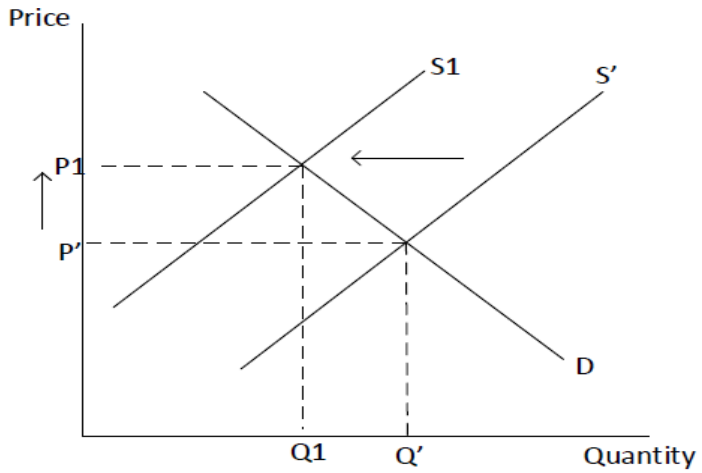



**Figure 1: A decrease in the supply of Oil**

Within the same period economic activities were on a decline in the United States as real Gross Domestic Product (GDP) fell by 1.8 percent, there was a twofold increase in inflation and an increase in the rate of Unemployment, leading to a recession(Hamilton, 1983b). This compelled Hamilton, one of the early researchers, to investigate if it was just a coincidence or whether indeed oil price has a significant impact on the US economy. From his findings, Oil price shocks did contribute to 4 out of 5 of the U.S recession(Hamilton, 1983a).

1978-80 represents the second Oil price shock. The cause of the shock was related to the Middle East, similar to the first one, but OPEC was not involved. There was an Iranian revolution, and a war between Iran and Iraq disrupted the production of Oil. Speculations were high that there would be further disruption in the supply of oil; this increased hoarding behavior, which led to a hike in oil price to about US $103.76 per barrel (Van der Merwe & JH, 1990). The graph above explains the effect of the cut in supply on the price of oil.

In 1985, Saudi Arabia, a major oil-exporter went against OPEC restriction on the production and increased their supply of oil to increase its market share. This action led other OPEC members to increase their production as their revenues began to decline. Prices plummeted to about US$22 per barrel in 1986 owing to excess supply as seen in figure 2.

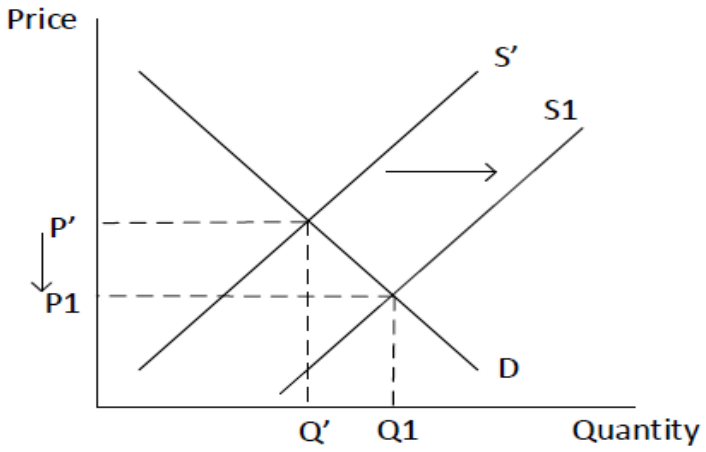



**Figure 2: Increase in supply of Oil.**

There was yet another shock in 1990 caused by Iraq's invasion in Kuwait. The price of oil doubled from US$17 per barrel to about US$35 per barrel in October 1990. Although the hike in price was for a short time as sentiment calmed in the oil market and the price of oil dropped to about US$20 per barrel due to the intervention of the US and allied military forces deployed to defeat the war (Wakeford, 2006). Within the same period, most industrialized countries were undergoing severe recession that reduced their demand for oil, further contributing to the reduction in the price of oil. Figure 3 displayed below shows the effect of a decrease in demand on the price of oil.

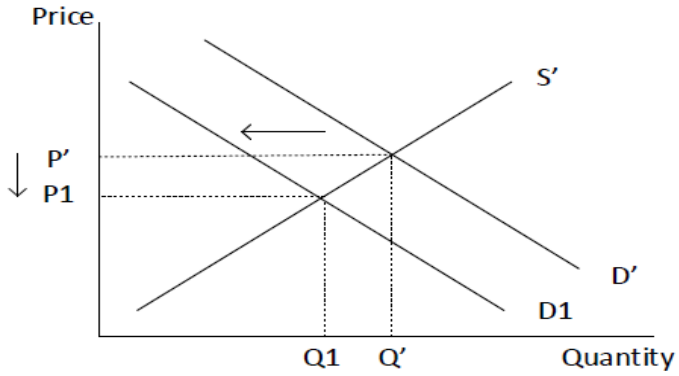



**Figure 3: Decrease in demand for Oil**

There was another decrease in the price of oil in 2001; this was due to the decline in economic activity in the US and a constant increase in production by OPEC and non-OPEC countries. From the period of 2003- 2006, there was a disruption in the supply of oil due to various factors from different parts of the world. There was a conflict between Iraq and the United States, pipeline vandalization in the Niger Delta part of Nigeria, leaking pipeline that lead to its closure in Prudhoe Bay field in Alaska in August 2006. All of these led to a decrease in the supply of crude oil; also, the increase in demand from Asian countries due to economic expansion contributed to the hike in the price of oil. Exhibit 1 explains the effect of the shift in supply. Oil prices rose from US$25 in 2003 to US$78 per barrel in 2006.

The Arab spring in the Middle East and North Africa in 2010 led to a spike in the price of oil to about US$117 per barrel due to a cut in production caused by political instability. The Global Financial Crisis of 2007-2008 led to another surge in the price of oil owing to speculations of a decline in supply in the future market and diminishing demand. In 2009, the price of oil rose from US$60 per barrel to US$145 per barrel which was the highest in the history of Oil price. In 2014 to 2015, oil had lost about 75% of its worth within a short space in time. This was caused by the reduction in the growth of countries that were experiencing economic expansion which led to a massive decline in demand for oil.

Empirical analysis has shown that several factors affect the stability of oil prices; from political events of the oil-producing States which affects the production of Oil (Supply shocks) (Hamilton

2003), to the increase ( decrease) in demand caused (demand shocks)( Kilian 2009). Kilian (2009) further divides the demand shocks into;

- The aggregate demand shock: An increase in the demand for oil will spike the price given that there is no increase in quantity supplied. The effect of this will reflect on both the consumers and producers behavior leading to a reduction in disposable income for consumers and a decrease in the profitability of firms for producers (Basher & Sadorsky, 2006)
- The precautionary demand shock: This is the demand due to speculations in the futures market that there might be a shortage of oil supply leading to high demand for oil now as a precautionary measure against the future hike of oil. This further pushes oil prices upward.

According to Park and Ratti (2008), if oil price shocks affect the behavior of consumers and producers, then it should be reflected on the stock market as it serves as an economic indicator which represents the strength of an economy.

### 1.6 Theoretical relationship between Oil Prices and the Stock Price

There are several transmission mechanisms by which Oil prices can affect the stock market. Below are the channels through which oil prices affect the Stock Market.

- **Stock Valuation Channel**

  The link between Oil prices and stock returns can be explained extensively in the Stock valuation method. The stock return is expressed as the log difference in the equation below

$$\text{SR}=\log\left(p_{m,t}\middle|p_{m,t-1}\right)$$

  where Pm is the stock price of firm m at period t. Economic theory states that stock price is the sum of all discounted cash flow. The Discounted Cash Flow (DCF) uses future expected cash flow and discounts it using the discount rate to determine the present value of a firm. Thus, any movement in the expected cash flow or the discount rate will affect the stock price of a firm (Huang et al., 1996).

$$p_{m,t} = \sum_{n=t+1}^{N} (E(CF)|1 + E(r))$$

Oil price changes can affect the expected cash flow of a firm positively or negatively depending if the firm is an oil-consumer or producer (Mohanty, Nandha, Turkistani, & Alaitani, 2011). Oil is seen as a major input in the production process and a primary source of energy ( in the production of electricity and heat); an increase in the price of oil will lead to higher energy prices, an increase in the cost of production leading to a decline in the profitability of the firm for an Oil consuming firm, thereby affecting expected cash flow (Basher & Sadorsky 2006, Degiannakis et al. 2017). For Oil producing firm, an increase in oil prices will increase the firm's profit margin, thereby increasing the future expected cash flow. Firms in this category exhibit a bearish behavior in terms of an increase and a bullish behavior when there is a decrease in oil prices.

- **Monetary Channel**

Oil Prices can also affect stock prices through expected discount rates (Huang et al. 1996). This is the rate of return used to discount all future cash flows. It is composed of expected inflation and expected interest rate (Mohanty et al. 2011). Oil is priced in hard currency making an increase in oil prices to depreciate the exchange rate, leading to an increase in inflation. Also an increase in oil price will affect inflation due to its increase in the cost of production; the cost is further passed to consumers of the output putting upward pressure on inflation. The rate of inflation has a positive correlation with the discount rate and a negative correlation with the stock market. To curb inflationary pressure, central banks, where credible, will increase short-term interest rates, leading to an increase in discount rates and a decrease in investment. The increase in discount rates will reduce the values of Stock prices.

- **Fiscal channel**

This channel particularly concerns oil-exporting economies. The rise in the price of Oil for an Oil-exporting country will lead to an increase in government expenditure due to the transfer of wealth from Oil consuming economies. Oil revenues can be used to finance physical and social infrastructure (Emami & Adibpour 2012). In conditions where consumption and government

expenditure complement each other, then this will lead to an increase in household consumption and cash flows of private firms should increase and thus their profitability, bringing stock prices to a high level.

In the condition where consumption and government expenditure are substitutes, the reverse will be the case as it will lead to a downturn in the stock market due to crowding out effects.

- **Uncertainty channel**

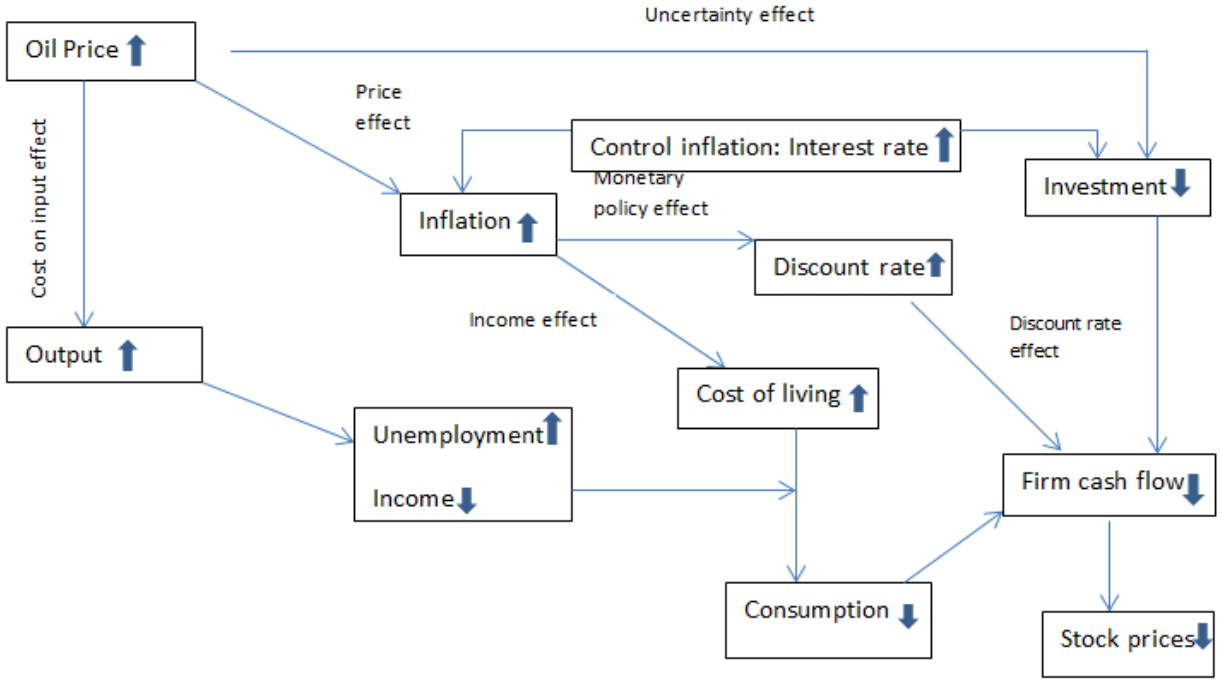
Another transmission channel as suggested by Brown & Yücel (2002) is the Uncertainty channel. Due to the effect of an oil price increase on inflation, exchange rate, output, and consumption, it will further lead to higher uncertainty of investment for firms which reduces expected cash flows and a reduction in the consumption pattern of consumers in the real economy. Due to the high rate of uncertainty concerning the future, consumers would prefer to save rather than consume durable goods, thus dampening stock returns (Edelstein & Kilian 2009).

- **Output channel**

The fifth transmission channel of oil price shocks is on Output. Studies have shown that oil price shocks ( positive shock) affect aggregate output through income and production cost (Hamilton, 1983a 2009, Kilian 2009).

A rise in the price of oil will worsen the terms-of-trade for an oil-importing economy, which will lower income and reduce consumption, and further lower aggregate demand. The effect of this on the stock market is that the reduction in consumption will lower expected cash flows, which will lower stock prices. Put another way, an increase in oil prices will reduce the disposable income of a household, due to the cost effect on production, which is reflected on the price of the output and the increase in the price of heating oil and gasoline. This will lead to lower consumption from the household and less demand for labor from firms.

The effect of oil price shocks on aggregate output depends on whether the economy is an oil-importer or oil-exporter. For an oil-exporter, the effect remains the same on production as the cost of production will increase, but the rise in oil prices will have a positive income effect due to its increase in oil revenues, leading to an increase in demand and higher output.




**Adapted from** Degiannakis et al. 2017, Tang, Wu, and Zhang (2010)

**Figure 4: Transmission channels of oil price shocks**

### 1.5 Delimitation of Study

The study covers a sample period from January 2000 to July 2018. Countries for the study are selected based on the size of the market from each regional bloc. Also considered are top oil-exporters and oil-importers in Africa. The countries are Tunisia, and Egypt (oil-exporter), for Northern Africa, Nigeria (oil-exporter) for western Africa, South Africa, Botswana and Mauritius for southern Africa (all oil-importers) and Kenya (oil-exporter) for East Africa.

### 1.6 Limitation of Study

The time period covered in this research is short even though current and only one country is used as a representative of West Africa due to availability of data. There are over fifty-four countries in Africa, and this study covers only seven from this continent which limits how the work will be generalized as it is not representative of all oil-exporting and oil-importing countries in Africa.

# CHAPTER TWO

## LITERATURE REVIEW

There are several studies in the literature that have empirically studied the relationship between oil price shocks and macroeconomic and financial variables since the first oil price shock in the 1970s.

This chapter summarizes previous work in the relevant literature on the effect of oil price shocks on the stock market. Most studies have identified the importance of oil prices when trying to understand variation in stock prices; still there has been no consensus among researchers and economists. There has been evidence of mixed results from empirical findings with particular reference to developed and emerging market economies.

### 2.1 Effect of Oil price shocks on aggregate stock returns

Among early research is the seminal work of Jones and Kaul (1996). They investigate the reaction of the stock market of the United States, Canada, Japan, and the United Kingdom through changes in real cash flow or expected returns on changes in oil price. Using the standard dividend model, with quarterly data ranging from 1947 to 1991, from their empirical findings, an increase in oil price affects the stock market of Canada and the United States through its real cash flow. For the United Kingdom and Japan, an innovation in oil prices causes a large change in stock prices than changes in real cash flow. In conclusion, an increase in oil prices has a significant negative impact on stock market returns.

Contrary to the above findings, Huang et al. (1996) use the multivariate vector autoregressive (VAR) approach with daily data spanning 1979 to 1990, the authors examine the impact of oil price shock on the U.S financial market. They conclude that changes in oil prices affect specific individual oil companies but find no relationship between oil prices shocks and stock market return.

Sadorsky (1999) investigate for OECD Countries, using a VAR model for estimation with monthly data covering the period from January 1947 to April 1996. The author finds that oil price has a significant negative impact on the stock returns for countries studied. His findings are in

accordance with Jones and Kaul (1996). Furthermore, he finds that changes in oil prices have an impact on economic activities.

More recently, Nandha and Faff (2008) used standard market model augmented by oil price factor to investigate the impact of an oil shock on stock returns using global equity indices. They find that oil price shock has a negative impact on stock returns of all sectors except for the mining and oil and gas sector.

Diaz et al. (2016) study the relationship between oil price volatility and the stock returns of G7 countries, using the VAR model with monthly sample period from 1970 to 2014. The authors find that the stock markets react negatively to an increase in oil price volatility and that world oil price volatility is highly significant for stock markets as compared to the national oil price volatility.

Zhang (2017) uses Multivariate time series with stock market indices of six major markets in the world and finds that oil price has a significant impact on the stock market but occasionally with large shocks of great importance to the market.

Studies in emerging economies have provided mixed results with most studies on Asian, Middle East, and Latin American countries, leaving a gap for markets in Africa.

Maghyereh (2004) empirically investigates the impact of oil price shocks in 22 emerging stock markets using a Generalized VAR approach. Results from the findings suggest that oil price shocks do not have a significant impact on stock index returns in emerging economies. The result supports the findings that stock returns in emerging economies do not rationally indicate shocks from the oil market. In the work of Cong et al. (2008), they investigate the effect of oil shocks on China's financial market using the multivariate vector regressive model. They find that oil price shocks have a negative and statistically significant impact on the real stock returns of most of the indices except for some oil companies and manufacturing index. Additionally, an increase in oil price volatility raises speculations of the mining and petrochemical index which further leads to an increase in their stock returns.

Ono (2011) used the VAR approach to study for the BRIC economies and finds that rise in oil price has a positive and statistically significant impact on the real stock returns for Russia, India, and China, while for the case of Brazil, the result shows no significant relationship between oil

price shocks and their stock market. More so, the asymmetric effect of an oil price increase and decrease proves to be statistically significant for India, and that a rise in oil prices contributes largely to the volatility of real stock returns in China and Russia.

In contrast to the above findings, Fang and You (2014) used the Structural VAR approach for their estimation and finds mixed results for China, India, and Russia stock markets. In the case of India, they find a negative effect of an oil price shock on the stock market when the shock is not driven by an increase in oil consumption. For Russia, a rise in oil price driven by Russia oil-specific supply shocks has a positive impact on their stock market and for China; the empirical result suggests that global oil demand shock has no significant impact on stock returns and a negative impact from China oil-specific demand shocks.

To capture the short-run and long-run asymmetric effect of oil prices on the stock market Raza, Shahzad, Tiwari, and Shahbaz (2016) empirically investigate the effect of oil price shocks on the stock markets of China, India, Brazil, Russia, South Africa, Mexico, Malaysia, Thailand, Chile, and Indonesia. Their findings suggest that an increase in oil price has a negative impact on all markets of study. Furthermore, oil price volatility has a negative effect both in the short-run and long-run. They support their findings with the view that stock markets in emerging economies are highly sensitive to bad news and event.

### 2. 2 Oil–importing economies and Oil-exporting economies

With a vast body of literature that has examined the effect of oil price shocks on a stock market, only a few have categorized their study on the impact of oil price shocks on the stock market of oil-importing and exporting economies. The difference in empirical result stems from the origin of oil price shocks, the non-linear relationship between oil price shocks and stock returns if an asymmetric effect is present and the condition of the stock market (whether bullish or bearish). There exists a common relationship when gathering results from the literature; the findings are that an increase in oil prices or increases in the volatility of oil prices both have an asymmetric effect on the stock market depending on the economy. Economic theory holds that increase in the price of oil will have a negative impact on the stock market of oil-importing countries due to its cost-effect implication, and a positive impact on the stock market of oil-exporting countries due to the

transfer of wealth from oil-consuming countries to oil-exporting countries. The extent to which oil price shocks affect the stock market depends on two basic factors, the origin of the shock and the state of the stock market.

Apergis and Miller (2009), Arouri and Rault (2012), Bjørnland (2009), Cunado and Gracia (2014), El-Sharif et al. (2005), Jammazi and Nguyen (2015), Kilian and Park (2009) focus on the effect of oil price shocks on the stock market of oil producing countries and oil consuming countries.

Arouri and Rault (2012), Bjørnland (2009), and El-Sharif et al. (2005) focus their research on oil-producing economies, though different countries with a different approach, but with similar findings.

El-Sharif et al. (2005) conclude that oil price shocks have a significant positive impact on stock returns of the oil and gas sector in the United Kingdom using a conventional multifactor model approach, with daily data spanning from 1989-2001. The authors' empirical result aligns with economic theory. Considering that the UK is the largest producer of oil in the European Union, an increase in the price of oil should be beneficial to the stock returns of the oil and gas sector in the economy

Bjørnland (2009) uses the structural VAR model to estimate the effect of oil price shocks on the stock returns in Norway, a net oil- exporter. The author finds that higher oil prices lead to higher stock market returns.

Using the bootstrap panel co-integration techniques and seemingly unrelated regression (SUR) methods, Arouri and Rault,(2012) investigate if a link exists between oil prices and the stock markets of Gulf Co-operation Council (GCC) countries. From their findings, there exists a long-run positive relationship between an increase in oil prices and the stock returns of GCC countries.

Phan, Sharma, and Narayan ( 2015) also find that the stock markets of oil producers react positively to a positive change in oil price and that of oil-consuming economies react negatively to increase in oil prices. They also find an asymmetric effect of changes in oil prices on stock returns for most sub-sectors. Using simple trading strategies, they find that an increase in oil prices is beneficial for investors in both economies, but that of oil-producing countries make more returns relative to returns in oil consuming countries.

Quite a few studies have focused on the origin of oil price shocks to understand the effects of oil price shocks on stock markets.

Hamilton (2009) identifies two kinds of oil price shocks; the demand-side shock and the supply shock. He defines the demand-side shock as an increase in demand for Oil due to industrializations of countries, and the supply side shock as a shock due to a delay in response in oil supply to demand. Kilian,(2009) argues that there are three sources of Oil price shock. They are; the aggregate demand shock, which is an increase in oil prices due to fluctuation in the global business cycle; the precautionary demand shock, which is the demand shock caused by the uncertainty of future oil supply and; the Supply shocks which occurs due to a reduction in the production of oil.

Kilian and Park (2009) conducted an empirical investigation on the impact of oil price shock on the US stock market. The authors use the structural VAR approach with monthly data that covered the period from January 1973 to December 2006 to disentangle oil price shocks into aggregate demand shock, precautionary demand shock and supply shock. They maintain that demand shocks have a significant impact on the stock returns of the US and that the oil supply shocks have no significant impact on the stock market. To be precise, the precautionary demand shocks have a significant negative impact on stock returns. For aggregate demand shocks, the market reacts positively (higher stock prices). In line with L Kilian & Park (2009), Apergis & Miller (2009) focus on eight stock markets (Australia, Canada, France, Germany, Italy, Japan, United Kingdom, and the United States) and reports similar findings, but the size of the impact is in small magnitude. They conclude that the oil price shock is not really valued in the financial market.

Similarly, Jung and Park (2011) investigate for Norway and Korea. From their findings, Oil supply shock has no significant impact on the stock returns of both countries, but aggregate demand shock has a significant positive impact on both stock market; albeit more prevalent in Norway stock returns (a net oil-exporter) as compared to the stock returns of Korea, an oil importer. An increase in oil prices due to precautionary demand shock will have a significant positive on the stock returns of Norway in the short-run, and a negative impact on stock returns of Korea, which makes economic sense.

Abhyankar, Xu, and Wang (2013) examine the impact of oil price shocks on Japan's Stock market using the SVAR model using monthly sample period that ranges from January 1988 to December

2009. From their findings, oil price shocks are not necessarily bad news for the Japan stock market. Oil price shock due to aggregate demand has a significant and positive effect on stock prices of Japan, whereas an increase in oil prices due to precautionary demand has a significant and negative impact on the stock market. Oil price rise caused by supply shocks proves to have less value in explaining the stock prices. Additionally, in contrast to previous studies by Jones & Kaul (1996) using the US data set, the Japanese stock market reacts to oil price shocks through expected real cash flows rather than changes in expected returns.

Gupta and Modise (2013) examine the relationship between different oil price shocks and the stock market of South Africa; the largest oil-consumer in Africa, using the methodology developed by Kilian (2009). From his empirical result, an Oil price shock has a positive impact on South Africa stock returns only when there is an improvement in economic activity. Furthermore, oil supply shock and precautionary demand shock have a negative impact on stock returns, with oil supply shock contributing more to the variation in real stock prices.

An empirical study with a focus on Nigeria, the largest oil producer in Africa was investigated by Effiong (2014) to examine the impact of oil price shocks on its stock market. Using the structural VAR approach with monthly data from January 1995 to December 2011, the author disentangled oil price shocks into aggregate demand shocks, Precautionary demand shocks, and the supply shock. He concludes that oil supply shocks have an insignificant negative impact on Nigeria stock return, while the aggregate demand and precautionary demand shocks have a positive impact on stock returns. Additionally, the author concludes that oil price shocks contribute over 47 percent to the variations in stock prices.

Li, Cheng, and Yang (2017) decompose Oil price shocks into four components; the global demand shocks, domestic demand shocks, precautionary demand shocks, and the Oil supply shocks with the same methodology, using data ranging from 2009 to 2014 with focus on listed Oil and gas companies in China. The results suggest that the returns of the sector appreciate with the increase in oil prices, with the supply and precautionary demand shocks most significant.

In contrast to their findings, Cunado and Gracia (2014) uses the VAR and the vector error-correction model(VECM), with monthly data from February 1973 to February 2011 for twelve European oil-consuming countries to examine the impact of oil price shocks on their stock market.

The authors used world oil production and world oil price to separate the shocks into supply and demand shock. They define supply shock as a shock that occurs when world oil prices and world oil production move in the opposite direction, and the demand shock as the shock that occurs when world oil prices and world oil production move in the same direction. They agree that the reaction of the stock market to oil price shocks depend heavily on the underlying cause of the shock. From their result, they find a negative and significant impact of oil price shocks on the stock market. This is in line with the theory that an increase in oil price will have a negative impact on the stock returns of oil-consuming countries due to its cost implication on production. Furthermore, they find that oil supply shock has a higher negative impact relative to oil demand shocks on stock returns, in contrast to previous findings. Their findings were supported with an aggregate demand and supply model; that an increase in oil prices due to supply shocks will increase the cost of production and further decrease economic activities of oil-importing countries.

Kang et al. (2016) use the structural VAR to examine the impact of oil supply shocks on the real stock returns of the US. They emphasized the importance of distinguishing between US and non-US oil supply shocks to determine its impact on the stock market. From their findings, US oil supply shocks have a positive and significant impact on the US stock returns. Additionally, they find that demand and supply shocks are important in explaining the real stock returns of the market, which is in contrast to Kilian and Park (2009).

Aloui and Jammazi (2009) use a Markov-switching EGARCH model to investigate the effect of crude oil shocks on the stock market behavior of UK, France, and Japan. From their findings, an increase in oil prices plays a substantial role in explaining high stock market volatility and the likelihood of transition from a stable regime to an unstable one. Similar to these findings is the work of Chen (2010), using the time-varying transition probability Markov-switching for the US stock market. The author examines if a rise in oil prices will lead to the bearish stock market. From the findings, there was supporting evidence that an upward movement in oil prices increases the possibility for the market to change from a low variance regime to a high variance regime. Furthermore, the effect of the oil price shocks on the stock market stays for a long period.

Angelidis, Degiannakis, and Filis (2015) also apply the Markov-switching Framework to investigate whether oil price shocks have the predictive power to determine stock market behavior

and oil price volatility. Using monthly data for the US stock market, they find that oil price shocks have a high predictive power to forecast the state of the market returns and volatility.

Using a two-stage approach, oil price shocks was decomposed using the SVAR model and then a test for non-linear relationship between oil price shocks and stock returns using the Markov-switching framework, Basher et al. (2018) investigates for major oil-exporting countries (Canada, Norway, Russia, UK, Kuwait, United Arab Emirates, Saudi Arabia, Mexico) using monthly data. Disentangling the shocks into four structural shocks; flow oil-demand shocks, oil market specific shocks, oil inventory shocks, and oil supply shocks, they find that flow oil-demand shocks is statistically significant on stock returns in Canada, Norway, Russia, Kuwait, Saudi Arabia, and the UAE. The idiosyncratic oil market specific shocks affect stock returns of Norway, Russia, Kuwait, Saudi Arabia, and the UAE. An increase in oil prices due to speculative (oil-inventory) shocks affect the stock market of Canada, Russia, Kuwait, and the UAE and for shocks caused by oil-supply, it affects returns of UK, Kuwait, and the UAE.

Ramos and Veiga (2013) conducted his study on 18 stock markets, distinguishing them into two categories; Oil consuming and Oil producing countries. The countries of selection were Austria, Belgium, Finland, France, Germany, Japan, Netherland and Ireland representing oil-importing countries; and Canada, Columbia, Mexico, Norway, and Russia for oil-exporting countries. Using a generalized autoregressive conditional Heteroskedasticity (GARCH) model, with monthly data spanning from December 1988 to 2009, they find that oil price shock has a negative impact on stock returns of oil consuming countries and a positive impact on stock returns of oil-importing countries. This aligns with Bjørnland (2009) and Jung and Park (2011) findings.

Investigating for five developed countries, Jammazi and Nguyen (2015) use the regime-shifting model to examine the impact of oil price shocks on their stock market. The authors try to identify if the impact of the shocks depends on the state of the market. To test for the regime-shifting, the authors use an MS-EGARCH model due to its ability to take into consideration the asymmetry effect and the regime shifts with data from 1987 to 2007. They conclude that an increase in oil price has a significant negative effect on the stock market when the market is at its boom phase. They justified their findings with the idea that during the period of economic recession production reduces and the demand for crude oil decreases, so an increase in the price of oil may not

necessarily affect the market at its bust phase. But during its boom cycle, it will have a significant negative effect on their stock returns.

Hammoudeh and Li (2005) examine the sensitivity of oil on equity returns of Norway and Mexico, oil-based countries and the sensitivity of returns of the US oil and transportation industries (oil-consumers). Utilizing the VECM and international Arbitrage Pricing Theory (APT) model, with high frequency data (daily) covering the period from 2 January 1986 till 30 September 2003, they find that a rise in the price of oil has a significant negative impact on the world capital market and the stocks of transportation firms, but a positive impact on stock returns of oil-related firms. Furthermore, they find that investors are more concerned with systematic risk when pricing oil-sensitive stocks and not oil sensitivity.

### 2.3 Summary of Findings from relevant literature

Most studies on the impact of oil price shocks on the stock market have treated the shock as exogenous. Some empirical investigations confirm that oil price shocks have an impact on the stock markets depending on the underlying source of the shocks but with different results on the impact of each shock on stock returns. Most of the findings were based on studies in developed countries, some in Asia and Latin America and others in emerging markets from the Middle East and Eastern Europe and these studies look at the linear relationship between oil shock and stock returns. For African market, the impact of oil price shocks has not been empirically examined in most countries (Botswana, Egypt, Mauritius, Tunisia, Kenya), Nigeria and South Africa have been empirically studied albeit using different time frame; and a test for possible non-linearity was not determined in both studies.

To bridge the gap in the African context, this study empirically examines the impact of oil price shocks (decomposing the shocks into oil supply shock, aggregate demand shock, and precautionary demand shock) on the stock market of seven African countries representing different regional blocs and net oil exporters and oil-consumers in Africa. The study uses the SVAR approach to disentangle oil price shocks and a two-stage Markov-Switching framework to determine the dynamic relationship between Oil price shocks and the stock market.

# CHAPTER THREE

# DATA AND METHODOLOGY

## 3.1 Data Description

All data used for this study are monthly data and covers a sample period from January 2000 to July 2018. The period of selection is based on the fact that it covers recent major global financial events; from the September 2001 attack, stock market crash in 2002, Iraq war in 2003, China and India becoming world financial powers, Global financial crisis in 2008, sovereign debt crisis 2010, among others; and important oil price historical events ( from a surge in the price of oil to its highest in July 2008 caused by high demand from Asian countries and a fall by 75 percent in December 2008 caused by the low demand due to the global financial crisis, the Arab spring in 2010, Venezuela Civil unrest in 2005, slump in oil prices by 47 percent in 2014 caused by overproduction among others). The data used are world supply of oil, oil price, real global economic activity, and stock prices for the selected countries.

Data for the world supply of oil (in thousands of barrel per day) and U.S refiner's acquisition cost of crude oil which is used as a measure for oil price were gleaned from the U.S Energy Information Administration (EIA).[1] The real price of crude oil is the nominal price of oil deflated by the U.S consumer price index available from the Bureau of Labour Statistics. An index for global real economic activity constructed by Kilian & Park (2009) is used as a measure for the demand for oil. The index was developed based on dry cargo single voyage ocean freight rates and it captures a shift in demand for industrial commodities in the global market. The advantage of this index is that it incorporates the economic activity of India and China which are important emerging economies, unlike the conventional measure like the OECD industrial production index which excludes these countries. Most of the increase in demand for global commodity tends to be driven by these two markets; it is only logical to use an index that incorporates the real economic activity of these countries.

The main objective of this study is to assess whether the underlying oil price shocks have any impact on African stock markets. To do this, changes in world oil supply, real oil prices, and world

[1] http://www.eia.gov/totalenergy/data/monthly/dataunits.cfm

real economic activity are used to represent the shocks. The stock price indices used are NGSEINDX index (Nigeria), TUSISE index, EGX30 (Egypt), JALSH index (South Africa), BGSMDC index (Botswana), SEMDEX (Mauritius), and NSE20 (Kenya). The countries selected were based on FTSE category of emerging and frontier markets in Africa. Also considered is the size of the market based on their market capitalization and availability of data in each region, with Nigeria representing the Western Coast, South Africa, Botswana, Mauritius for the Southern Africa, Tunisia, and Egypt, for North Africa and Kenya for the eastern part of Africa. Oil exporters and consumers were part of the criteria for selection; with Nigeria, Tunisia and Egypt for oil-exporters and South Africa, Botswana, Mauritius and Kenya as oil-importers. All data for the stock index was sourced from Bloomberg database except for Kenya that was taken from DataStream. All stock prices are denominated in US dollars for uniformity. Aggregate real stock returns are constructed by subtracting the consumer price index (CPI) as a proxy for inflation rate from the nominal returns. Data for CPI for all countries are available on DataStream. Below is a brief description of the countries selected in this study.

### 1. SOUTH AFRICA

South Africa is situated in the southern region of Africa with an estimated GDP output of US$349.419 billion and a growing population of 56,717,156 in 2017 (World Bank 2017). It is the second biggest economy in Africa and is classified by World Bank (2017) as an upper middle-income country. Equities are traded on the Johannesburg Stock Exchange (JSE), formed in 1887, with over 388 listed companies, and a market capitalization of $826.3 billion in August 2018, making it the biggest in Africa in terms of market capitalization and the 19$^{th}$ largest stock exchange in the world. The FTSE/JSE All Share Index is used as a benchmark for the market which covers 99% of the market capitalization. It is also the largest oil-consumer in Africa.

### 2. EGYPT

Egypt is the 3$^{rd}$ largest economy in Africa, classified by the World Bank (2017) as a lower middle-income country situated in the Northern region of Africa. The GDP output is estimated at $235.369 billion and a population of 97,553,151 in 2017 (World Bank 2017). The Egyptian

Stock Exchange was formed in 1883 with over 202 listed companies and a market capitalization of $10.5billion. It is among the net oil-exporters in Africa.

### 3. NIGERIA

Nigeria is located in the western coast of Africa, a country with one of the largest population in the world, with an estimated population of 190,886,311 and GDP output of $375.771 billion in 2017 (World Bank 2017). It is known as the biggest economy in Africa (World Bank 2017) and categorized among the lower middle-income country. Nigeria is the largest producer of oil in Africa and oil contributes about 83 percent to total export revenue and 10 percent of it GDP. It is highly dependent on the revenue derived from oil export. The Nigerian Stock Exchange was founded in 1960, with 169 companies listed and a market capitalization of $32 billion in 2018. The benchmark for the market is the Nigerian All-Share Index (NGSEIDX).

### 4. KENYA

Kenya is the 8$^{th}$ largest economy in Africa situated in the eastern region of Africa with a population of 49,699,862 and an estimated GDP output in 2017 of $74.938 billion (World Bank 2017). It is categorized as a lower middle-income economy by the World Bank. Equities are traded in the Kenyan Nairobi Stock Exchange, founded in 1954 with 65 listed companies and a market capitalization of $20.66 billion in 2018. Kenya is known as an oil-consuming Country in Africa.

### 5. BOTSWANA

Botswana is situated in the Southern part of Africa, the second biggest in her region, and is known as one of the World's fastest growing economy. With a GDP of $17.407 billion and a population of 2,291,661 in 2017, Botswana is classified as an upper-middle–income economy ( World Bank 2017). The Botswana Stock Exchange was founded in 1995 with 33 listed companies and a market capitalization of $3.7 billion in 2018.

### 6. MAURITIUS

Mauritius is from the southern region of Africa with an estimated GDP of $13.338 billion and a population of 1,264,613. It is classified by the World Bank as an upper-middle-income

economy. The Stock Exchange of Mauritius has 88 listed companies and a market capitalization of $9.3 billion in 2018.

### 7. TUNISIA

Tunisia is on the northern part of Africa and is classified by the World Bank (2017) as a lower-middle-income economy. The GDP for 2017 was estimated at $40.257 billion with a population of 11,532,127. It is known as one of the net oil-exporter in Africa. The Tunisia Stock Exchange founded in 1969 with 88 listed companies has a market capitalization of $5.6 billion in 2018.

## 3.2 Empirical model

To help address the limitations of previous studies as discussed in the previous chapter, a two-stage approach is employed to explore the impact, if any, of oil shocks on the stock markets of two groups of countries, viz. oil-exporting and oil-importing economies. The methodological approach in this study follows Basher, Haug, & Sadorsky (2016). Firstly, applied for this study is Kilian & Park's (2009) shock identification procedure using the SVAR. This is used to disentangle Oil shocks into oil demand shock, supply shock, and oil specific shock. This methodology combines time series analysis and economic theory to investigate the dynamic relationship between the variable of interest and independent shocks. A set of restrictions is imposed to decompose the shocks into mutually orthogonal shocks based on economic theory. Secondly, an empirical assessment to examine the response of the stock market to the shock using the Markov-switching framework is applied. The constructed shock orthogonal variables are uncorrelated to other variables in the model and omitted variables in the regression of the second stage analysis. This implies that the regression coefficient estimations are unbiased.

The Markov-switching model involves multiple equations that can characterize the time series behaviors in different regimes (Basher, Haug, & Sadorsky, 2016). It captures possible complex nonlinearity and asymmetry effect in a manner that pushes the adjustment of stock prices to oil shocks. The framework generating process is exogenous and has proved helpful in conditions where the adjustment is driven by exogenous events. The sample in this study covers several events driven by those factors: the September 11 2001 terrorist attack on the USA, the Second Persian Gulf War in 2003, the 2007-2008 global financial crisis, the European sovereign debt crisis; are

amongst a few to mention. These occurrences are treated as exogenous only with regards to the Markov-switching approach; however, their impact on the oil market and macroeconomic variables are not considered to be exogenous. Historically, the correlation between oil prices and stock prices has vacillated from negative to positive values pointing to asymmetry and nonlinearity. The Markov-switching model with two-regimes is deemed able to adequately capture this interaction between oil prices and stock prices.

### 3.2.1 The Structural VAR Model

Kilian & Park's (2009) approach is used to decompose oil price shocks into demand and supply shocks to reveal the endogenous properties of these shocks using the Structural Vector-auto regression (SVAR) model. In other words, we consider Oil Price based on its underlying origin. The SVAR model is represented as:

$$A_0 y_t = \alpha + \sum_{i=1}^{2} A_i y_{t-1} + \varepsilon_t \qquad (1)$$

where $y_t$ =($\Delta prod, rea, rpo$), where $\Delta prod$ is the percent change in global oil production, $rea$ is an index which captures activities in the real global economy and $rpo$ is the price of oil in real terms in US dollars. Both rea and $rpo$ are expressed in log form. $\varepsilon_t$ represents a vector of independently and identically distributed structural innovations. The matrix $A_0^{-1}$ is assumed to have a recursive structure such that the reduced-form error $e_t$ can be decomposed according to $e_t$ = $A_0^{-1}\varepsilon_t$, where $e_t$ is the vector of errors in a VAR.

$$y_t = A_0^{-1} A(L) y_{t-1} + A_0^{-1}\varepsilon_{t.} \qquad (2)$$

$A_0^{-1}$ in equation (2) is derived by imposing some exclusion restrictions in equation (3). The three structural shocks are defined as follows: $\varepsilon_{1t}$ indicates oil supply shocks; $\varepsilon_{2t}$ captures shocks to the global demand for all industrial commodities that are driven by global real economic activity ( aggregate demand shocks); and $\varepsilon_{3t}$ represents an oil-specific demand shock), in line with Kilian & Park's (2009):

$$e_t = \begin{pmatrix} e_{1t}^{\Delta prod} \\ e_{2t}^{rea} \\ e_{3t}^{rpo} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{pmatrix} \varepsilon_{1t}^{oil\ \sup\ plyshock} \\ \varepsilon_{2t}^{aggregatedemandshock} \\ \varepsilon_{3t}^{oil-specificdemandshock} \end{pmatrix} \qquad (3)$$

The assumption of the identifying restrictions is that in the short-run; there is a vertical supply curve for oil and that oil supply shocks are not immediately responsive to oil demand shocks in the same period. This is credible, as in practice oil-producing countries are slow to respond to demand shocks, considering the cost of adjusting production and uncertainty of the oil market.

An innovation to global real economic activity that cannot be explained by crude oil supply shocks is referred to as shocks to global demand for industrial commodities which is the aggregate demand shocks. The restriction of the model on this shock is that increase in the price of oil that is specifically driven by oil market will not push down global real economic activity immediately, but with a deferment of at least a month. This is also plausible as there is always a lethargic change of the global real economic activity due to movement in the prices of oil.

Lastly, innovations to the real price of oil that cannot be explained based on oil supply or aggregate demand is referred to as oil-specific demand shocks. This shock is caused by fluctuations in the precautionary demand due to speculation of a possible drop in the supply of oil from the futures market. It is assumed that the shock responds to innovations from both shocks (oil-supply shocks and aggregate demand shocks) in the same period. This restriction holds primarily due to the immediate reflection on oil price of all exogenous changes that occur in oil supply or the real economy.

Unit roots test and cointegration are not imposed on the VAR. This is in line with Kilian (2009) approach. Sims, Stock, and Watson (1990) have shown that when unit roots and cointegration are ignored, one can still have consistent parameter estimates by applying least square to level VARs.

### 3.2.2 The Markov-Switching Framework

Following Basher et al. (2016b), a linear regression model is estimated for stock returns of all countries in this study to provide some baseline results.

$$SR_{i,t} = \beta_{0,i} + \beta_{1,i}\varepsilon_{i,t}^{s} + \beta_{2,i}\varepsilon_{i,t}^{d} + \beta_{3,i}\varepsilon_{i,t}^{p} + \beta_{4,i}SR_{i,t-1} + u_{i.t} \qquad (4)$$

Where SR is the first difference of the real stock returns for country $i$ at time period $t$. The oil price shocks are derived from the Structural Vector Autoregressive model as outlined in section 3.2.1, where $\varepsilon^s$ represents the oil supply shocks, aggregate demand shock is denoted by $\varepsilon^d$ and oil specific demand shock as $\varepsilon^p$. It is assumed that oil price shocks are pre-determined. This is in line with Kilian (2009). The lags of oil price shocks are excluded in the explanatory variables because it is expected that the market absorbs information fast when shocks occur. For a better regression and residual diagnostic, an AR (1) term is included as an independent variable.

To capture any possible nonlinearities, a Markov-switching model is applied, as indicated below

$$SR_{i,t} = \beta_{0,i,s_t} + \beta_{1,i,s_t}\varepsilon^s_{i,t} + \beta_{2,i,s_t}\varepsilon^d_{i,t} + \beta_{3,i,s_t}\varepsilon^p_{i,t} + \beta_{4,i,s_t}SR_{i,t-1} + u_{i,t.} \qquad (5)$$

Because the model permits switching between structures, it captures a more complex dynamic pattern (in other words, it checks for break effect). For this study, it accounts for the likelihood that impact of oil price shocks on stock prices is dependent on state $(s_t)$. One of the properties of Markov Switching is that the possibility of a change from state 1 at period t to state m at period t+1 depends solely on the previous state. It is presumed that the randomly determined regime-generating process is characterized by a first-order Markov chain with a fixed number of regimes (m) and constant transition probabilities.

$$p_{lm} = \Pr(s_{t+1} = m / s_{t+1} = l), p_{lm} \geq 0, \sum_m^M plm = 1 \qquad (6)$$

The "fMarkovSwitching" package in R (Perlin, 2008) is used for all estimations of the Markov switching models for all stock returns. Two state regimes were estimated in the model; state one is the state dependent regression coefficient whereas state two is the state dependent volatility for the innovations. Volatility is allowed to fluctuate across regimes because stock prices are known for volatility clustering. The student-t distribution is used for estimations for the error term as it augments the stability of regimes. To check the accuracy of Markov switching models a regime classification model (RCM) of Ang & Bekaert (2002) is used. A good fitting model is one that has

smoothed probabilities close to zero or one and sharp classification regimes. The RCM formula is identified below as;

$$RCM(S) = 100S^2 \frac{1}{T} \sum_{t=1}^{T} \prod_{j=1}^{s} P_{j,t} \quad (7)$$

The regime classification measure is calculated as the mean of the product of smoothed probabilities p, where s is the number of regimes. Following a Bernoulli distribution, the RCM provides an estimation of variance. The values range from 0 to 100, where zero is a perfect regime classification and 100 indicates a failure to detect regime classification. Thus, to ensure significant different regime RCM close to zero and smoothed probability indicator close to one is desirable (Basher, Haug, & Sadorsky 2016).

# CHAPTER FOUR

# DATA REPRESENTATION AND RESULTS ANALYSIS

## 4.1 Preliminary Analysis

A set of preliminary analysis is examined for oil-exporting (Nigeria, Tunisia, and Egypt) and Oil-importing (Botswana, South Africa, Kenya, and Mauritius) countries. Firstly, a trend analysis of the stock price of the respective stock market index for each country investigated is represented in figure 5

A fairly consistent long–term upward pattern is observed for South Africa, Botswana, Tunisia, and Mauritius, with Nigeria and Egypt exhibiting intermittent volatility across the sample. Also noticed was a massive drop in price for all stock market within the period 2008- 2010, possibly caused by the spillover effect of the global economic and financial crisis of 2008. In all, there is considerable variability for all markets across time.

The structural shocks (oil demand, oil supply, and oil specific shocks) were deduced from the Structural Vector Autoregressive model in equation (2). To select an appropriate lag length for the time series, the Akaike information criterion (AIC), Bayesian information criterion (BIC) and Hannan-Quinn information criterion (HQIC) are used and all three tests give a lag length of 2 which is used for the estimation of the SVAR. The residuals are randomly distributed and all characteristics roots lie within the unit circle, fulfilling the goodness-of-fit requirement of the SVAR. Figure 7 shows the plots for the shocks, with the oil supply shocks showing relatively higher volatility in the first half of the series, aggregate demand shocks display relatively higher volatility post the 2008-2009 global financial crisis, and oil price shocks experienced considerable volatility over time.

For each country, real monthly returns are constructed as nominal returns less inflation. Nominal returns is given by $(\log(p_{m,t}|p_{m,t-1})$ where $P_t$, is the price of the stock index at period $t$. The plots for real stock returns are shown in figure 6. Table 1 presents the descriptive statistics for oil price shocks and real stock returns. The three shock variables have a mean value of zero (to three decimal places) with a standard deviation close to unity. For stock returns, it is evidence that on the average, negative returns are more likely (based on the mean value) for oil exporting countries

except that of Tunisia that show possible positive returns. For oil importing countries, Botswana and Kenya show high possible chance of negative returns and South Africa, and Mauritius show possible positive returns. The standard deviation measures the stock volatility and for all markets in the study and the result shows that African stocks are highly volatile, with the highest at 9.607 for Egypt and the lowest at 4.336 for Botswana. The skewness of a distribution gives an insight on the shape of the distribution for each market. From the descriptive statistics, the skewness for most of the Countries in this study are skewed to the left, indicating it is not a normal distribution, except for Kenya which is fairly symmetric. From the result for Kurtosis, all markets exhibit heavy-tails (leptokurtic). As per the Shapiro-Wilk test, normality is not present for any of the variables.

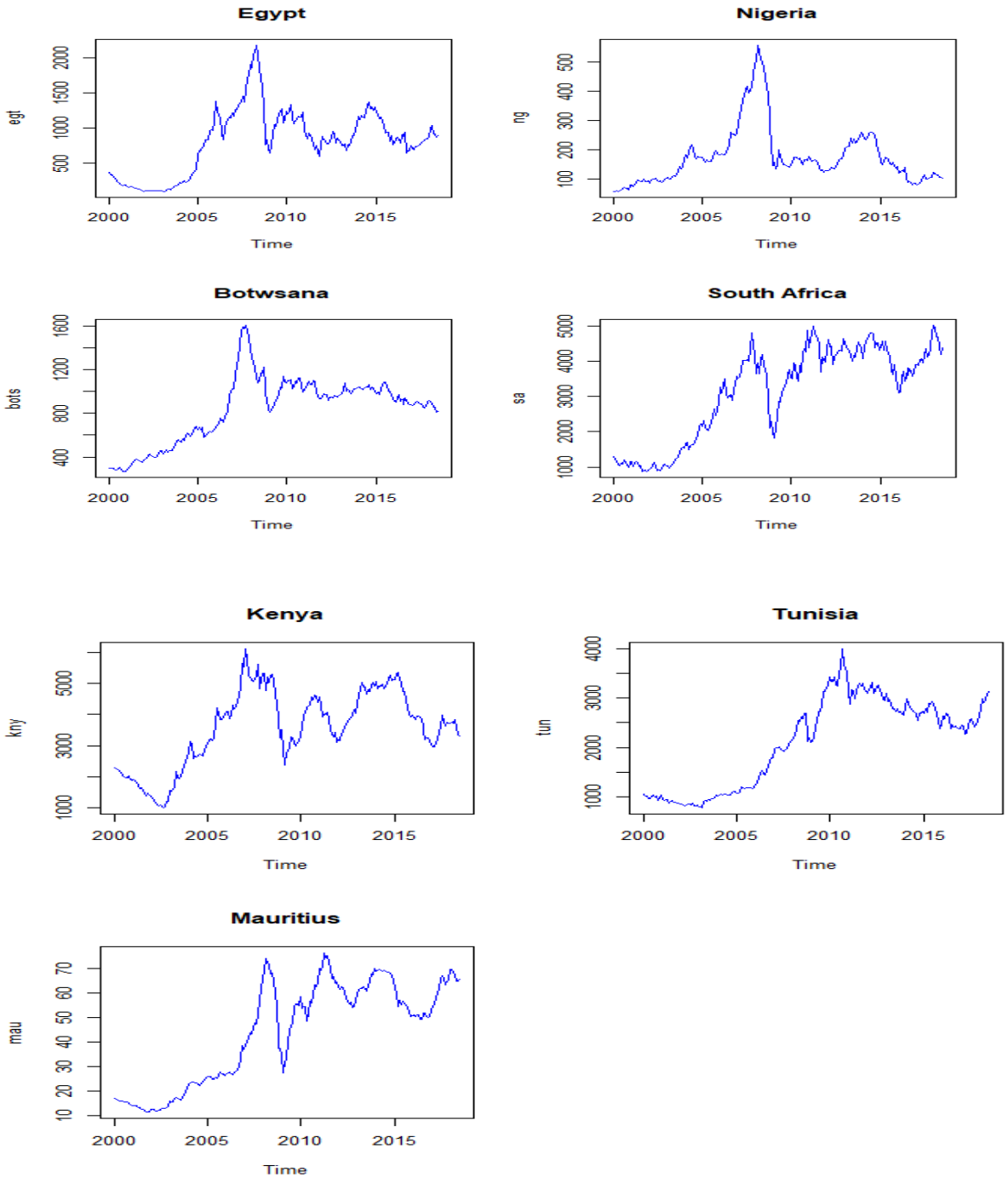



**Figure 5: Africa stock market trends**

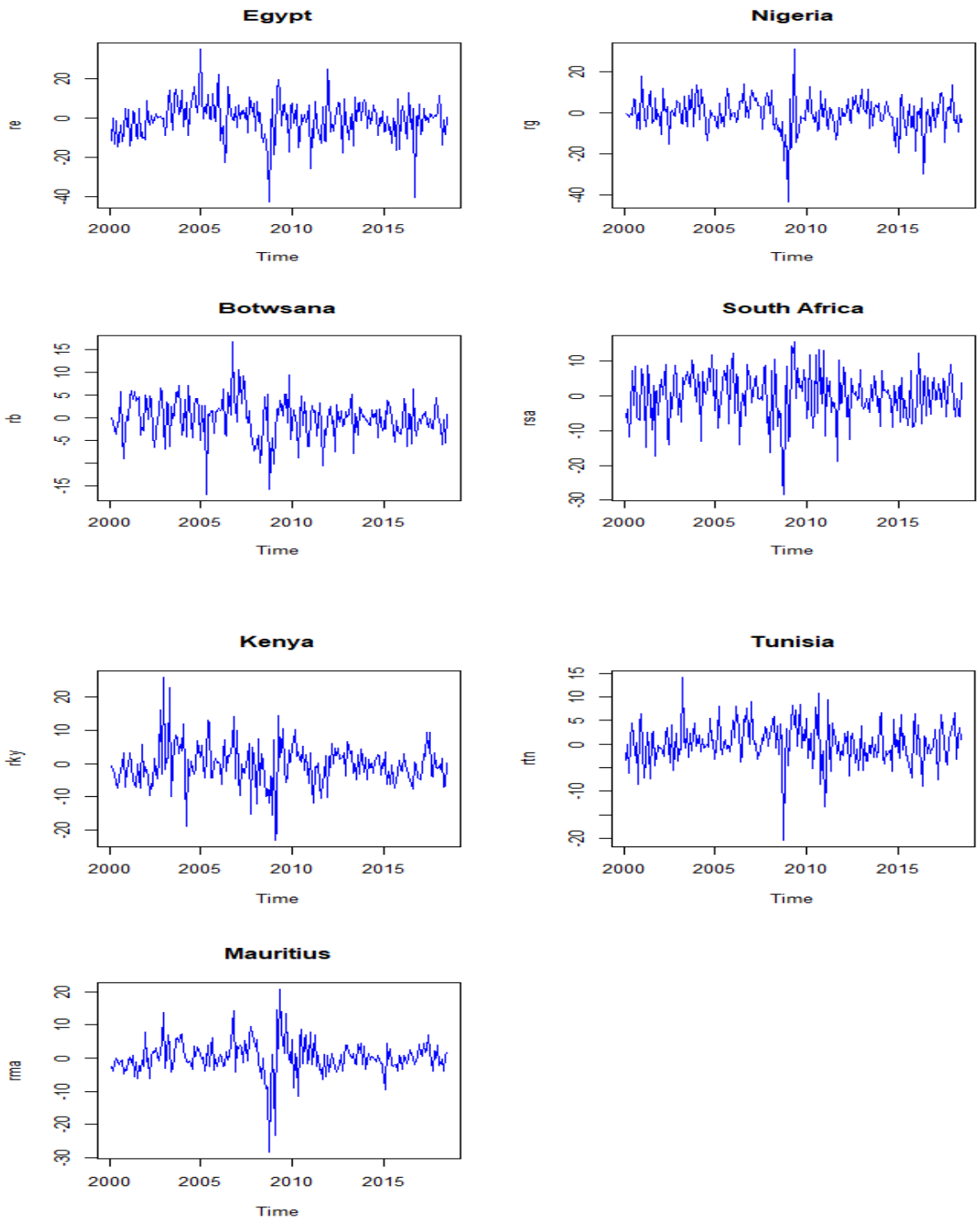



**Figure 6: Real stock returns**

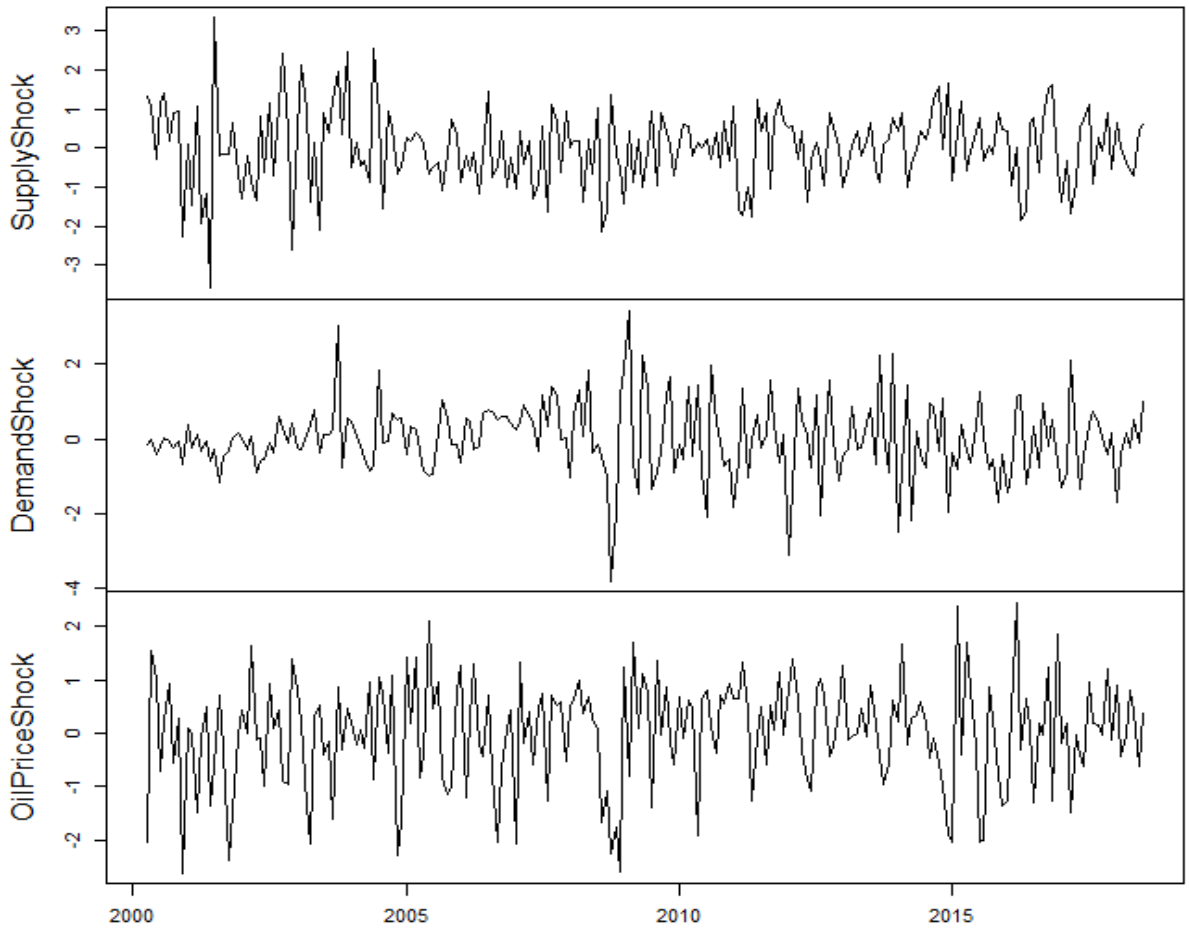



**Figure 7: Oil Supply shocks, global economic activity demand shocks (aggregate demand shocks), and oil price shocks (Precautionary demand shocks).**

**Table 1**: **Descriptive statistics**

| | Supply Shock | Demand Shock | Oil Price Shock | NIGERIA | TUNISIA | EGYPT | BOTSWANA | S.A | KENYA | MAURITIUS |
|---|---|---|---|---|---|---|---|---|---|---|
| **Observations** | 220 | 220 | 220 | 222 | 222 | 222 | 222 | 222 | 222 | 222 |
| **Min** | -3.609 | -3.805 | -2.620 | -43.409 | -20.326 | -42.361 | -16.981 | -28.471 | -23.047 | -28.477 |
| **Max** | 3.337 | 3.454 | 2.440 | 31.163 | 14.183 | 35.415 | 16.736 | 15.532 | 25.984 | 20.720 |
| **Median** | 0.075 | -0.054 | 0.098 | -0.705 | -0.132 | 0.201 | 0.001 | 0.806 | -0.538 | -0.028 |
| **Mean** | 0.000 | 0.000 | 0.000 | -0.732 | 0.161 | -0.400 | -0.101 | 0.078 | -0.468 | 0.230 |
| **Std. dev** | 0.986 | 0.986 | 0.986 | 8.209 | 4.183 | 9.607 | 4.336 | 7.047 | 6.213 | 5.079 |
| **Skewness** | -0.129 | 0.000 | -0.421 | -0.756 | -0.366 | -0.478 | -0.290 | -0.613 | 0.270 | -0.659 |
| **Excess Kurtosis** | 0.751 | 1.585 | -0.058 | 3.944 | 2.507 | 2.653 | 1.782 | 0.897 | 2.779 | 6.939 |
| **Normtest.W** | 0.991 | 0.979 | 0.981 | 0.948 | 0.973 | 0.966 | 0.979 | 0.979 | 0.959 | 0.903 |
| **Normtest.p** | 0.188 | 0.002 | 0.004 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 |

Note: the table contains descriptive stats for the oil shocks, deduced from the SVAR model, and monthly real stock returns for the countries under investigation.

A battery of unit root tests is carried out for oil shocks and real stock returns. Considering that economic and financial time series have a more complicated and dynamic structure that cannot be captured in an autoregressive model, the Augmented Dickey-Fuller (ADF) test is used and is considered a more appropriate approach to test for unit root with this kind of data series. The Kwiatkowski-Phillips-Schmidt-Shinn (KPSS) test is also applied in this study because it has a higher power. The result for the unit roots test is shown in Table 2. For both tests, 6 lags were chosen by the information criterion (AIC). The result from the ADF and KPSS test s indicates that all variables are stationary at first difference, with the ADF at 5% level of significance and 1% level of significance from the KPSS test.

**Table 2**: **Test of Stationarity**

| | ADF | KPSS |
|---|---|---|
| Supply | -6.500[b] | 0.082[a] |
| Demand | -6.500[b] | 0.230[a] |
| Oil | -6.200[b] | 0.220[a] |
| Nigeria | -4.600[b] | 0.290[a] |
| Tunisia | -5.600[b] | 0.230[a] |
| Egypt | -4.600[b] | 0.210[a] |
| Botswana | -5.000[b] | 0.300[a] |
| South Africa | -5.700[b] | 0.110[a] |
| Kenya | -4.400[b] | 0.110[a] |
| Mauritius | -5.900**[b]** | 0.077[a] |

Note: Results of Unit root tests are shown in the table for oil shocks, and real stock return. [a] and [b] indicate first difference stationarity at 1% and 5% significance levels, respectively.

### 4.2 The impact oil price shocks on stock returns (linear models)

A battery of regression models is estimated. Specifically, the real stock returns are regressed on the oil shocks and a lag of real stock returns for each country. The results (see Table 3) show the relationship between oil shocks and real stock returns without any switching effect and is used as a baseline for the analysis. The $R^2$ from the regression range from 0.0118 (Kenya) to 0.0697 (South Africa), which is rather low in terms of model fit.

In the case of Nigeria, Botswana, SA, and Kenya, the autoregressive terms tend to be positive and statistically significant, ranging from 0.1602 (Kenya) to 0.329 (Nigeria) indicating a low to moderate degree of persistence in the real stock returns. For Egypt and Mauritius, the lag is positive but not statistically significant, and Tunisia negative but not statistically significant.

Oil supply shock for most countries is not statistically significant though negative, except for Kenya which is positive and statistically significant at 10% level of significance. The result for all countries except for Kenya is consistent with findings of Effiong (2014), Park (2007), Kilian and Park (2009) that the impact of oil supply shock on the stock returns is not statistically significant. For Nigeria and Egypt (oil exporters), oil-specific shocks are positive and statistically significant at 10% and 5% respectively, indicating that all things being equal, a 1% change in oil-specific shock will lead to 0.98 unit change in Nigeria's stock returns and 1.40 unit change for Egypt, which is what is expected from theory of oil exporting country stock returns. For Tunisia, the oil-specific shock is also positive but not significant. Positive and significant coefficients are realized for the demand shocks for Tunisia, with Nigeria and Egypt not statistically significant. This implies that oil specific shock is important for oil producers.

For countries that import oil, the aggregate demand shock is positive but not significant for Botswana, South Africa, and Kenya, but is positive and significant for Mauritius, indicating that a rise in the price of oil due to global demand shocks raises real stock returns for these countries. Oil price shocks are not statistically significant for all oil-importers except for South Africa and Mauritius which is positive and statistically significant at 1% level of significance. In conclusion, Oil price shocks have a statistically significant impact on the stock returns for six of the seven countries studied, with Botswana having no statistically significant relationship with its real stock returns. This may be the case for Botswana. It could also be that the

relationship between oil shocks and Botswana stock returns are not linear and cannot be detected in a linear framework.

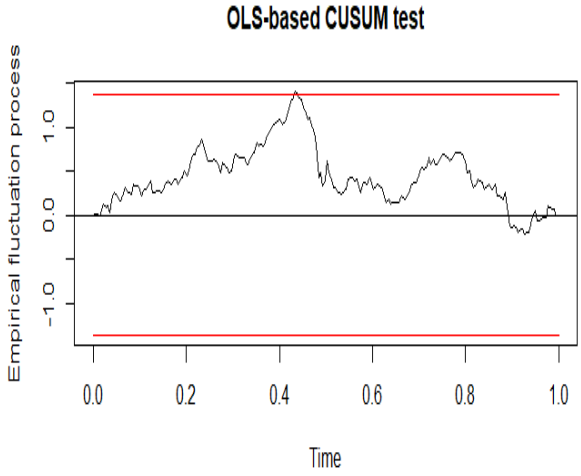
The plots in figure 8 denote the stability tests and there is evidence that there is no signal of structural breaks or instability in the model over the period studied for most countries, with Botswana and Egypt outside the confidence bounds indicating a weak sign structural break from the OLS and Recursive CUSUM test respectively.

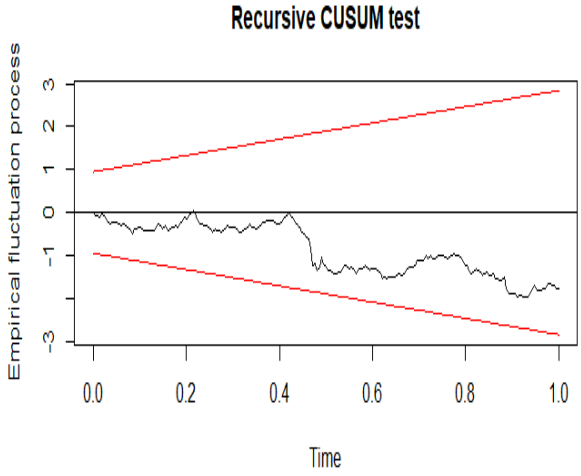
**Table 3: Linear Regression Models Output**

| | Constant | Supply | Demand | Oil | ΔSR(-1) | $R^2$ |
|---|---|---|---|---|---|---|
| Nigeria | -0.683 | -0.237 | 0.724 | 0.980[c] | 0.329[a] | 0.0388 |
| | (-1.25) | (-0.43) | (1.30) | (1.76) | (2.61) | |
| Tunisia | 0.1746 | -0.2077 | 0.6250[b] | 0.4316 | -0.0322 | 0.0162 |
| | (0.62) | (-0.73) | (2.18) | (1.51) | (-0.49) | |
| Egypt | -0.3304 | -0.0012 | 0.6734 | 1.4037[b] | 0.2470 | 0.0225 |
| | (-0.51) | (0.00) | (1.03) | (2.14) | (1.66) | |
| Botswana | -0.0811 | -0.1496 | 0.3837 | 0.3227 | 0.2134[a] | 0.0462 |
| | (-0.28) | (-0.51) | (1.31) | (1.10) | (3.21) | |
| South | 0.133 | -0.500 | 0.633 | 1.548[a] | 0.238[b] | 0.0697 |
| Africa | (0.29) | (-1.07) | (1.35) | (3.31) | (2.23) | |
| Kenya | -0.4470 | 0.8037[c] | 0.2390 | 0.1616 | 0.1602[c] | 0.0118 |
| | (-1.06) | (1.88) | (0.56) | (0.38) | (1.64) | |
| Mauritius | 0.2707 | 0.2108 | 0.6752[b] | 1.1746[a] | 0.1248 | 0.0692 |
| | (0.81) | (-0.62) | (2.00) | (3.48) | (1.63) | |

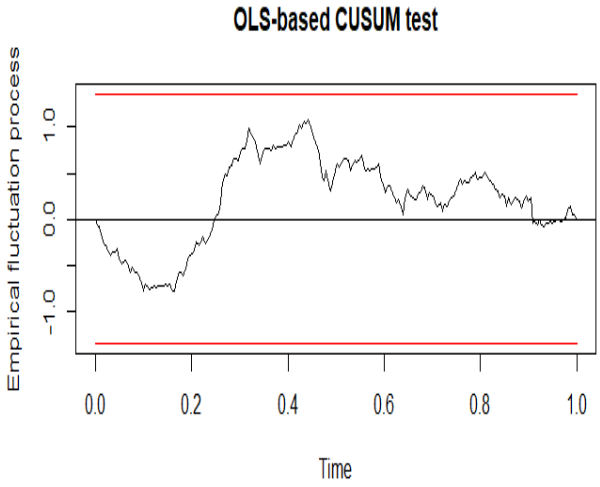
Note: The table shows regression results for the impact of oil shocks on stock returns. Supply, demand and oil, respectively represent global oil supply shock, shock to global economic activity and shock to precautionary demand (oil-specific shock), [a] and [b], and [c] indicate significance at 1%, 5% and 10% levels, respectively. t-values are in parentheses.

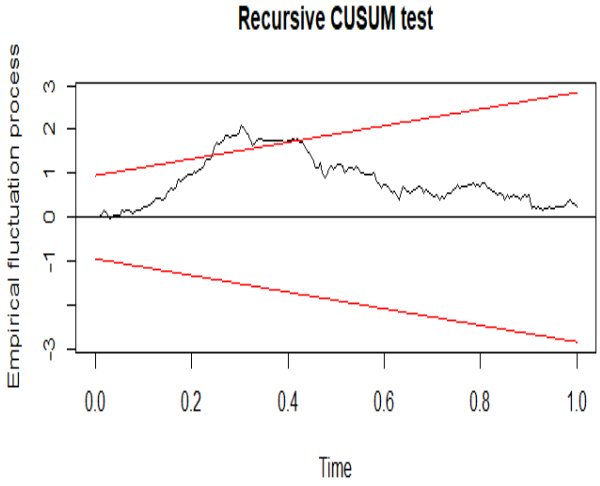
- Nigeria



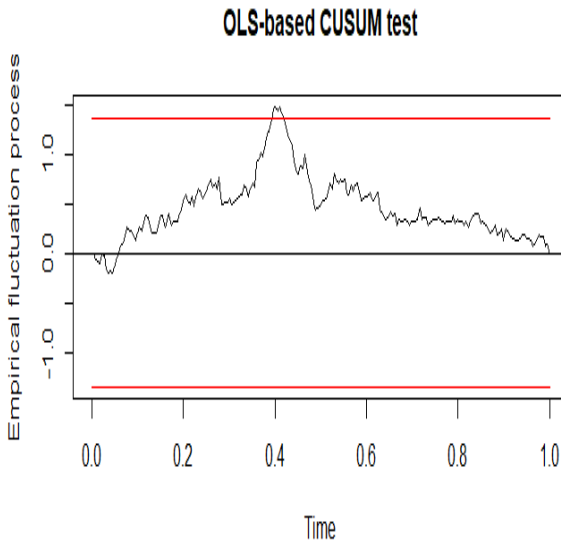



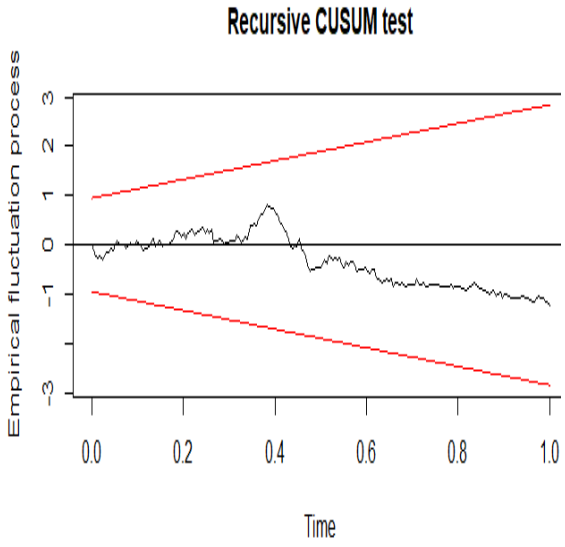

- Egypt



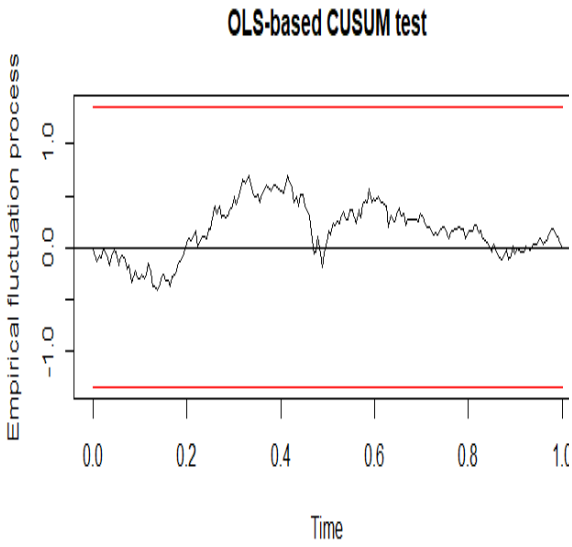



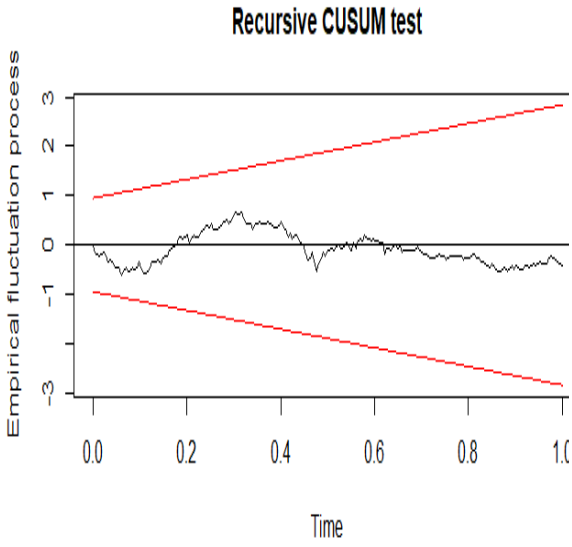
- Botswana



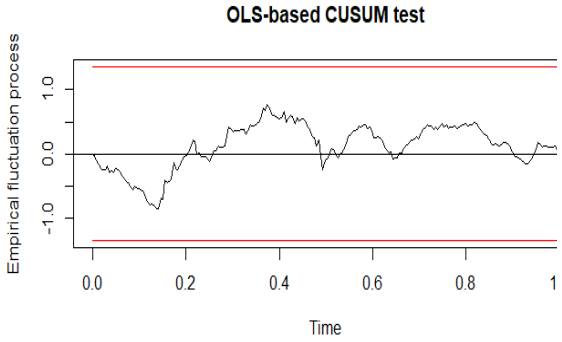



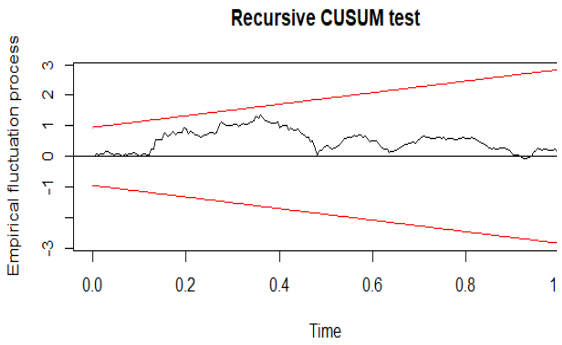

- South Africa



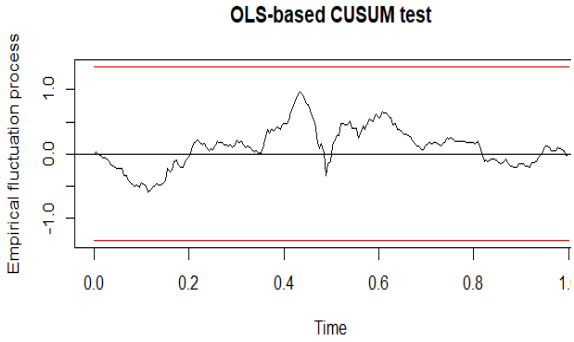



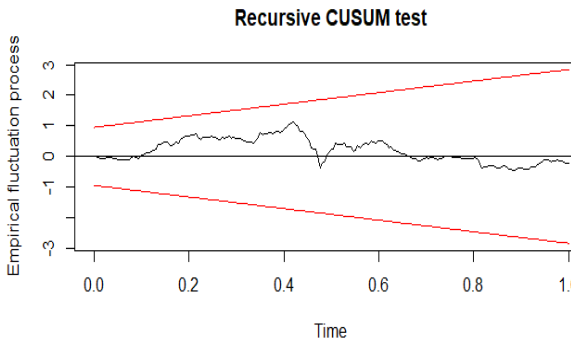
- Kenya



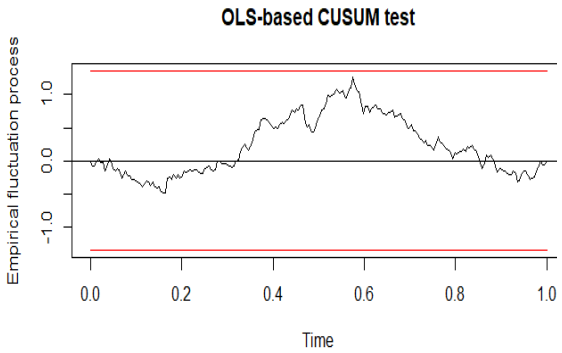




- Mauritius




- Tunisia



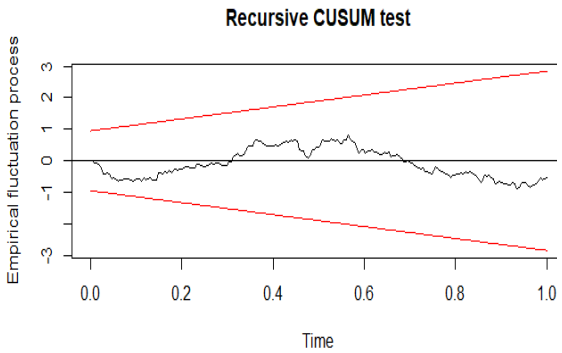




**Figure 8: Stability Test for Linear Models**

### 4.3 Impact of oil price shocks on stock returns (Markov-switching Model)

The Markov-switching model is employed to model the non-linear relationship between oil shocks and real stock returns. The model is estimated using the t-distribution. The t-distribution is bell-shaped like the normal distribution but has heavier tails which fit for financial data. It is also valuable in regime-switching because it improves the stability of regimes. Results from the models are shown in Table 4 and 5. From the results certain things stand out, the estimated coefficient of the one period lag for each country is statistically significant in at least one regime. This result is important as it explains that the lagged stock return is regime-dependent. This outcome is recorded for both oil-exporting and oil-importing countries.

For countries that export oil (Nigeria, Tunisia, and Egypt), it is observed that the estimated coefficient for oil supply shocks is not statistically significant at both states, indicating that oil shocks caused by a cut in supply have no impact on the real stock returns of oil exporters in this study. For global demand shock, the estimated coefficient for all oil-exporters is positive and statistically significant at 1% in the first regime ( low volatility regime), with Egypt, having a switch in regime from positive (S1) to negative (S2) indicating that the impact of the shock on real stock returns is non-linear and varies between regimes. For Nigeria, Oil price shocks are positive in State 1 (with low volatility of 4.7781) but not statistically significant. For state 2 (at high volatility of 5.1930), the oil price shock is negative and statistically significant, indicating that in a high volatile regime an increase in oil prices caused by precautionary demand shock will have a negative impact on the stock returns of Nigeria. This contradicts the findings of Effiong (2014) which is quite unexpected as it should have a positive impact on its real stock returns due to the transfer of wealth effect. A plausible explanation is mismanagement of government receipts and weak institutions that are unable to conceive and implement investment projects with the revenue derived from this windfall. Furthermore, Nigeria subsidizes oil and sells to the public below the market price. She also imports refined Crude oil. These offset the gains from the transfer of income from oil importing countries. Economic theory holds that government revenues (in this case, 90% of revenues derives from oil) when not utilized to finance physical and social infrastructure, will not reflect on its stock returns. For Tunisia, oil price shocks are negative and statistically significant in state one (low volatility regime) and positive and statistically significant in state two (high volatility regime). It is important to note that Tunisia is an oil producing country but also a net importer. This is

due to small production capacity and its small refinery with low production of refined products. This can explain the reason why there is a switch from negative to positive impact on the stock returns for Tunisia. For Egypt, oil price shock is positive and statistically significant in its first state (low volatility regime), which aligns with economic theory that for an oil exporter, oil price shocks should have a positive impact on the stock return of that country.

For oil-importing countries, Oil supply shocks are statistically insignificant for Botswana and South Africa, with Kenya and Mauritius significant; positive in state 1 (low volatility-3.8197) for Kenya and negative in state 2 (low volatility-0.0007) for Mauritius. This implies that an oil price increase, *ceteris paribus* will have a positive impact on stock returns in state 1 and a negative impact in state 2 respectively. For aggregate demand shocks, the estimated coefficient is positive and significant at one regime for all oil-importers, except for the result of Botswana, which is not statistically significant. This result makes economic sense because as long as global economic activity increases, the rise in the price of oil due to an increase in demand for the commodity should lead to a rise in stock prices. There is evidence that oil price shocks are positive and statistically significant in state 2 for all oil-consumers (Botswana, South Africa, and Mauritius) except for Kenya which is not significant. The impact of the oil-specific shock on South Africa stock returns is in contrast with Gupta and Modise (2013). A plausible explanation for this is that South Africa is a commodity-based economy with the mining industry contributing over 60% of its exports, with six out of ten from commodities. South Africa is the world biggest producer of gold and one of the factors that affect gold price is inflation. Since an increase in oil price will push up inflation, oil and gold are expected to move in the same direction. The Johannesburg Stock Exchange is dominated by global mining giants; which explains why a rise in gold prices could offset the increase in the price of oil. Another important point to note is that South Africa is the second largest producer of coal. An increase in oil prices leads to an increase in demand for coal which can be converted to liquid fuel and used as a substitute for oil. All of these explains why an increase in oil price due to precautionary demand will lead to an increase in its stock returns. In summary, the real stock returns response to oil shocks varies across oil-exporting and oil-importing countries.

There is also evidence that the estimated coefficient of the sigma for each country is statistically significant in both regimes for Tunisia, Egypt, Botswana, and Kenya. Nigeria and

South Africa are statistically significant in state 2 and Mauritius in state 1. The Sigma refers to the standard deviation of each regime, with the state with the highest estimated coefficient of Sigma the 'high volatile regime' and the state with the lower estimated coefficient the 'low volatile regime.' The strength of the high volatility and low volatility for all countries in this study is relatively small except for Kenya which shows a strong distinction between the high volatility and low volatility regime, where the unconditional variance is three times the value of the low volatility regime in state 2. Except for Botswana and Mauritius whose state 1 is high volatility, the rest of the countries indicate low volatility in state 1 and high volatility in state 2.

**Table 4: The impact of oil shocks on real stock returns- Markov-switching Models**

| Country | State | Intercept | Supply | Demand | Oil | ΔSR(-1) | Sigma | LL |
|---|---|---|---|---|---|---|---|---|
| A. Estimated Coefficient | | | | | | | | |
| Nigeria | S1 | 0.3833 | -0.4206 | 2.2678[a] | 6.3686 | -0.0011 | 4.7781 | -738.1 |
| | | (0.64) | (0.63) | (0.00) | (NaN) | (0.99) | (NaN) | |
| | S2 | 0.4999 | 0.3431 | -0.1795 | -1.4955[b] | 0.2445[a] | 5.1930[a] | |
| | | (0.42) | (0.60) | (0.76) | (0.01) | (0.00) | (0.00) | |
| Tunisia | S1 | 0.6387 | -0.6855 | 6.9824[a] | -2.8762[a] | -0.2877[c] | 2.7757[a] | -595.2 |
| | | (0.49) | (0.37) | (0.00) | (0.00) | (0.05) | (0.00) | |
| | S2 | 0.1809 | 0.2926 | -0.1718 | 0.6329[b] | 0.0735 | 3.3788[a] | |
| | | (0.50) | (0.31) | (0.53) | (0.03) | (0.31) | ((0.00) | |
| Egypt | S1 | 0.0969 | -0.4050 | 3.6339[a] | 2.0652[b] | 0.3322[a] | 6.9174[a] | -778.6 |
| | | (0.89) | (0.53) | (0.00) | (0.01) | (0.00) | (0.00) | |
| | S2 | 0.6609 | -0.5999 | -1.5427[b] | -0.1568 | -0.0984 | 7.1406[a] | |
| | | (NaN) | (0.51) | (0.03) | (0.81) | (0.26) | (0.00) | |
| Botswana | S1 | 0.2009 | -0.2408 | -0.0013 | 0.2421 | 0.2517[a] | 4.2664[a] | -608.3 |
| | | (0.62) | (0.51) | (1.00) | (0.54) | (0.00) | (0.00) | |
| | S2 | 0.5085 | 0.0187 | 0.4852 | 0.7180[b] | -0.0753 | 2.4759[a] | |
| | | (0.11) | (0.96) | (0.16) | (0.03) | (0.59) | (0.00) | |
| South Africa | S1 | 1.168 | -0.3427 | 0.0446 | 0.9070 | 0.2578 | 5.7424 | -717.9 |
| | | (0.10) | (0.10) | (0.95) | (0.10) | (NaN) | (NaN) | |
| | S2 | -1.7923[c] | -0.6005 | 2.7243[a] | 3.2709[b] | -0.7332[b] | 6.0017[a] | |
| | | (0.09) | (0.54) | (0.00) | (0.02) | (0.03) | (0.00) | |
| Kenya | S1 | -0.5807[c] | 0.7070[b] | 0.6165[c] | 0.1227 | 0.3134[a] | 3.8197[a] | -674 |
| | | (0.08) | (0.03) | (0.07) | (0.71) | (0.00) | (0.00) | |
| | S2 | 1.5697 | 0.3548 | -3.421 | 0.4761 | -0.2652 | 10.4857[a] | |
| | | (0.46) | (0.86) | (0.16) | (0.80) | (0.25) | (0.00) | |
| Mauritius | S1 | 0.1208 | 0.1207 | 0.6135[b] | 0.0852 | 0.3410[a] | 2.9021[a] | -573.4 |
| | | (0.62) | (0.63) | (0.03) | (0.73) | (0.00) | (0.00) | |

Note: The dependent variable is the monthly stock returns, Supply, demand and oil, respectively represents global oil supply shock, shock to global economic activity and shock to precautionary demand (oil-**s**pecific shock). Sigma is the standard deviation of each state. [a] and [b], and [c] indicate significance at 1%, 5% and 10% levels, respectively. P-values are in parentheses. The maximum log likelihood value is represented as LL.

**Table 5: Transition Probabilities and Expected Durations**

| | P11 | P12 | P21 | P22 | DU1 | DU2 | RCM |
|---|---|---|---|---|---|---|---|
| Nigeria | 0.00 | 1.00 | 0.57 | 0.43 | 1.00 | 1.76 | 56.16 |
| Tunisia | 0.73 | 0.27 | 0.04 | 0.96 | 3.71 | 25.15 | 34.72 |
| Egypt | 1.00 | 0.00 | 0.01 | 0.99 | 1.11 | 22.15 | 2.133 |
| Botswana | 1.00 | 0.00 | 0.01 | 0.99 | 18.99 | 1.00 | 2.128 |
| S.A | 0.60 | 0.40 | 1.00 | 0.00 | 2.53 | 1.00 | 65.64 |
| Kenya | 0.92 | 0.08 | 0.35 | 0.65 | 12.46 | 2.84 | 68.04 |
| Mauritius | 0.97 | 0.03 | 0.68 | 0.32 | 32.42 | 1.48 | 3.182 |

Note: The transition probabilities are reported as P11, P12, P21, and P22. The expected duration of being in state I are reported as Dui, that is DU1 for state 1 and DU2 for state 2. The RCM is the regime classification measure.

### 4.4 A robustness check on the error distribution

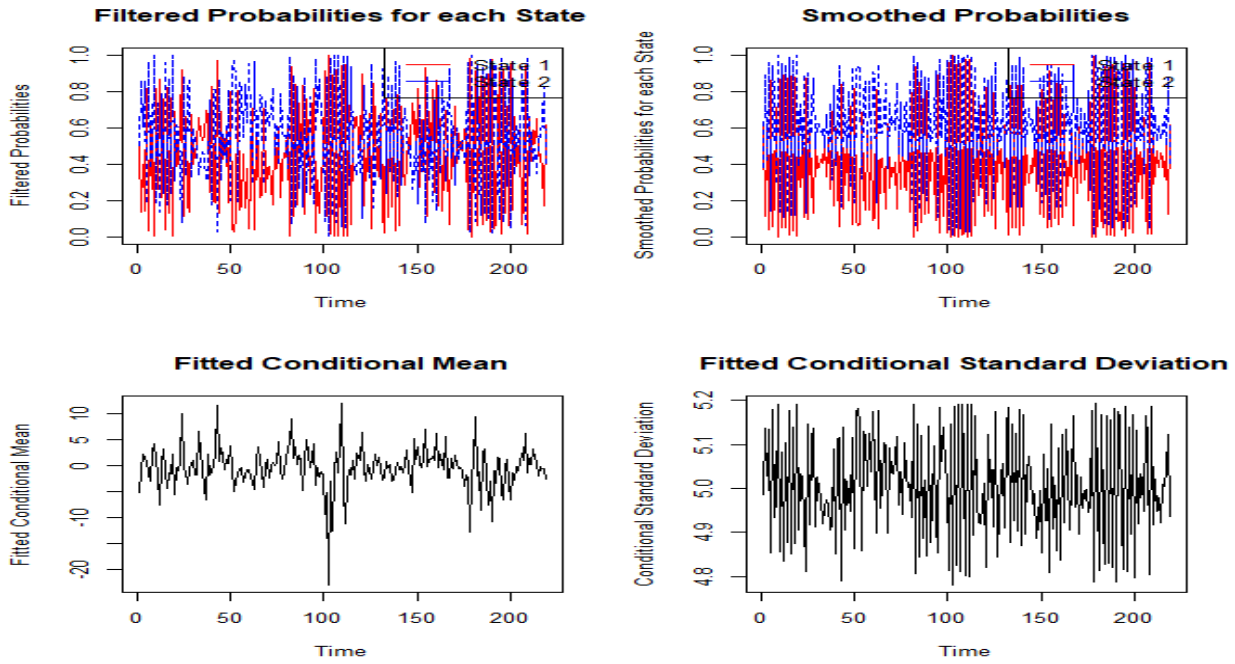
The regime classification measure (RCM) reveals if the Markov-switching model is a good fit for the model, with a low RCM indicating a perfect fit and a high RCM indicating the model is not fit for the Markov-switching. Smoothed transition probabilities indicate the levels of persistence of the regimes. So if transition probabilities are high, moving from S1 to S2 (see P11 and P22), it means each regime is highly persistent. Large constant regime probabilities and very low expected durations of being in a particular state also reveal that the model is a fit as it is expected to give a low RCM. The robustness check test is shown in Table 5B.

For Nigeria, P11 and P22 (representing the transition probabilities from state 1 to 2) show the regimes are not persistent, the duration, which is the frequency of the data, is short as evidenced from the table (DU1 and DU2) with a high RCM of 56.16. Tunisia is not persistent and has a short duration. For Egypt, the transition probabilities from P11 to P22 are persistent, with high duration and a low RCM. For oil- exporting countries, Egypt is a better fit (with the smallest RCM of 2.133) for the Markov-switching than Tunisia (with an RCM of 34.72) and Nigeria (with a high RCM of 56.16). This is clear evidence and can be viewed from the plots of the smoothed probabilities in figure 9 for all countries.

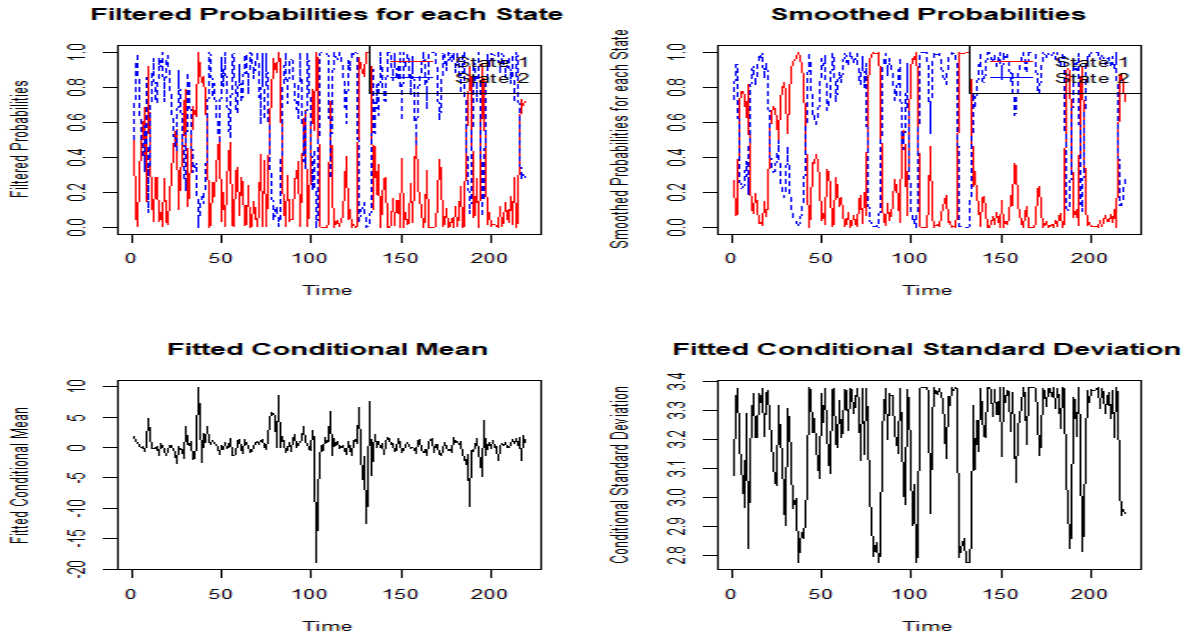
For Oil-consuming countries, Botswana and Mauritius show a better fit for the model with Botswana having the smallest RCM followed by Mauritius. P11 and P22 are highly persistent for Botswana with long duration in one state and an RCM of 2.128. For Mauritius, though not persistent (P11 and P22), the duration is long, giving a low RCM of 3.182. Kenya has the highest RCM of 68.04, followed by South Africa (RCM 65.64) showing the poorest fit for the model.

The RCM values correspond with the plots in figure 9, smaller RCM values show a clear pattern in switching between states. From the analysis, the Markov switching models deliver clear regime inference for three of the seven countries of the study, with Egypt showing a perfect fit for oil-exporters and Botswana and Mauritius for oil importers.

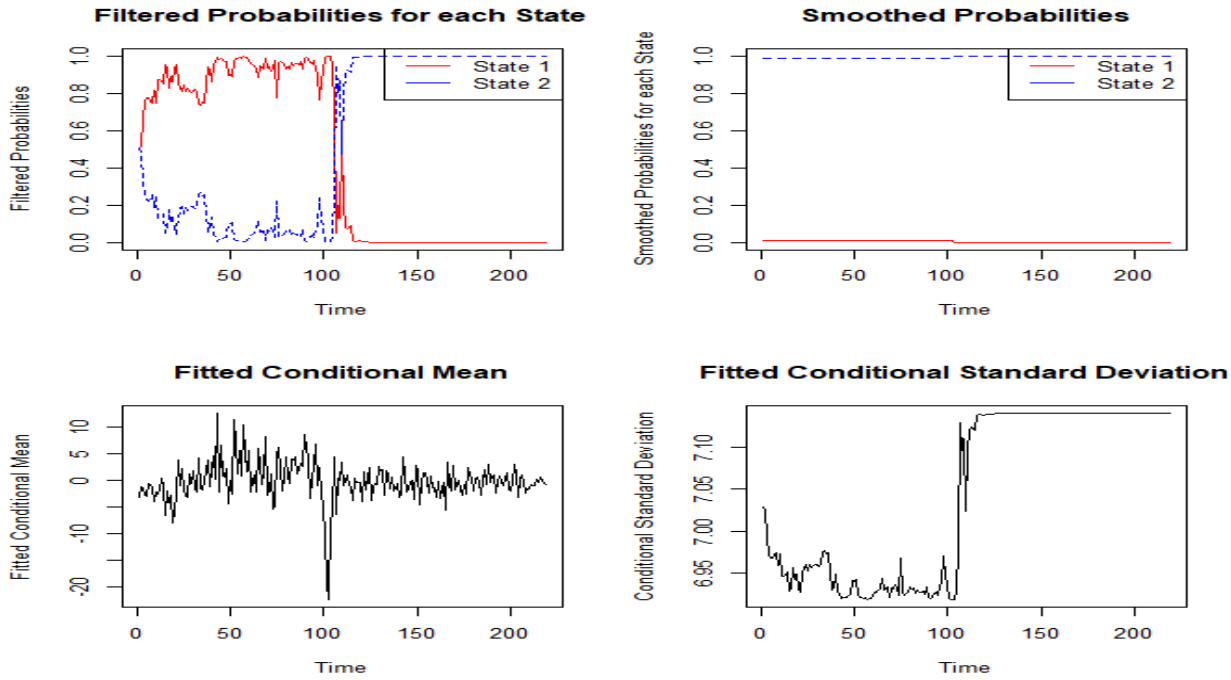
**Nigeria**



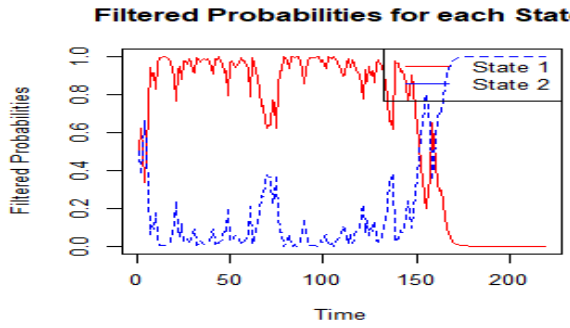
## Tunisia

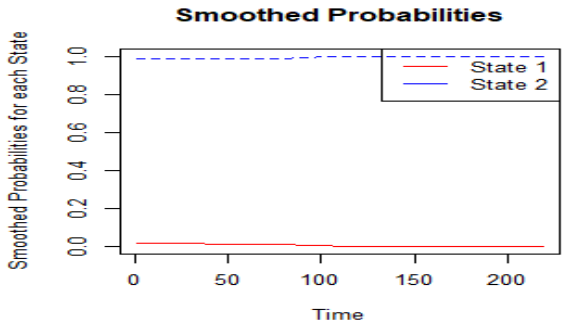


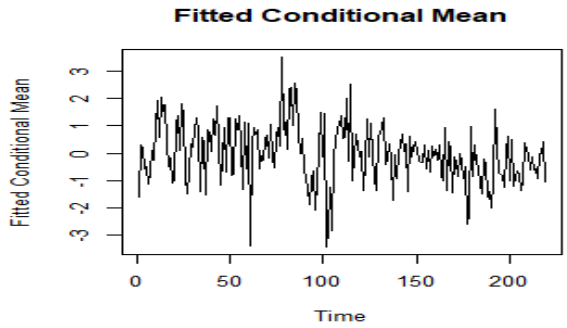

## Egypt

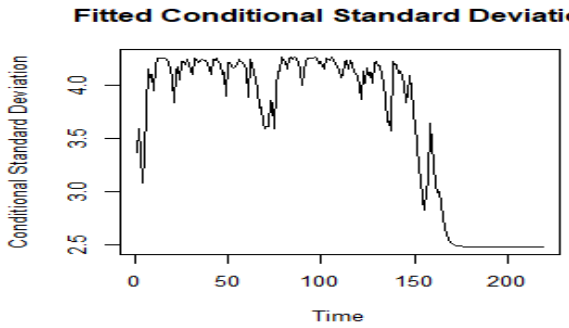


## Botswana

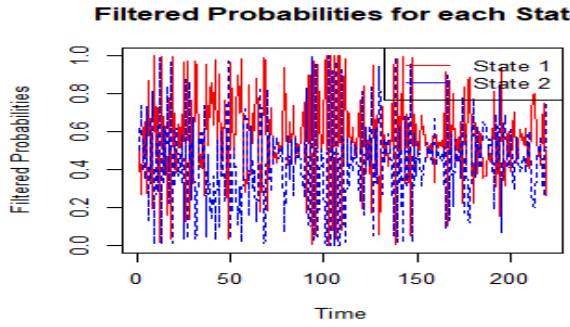


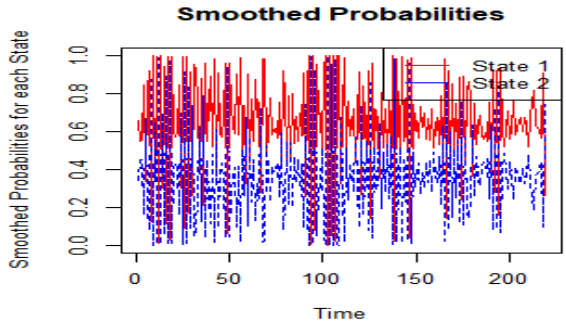



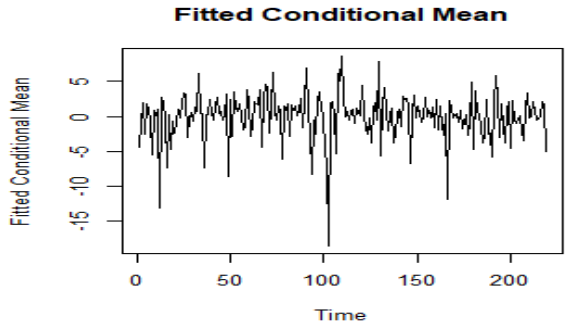



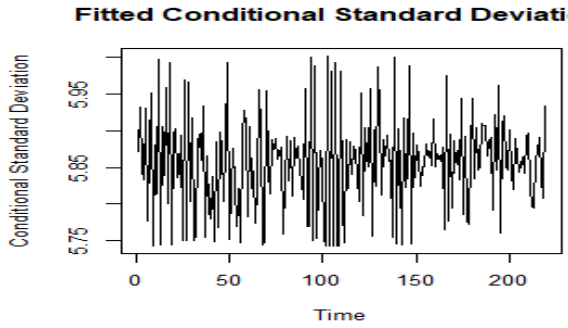




## South Africa

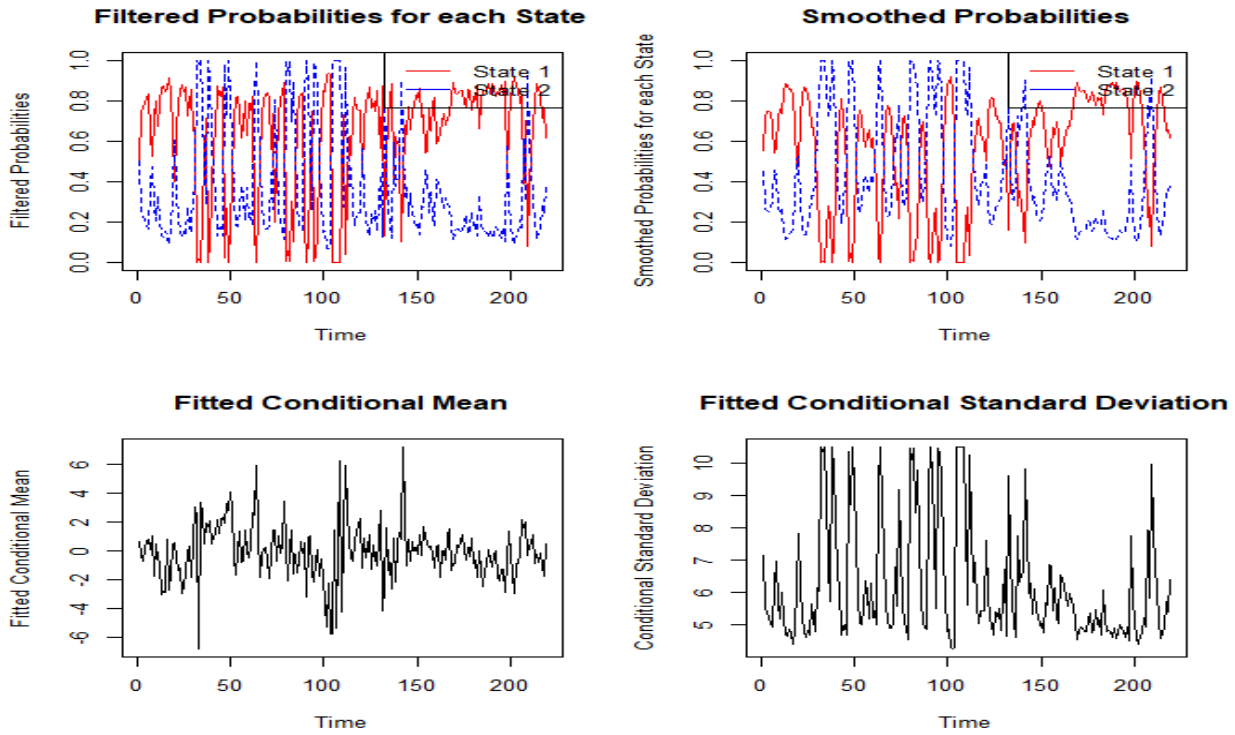


**Kenya**




**Mauritius**

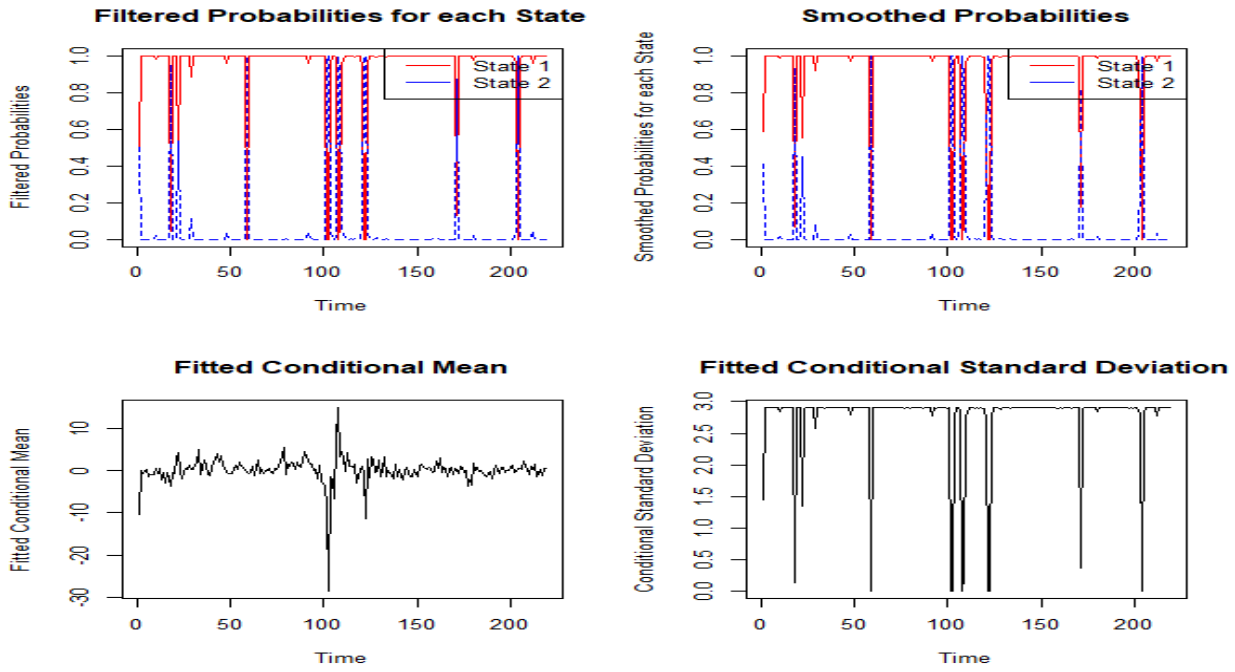



**Figure 9**: **Markov-switching Plots for each country**

# CHAPTER FIVE

# CONCLUSION AND RECOMMENDATION FOR FURTHER STUDIES

## 5.1 Conclusion

There is a wide range of empirical studies on the impact of oil price shocks on stock returns of many countries, with most studies on developed and emerging markets of Asian, Middle East, and North America. This study is of great importance, as fluctuations in oil prices affect the production process, inflation rate, exchange rate, interest rate, which further affects the profitability of firms. African markets are known to be one of the highest consumers of oil and have become major oil players in the oil market. This creates the need to investigate the impact of oil price shocks on African stock markets which is lacking in the literature. The stock market is used for our study because it serves as an indicator of economic performance and should reflect activities in the economy. The reaction of countries to oil price shocks depends on whether the country is an oil-exporter or oil-consumer. The effect of high oil prices also depends on the degree of oil intensity in the economy. Most of the studies that have investigated the impact of oil shocks on stock returns, including studies that have distinguished the countries as oil-producers and oil-consumers, have used linear models to investigate the impact of this shock.

The approach in this study is to investigate the impact of oil price shocks (disentangling the shocks into oil supply shock, global demand shock and oil specific shock) on real stock returns using the Markov-switching framework with two regimes. The advantage of this model is that it captures the possible non-linear relationship between oil price shocks and real stock returns which cannot be detected with linear models. This gives a better understanding of how oil price shocks affect the stock market.

The countries selected for this study are Nigeria, Tunisia, and Egypt representing oil-exporters in Africa and Botswana, South Africa, Kenya, and Mauritius for oil importers. The markets were selected based on the fact that they are emerging and frontier markets with large market capitalization from each region in Africa. Also considered were markets with data readily available. The sample period covered monthly data from January 2000 to July 2018. The sample was chosen to investigate the effect of current global events on oil and African stock

markets. The data ends in July 2018 because data for Global real economic activity ends in July 2018 and has not been updated.

Both in the linear and Markov-switching model, there is evidence that oil supply shocks have no impact on stock returns for most countries in this study. In the linear model, global aggregate demand shocks are statistically insignificant for five of the seven countries studied and oil specific shocks positive and statistically significant for both oil exporters and two oil consumers (South Africa and Mauritius). This implies that all things being equal, an increase in oil price caused by speculations will raise stock returns for these countries.

Several findings stand out from the study, Firstly; the application of the Markov-switching model with two regimes supports that underlying non-linear relationship between oil price shocks and stock returns for three countries, with Egypt for Oil-producer and Botswana and Mauritius for oil-consumers. The regime classification measure of Ang & Bekaert (2002) reveals that these countries are best fit using the switching regime. Secondly, global demand shock is positive and statistically significant in at least one regime for six of the seven countries investigated suggesting that the relationship between global demand oil shock and real stock return is non-linear. There is limited evidence that oil supply shock affects the real stock return for oil exporting and oil-importing countries. Thirdly, the oil-specific shock is statistically significant for most countries investigated (6/7), negative for Nigeria in state two, negative and positive in state one and two for Tunisia, and a positive impact in state one for Egypt on the stock returns. Surprisingly, there is strong evidence that oil specific shock is positive and statistically significant for three (Botswana, South Africa, and Mauritius) out of four oil-consuming countries.

The main implication from the findings is that oil-demand shock is an important factor in stock returns for both oil-exporting and oil-consuming countries and that oil-specific shock affects the stock market of oil-exporting countries. This means that fluctuations in oil prices caused by these shocks will affect the stock returns of these countries. It is recommended that oil-exporting countries diversify and not rely heavily on revenues derived from oil considering how volatile the oil market is. For oil importers, diversification could also help to absorb the shock in the oil market.

## 5.2 Recommendation for further studies

For further studies, it will be interesting to incorporate more oil-exporters in Africa like Angola, Algeria, and Libya to investigate the impact of oil price shocks on African stock markets. This will serve as a guide to give a distinct conclusion of the reaction of the markets to oil shocks and further investigate if there is a co-movement in each category (oil-producers and oil-consumers).

Furthermore, research on oil shocks using sectoral stock returns might be of great value as it will help investors understand which sector is highly susceptible to oil shocks and hedge oil price risk; also a long-term monthly or a higher frequency data will be beneficial for further studies.

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