

**OIL PRICE SHOCKS, EXCHANGE RATE DYNAMICS AND
STOCK MARKET BEHAVIOUR: EMPIRICAL EVIDENCE
FROM NIGERIA**

By

Hassan Hassan Suleiman

A Thesis Submitted in Partial Fulfillment of the Requirements of the University
of Abertay Dundee for the Award of the Degree of Doctor of Philosophy

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UNIVERSITY
of
ABERTAY DUNDEE

Dundee Business School

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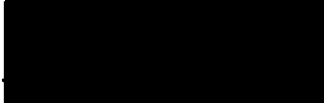
**Dundee Business School
University of Abertay Dundee**

Abstract

This thesis explores the relationship between oil price shocks, exchange rate dynamics and stock market behaviour in Nigeria using a variety of econometric specifications. The response of exchange rates and stock markets to oil price fluctuations is an issue of great interest to policy makers, monetary authorities and investors in both oil exporting and oil importing economies. Despite over 30 years of empirical research, there is still no consensus on their relationship, in addition there have been limited empirical efforts exploring this relationship for Nigeria. First, the thesis applies a Multivariate Vector Error Correction Model (VECM) and a Structural Vector Autoregression (SVAR) to investigate the interaction between real oil price, real exchange rate and productivity differentials. On the one hand results from the VECM suggest that, as predicted by the theoretical literature, oil price exercise a significant positive influence on Nigeria's real exchange rate but contrary to the Balassa-Samuelson hypothesis, productivity differential exerts a significant negative influence on Nigeria's real exchange rate. On the other hand, results from the SVAR analysis using short run restrictions do not offer much support for the theoretical literature on the impact of oil price shocks on exchange rates. The response of real exchange rate and productivity differentials to an oil price shock although positive is not statistically significant. Second, the thesis applies Generalised Autoregressive Conditional Heteroscedasticity (GARCH) class models to explore the influence of oil price return on exchange rate return in Nigeria during periods of extreme oil price volatility. Empirical estimates suggest that over the study period oil price return in Nigeria exercised a significant negative influence on exchange rate return. Third, on the relationship between oil price shocks and the stock market, the thesis employs a multivariate VAR along with a Generalised Impulse Response Function (GIRF) and Variance Decomposition (VDC) as well as an Ordinary Least Square (OLS) and Quantile Regression (QR) technique to examine the role of oil price on the Nigerian stock market. Results of the VAR analysis, OLS and quantile regression indicates that oil price changes do not play an important role in affecting real stock return in Nigeria. However, by employing the QR technique on a recent sample, overall results point to the importance of negative oil price changes in explaining movements in the Nigerian stock market lending credence to the view that the impact of oil price on the stock market occurs in the short run. Finally the thesis applies a DCC-I-GARCH (1,1) to evaluate the dynamic correlation between oil prices and the Nigerian stock market. The dynamic correlation findings demonstrate a number of notable positive and negative correlations between the two. While the Nigerian stock market does not always move in the same direction with oil price, correlations between the two tend to increase and decrease over time. The results of this study are of value to policy makers and investors who are interested in understanding the response of exchange rates and stock markets to an oil price shock in Nigeria. In addition, the results are also transferable and generalizable to other oil exporting economies.

Declaration

I Hassan Hassan Suleiman, hereby certify that the thesis is my original piece of work, that it is the record of work carried out by me and that it has not been submitted for a comparable academic award. The thesis is submitted in part fulfilment of the University's requirement for a research degree award.

Date: 12/Nov/2012 Signature of Candidate: 

Certification

I certify that this thesis is the true and accurate version as approved by the examiners, and that all relevant ordinance and regulations have been fulfilled.

Date: 12/11/12.. Signature of Director of studies, 

Dedication

To my late father and my mother

For their enduring love, support and prayers

Acknowledgement

All Praise and Thanks be to Allah the Almighty for his Guidance, Blessings and for giving me the opportunity to pursue this programme. In undertaking this study, I am indebted to a number of individuals. I would like to thank my supervisor, Professor Reza Kouhy for his guidance, invaluable suggestions and encouragements which have made this thesis possible. Professor Reza's keen interest in my work, his logical thinking and comments immensely improved the quality of this thesis. Special thanks are due to Dr Zahid Muhammad, for his invaluable suggestions and assistance in going through my empirical estimations. Special tribute also goes to Professor Mohamed Branine (Director Research Degrees) for his encouragement and support. I will like to also extend my appreciation to Professor John Innes (my external examiner); Professor Heather Tarbert and Dr Ayodele Asekomeh (my previous supervisors) and Professor Sabine Hotho (Head of Dundee Business School) for their numerous contributions.

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In the end it has to be stressed that I alone take responsibility for errors and inaccuracies that remain in this thesis.

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Acronyms

ADF	Augmented Dickey- Fuller Unit root test
ALSPI	All Share Price Index
ARCH	Autoregressive conditional heteroscedasticity
DCC	Dynamic conditional Correlation
D(LROILP):	Log difference of real oil price
GARCH	Generalised Autoregressive Conditional Heteroscedasticity
IFS	International Financial Statistics
IMF	International Monetary Fund
KPSS	The Kwiatkowski, Phillips, Schmidt and Shin unit root test
LROILP	Log of real oil price
NOC	Negative log difference of real oil price
NOPI	Net oil price increase
POC	Positive log difference of real oil price
PP	Phillips and Perron unit root test
RER	Real Exchange Rate
REER	Real Effective Exchange Rate
RSR	Real Stock Returns
SOPI	Scaled oil price increase
VAR	Vector Autoregressive model
VEC/VECM	Vector Error Correction model

CHAPTER 1

INTRODUCTION

1.1 Background and rationale of the study

Oil price shocks and its increasing fluctuations - especially in recent years - are issues of great interest to policy makers, investors and managers in both oil exporting and oil importing economies. Given its significance especially in the production process, the price of oil, ranks highly among the factors that drive macroeconomic and financial variables. As noted by Cifarelli and Paladino(2010:364) “oil price dynamics is often associated with both stock market and exchange rate behavior”. In this thesis, the response of exchange rate and the stock market to oil price fluctuations is investigated for Nigeria.

Hamilton’s (1983) study has been a central point in the analysis of interactions in the oil price macroeconomy literature, and following his pioneering work on the US economy, extensive studies of different countries have been carried out using a variety of estimation techniques. The majority, however, have concentrated on oil-importing industrialized economies, and particularly that of the United States. Yet, despite this, Malliaris and Kyrtsov (2009:825) observe that a general consensus is lacking, as contradictory results are still being reported in the literature, which as they note explains the renewed and growing “interest in employing new econometric tools and computational techniques in this area of research” as a means of resolving remaining questions.

Such research has evolved in several directions. Early empirical models implied a linear negative relationship between oil prices and the macroeconomy (see Hamilton, 1983; Burbidge and Harrison, 1984 and Gisser and Goodwin, 1986), although these models do not explain the recent findings regarding non-linear asymmetric effects of oil price shocks. This thus led to a series of refinements in the specification of the functional form of the oil price macroeconomy relationship (Jimenez-Rodriguez, 2009). Contributions include definitive works by Mork (1989), Lee, Nee and Ratti (1995), Hamilton (1996) and Hamilton (2003), investigating the nonlinearity of oil shocks in the aftermath of the price collapse of 1985.

Other researchers have looked at the channels of transmission of an oil shock, including the role of monetary policy (e.g. Romer and Romer, 1989; Dotsey and Reid, 1992; Bernanke, Getler and Watson, 1997; Barsky and Killian, 2001), while more recently, others have examined the changing statistical relationship (e.g. Blanchard and Gali, 2007; Naccache, 2010; Herrera and Pesavento, 2009). A small section of studies have concentrated on the pass-through of oil prices to the general price level (defined as a change in domestic prices that can be attributed to a prior change in oil prices) (e.g. Hooker, 2002; Hahn, 2003; Gregorio et al, 2007; Duma, 2008 and Chen, 2010).

A considerable number of recent studies have looked at the oil price macroeconomy relationship in Nigeria (see for example Adeniyi, 2011; Olomola and Adejumo, 2006; Akpan, 2009; Aliyu, 2009; Aliyu, 2011; Mahmoud, 2009; Iwayemi and Fawowe, 2010 and Chukwu et al, 2011). However, despite this there is a dearth of research that has examined the implication of oil price

fluctuations on exchange rate movement in Nigeria¹(Coleman et al, 2011). Equally, on the relationship between oil price and stock market, there are a limited number of examples in the literature exploring this relationship (Nandha, 2008, Apergis and Miller, 2009, Mohanty et al, 2011), and, as observed by Killian and Park (2009) there is still no consensus, as the empirical evidence to date is mixed/not consistent.

The goal of this study is therefore to investigate the impact of oil price shocks on exchange rate dynamics and stock market behaviour for Nigeria. By employing a variety of financial econometric techniques, this study will build upon existing empirical and theoretical literature and contribute to the growing research on the Nigerian economy. Nigeria is currently one of the largest oil producers in OPEC, with current proven oil reserves of an estimated 37.2 billion barrels. It depends on the oil sector for over 95 percent of its export and foreign exchange income and approximately 65 percent of government revenue. Nigeria's oil and gas wealth has been linked with the increasing volatility in its exchange rate, as well as its chronic tendency towards exchange rate over-valuation (Garcia et al., 2006).

Among others, Krugman (1983) and Arouri and Jawadi (2010) have put forward several persuasive arguments as regards the theoretical links between oil prices and exchange rates. For example, through its influence on the terms of trade and wealth transfer from oil-exporting countries to oil-importing countries, the price

¹ Although there have been several empirical efforts geared towards discerning the influence of oil prices on exchange rate movements, evidence on the behaviour of Nigeria and other less developed economies is limited.

of oil affects the exchange rates of the former. Furthermore, an oil price shock influences international capital movements, the international portfolio balance and the stock markets of oil-exporting economies and thus oil-exporting economies experience increased revenue and foreign exchange inflow through income and wealth effects, causing them to import more goods and services from industrial countries which may in turn affect exchange rates.

Several reasons have also been put forward by a number of researchers, including Bjørnland (2009) and Lee and Chang (2011) as to why movements in oil prices influence stock markets. They argue that oil price increases impact positively on stock markets of oil-exporting countries, through income and wealth effects. In a similar note, Filis et al (2011) argue that the stock market will respond positively as a result of the greater productivity and lower unemployment caused by the corresponding significant rise in income, which in turn raises expenditure and investment, thereby promoting productivity. Similarly, Bjornland (2009) also notes that if the income is used to procure goods and services domestically, this should raise the level of economic activity thereby improving stock market returns in oil-exporting economies, while the reverse will likely be the case in oil-importing economies (see also LeBlanc and Chinn, 2004 and Hooker, 2002).

Conversely, several possible alternative explanations have been put forward as to why there is no relationship between oil prices and stock markets, a view held by Chen, Roll, and Ross (1986), Haug et al (1996), Cong, Wei, Jiao, and Fan (2008) and Apergis and Miller (2009) among others. They argue that oil prices do not affect the stock markets as they are no longer a significant source of

economic fluctuation, as was advocated by Hamilton (1983) (see also Filis et al, 2011).

This thesis examines to what extent oil price shocks impact on exchange dynamics and stock market behaviour in Nigeria, an issue of relevance to the country's economy. The thesis contributes to knowledge in the following ways. First, by means of annual data for the period 1980 to 2010, this thesis applies a multivariate vector error correction model and a structural VAR framework to examine the interaction between the real oil price, real exchange rate and productivity differentials. As a preview of the empirical findings, results from the VECM suggest a long-run relationship between the real exchange rate, real oil price and productivity differential; additionally, as predicted by the theoretical literature, oil price exercises a significant positive influence on Nigeria's real exchange rate. On the other hand, and contrary to the Balassa-Samuelson hypothesis, productivity differential exerts a significant negative impact on Nigeria's real exchange rate. Differently, results from the SVAR analysis using short run restrictions, point to the positive - albeit not statistically significant - effect of oil prices on Nigeria's real exchange rate.

Secondly, employing daily data over the time span January 2, 2007 to December 31, 2010, the thesis further applies GARCH class models to examine the influence of oil price fluctuations on exchange rate return in Nigeria, a period characterised by extreme volatility in oil price. The empirical estimate suggests that over the study period the former exercised a significant negative influence on the latter.

Third, the thesis uses a multivariate VAR along with the estimated Generalised Impulse Response Function (GIRF) and Variance Decomposition (VDC) as well as a Quantile Regression technique to examine the response of the Nigerian stock market to oil price shocks. Employing monthly data for the period January 1985 to December 2011, results indicate that oil price changes do not play an important role in affecting real stock return. However from the quantile regression estimates, in recent times, restricting the data to January 2000 to December 2011, empirical results point to the importance of negative oil price in explaining movements in the Nigerian stock market.

Finally, the thesis applies a DCC-I-GARCH (1,1) to monthly data from January 2000 to December 2010 in order to evaluate the dynamic correlation between oil prices and the Nigerian stock market. Result demonstrates several notable positive and negative correlations between this market and international oil prices. The results of this study have important implications for policy makers and are also generalizable to other oil exporting economies.

This thesis may be seen as a direct extension of the works of Habib and Kalamova (2007); Narayan et al (2008); Ghosh (2010); Adebisi et al (2009); Asaolu and Ilo (2012); Adeniyi (2011) and Filis et al(2011) wherein similar methodologies are applied to different data sets, with the exception of Adebisi et al (2009), Adeniyi (2011) and Asaolu and Ilo (2012), all of whom also studied the Nigerian economy. However, by employing an updated data set and a wide variety of estimation techniques this thesis distinguishes itself, improving in particular upon the evidence presented by Adebisi et al (2009) and Asaolu and Ilo (2012) in two ways. Firstly, evidence is presented using higher frequency data

and a more recent sample period² and secondly, an Ordinary Least Square (OLS) and Quantile Regression (QR) technique is further applied to examine the relationship. It improves upon the evidence presented by Adeniyi (2011) by considering a longer time period and also by employing the Generalised Autoregressive Conditional Heteroscedasticity (GARCH)/exponential GARCH (EGARCH)-in-mean for the estimations³.

It should also be noted that whilst there is a substantial and growing literature on the Nigerian economy concerning the oil price macroeconomy relationship, this is usually concentrated on its impact on the real economy, with the previously noted exceptions discussed above. Noting this gap, in undertaking the analysis involved in this study, a further contribution is offered by employing a number of empirical techniques largely absent in existing literature on the Nigerian economy⁴.

² It is a known fact that higher frequency data provide more efficient estimates. Differently from Adebisi et al (2009) and Asaolu and Ilo(2012), the present study employs monthly data as opposed to quarterly and annual data respectively

³ Adeniyi used daily observations from 2 January 2009 to 28 September 2010 to investigate the oil price exchange rate dynamics in Nigeria, but did not cover the fluctuations that occurred in 2008 when oil prices rose to an all-time high of \$148 per barrel in July of that year before collapsing as low \$31 per barrel five months later, in December. In addition, the author did not estimate the GARCH/ EGARCH in mean models.

⁴ To my knowledge, there are also no studies that have explored the dynamic correlation between oil price and the Nigerian stock market using a DCC-I-GARCH.

1.2 Research questions and objectives of the study

Following the research problems stated above, the under-listed research questions are posed:

- What is the dynamic relationship between oil price shocks and the real exchange rate in Nigeria?
- What is the influence of recent oil price changes on nominal exchange rate in Nigeria during periods of extreme volatility?
- What is the impact of oil price shocks on stock market behaviour in Nigeria?, and
- What is the dynamic correlation relationship between oil price and the stock market in Nigeria?

In order to answer these research questions, the study addresses the following under listed objectives that will set forth and contribute to our understanding of the response of exchange rate and stock market to an oil price shock in Nigeria.

The objectives are:

- To investigate the dynamic relationship between oil price shocks and the real exchange rate in Nigeria;
- To explore the influence of recent oil price changes on nominal exchange rate in Nigeria during periods of extreme volatility;

- To analyse the extent to which oil price shocks have an impact on stock market behaviour; and
- To examine the dynamic correlation relationship between oil price and the stock market in Nigeria.

1.3 Outline of the thesis

The thesis is comprised of six main chapters. The first details the development of the background and rationale of the study, its aims and objectives, as well as the structure of the thesis.

Chapter 2 provides a review of the relevant background literature on the oil industry and reviews a number of important industry issues and developments (including the birth of the industry; historical oil price development, and so on), as well as those concerning the stock market and exchange rate management. It seeks to provide an overview of the Nigerian economy, oil market and other relevant background information.

Chapter 3 sheds light on the theoretical underpinnings and literature concerning the oil price macroeconomy relationship, with particular focus on the impact of oil price shocks on exchange rate dynamics and stock market behaviour, two distinct areas of research in the oil price macroeconomy literature.

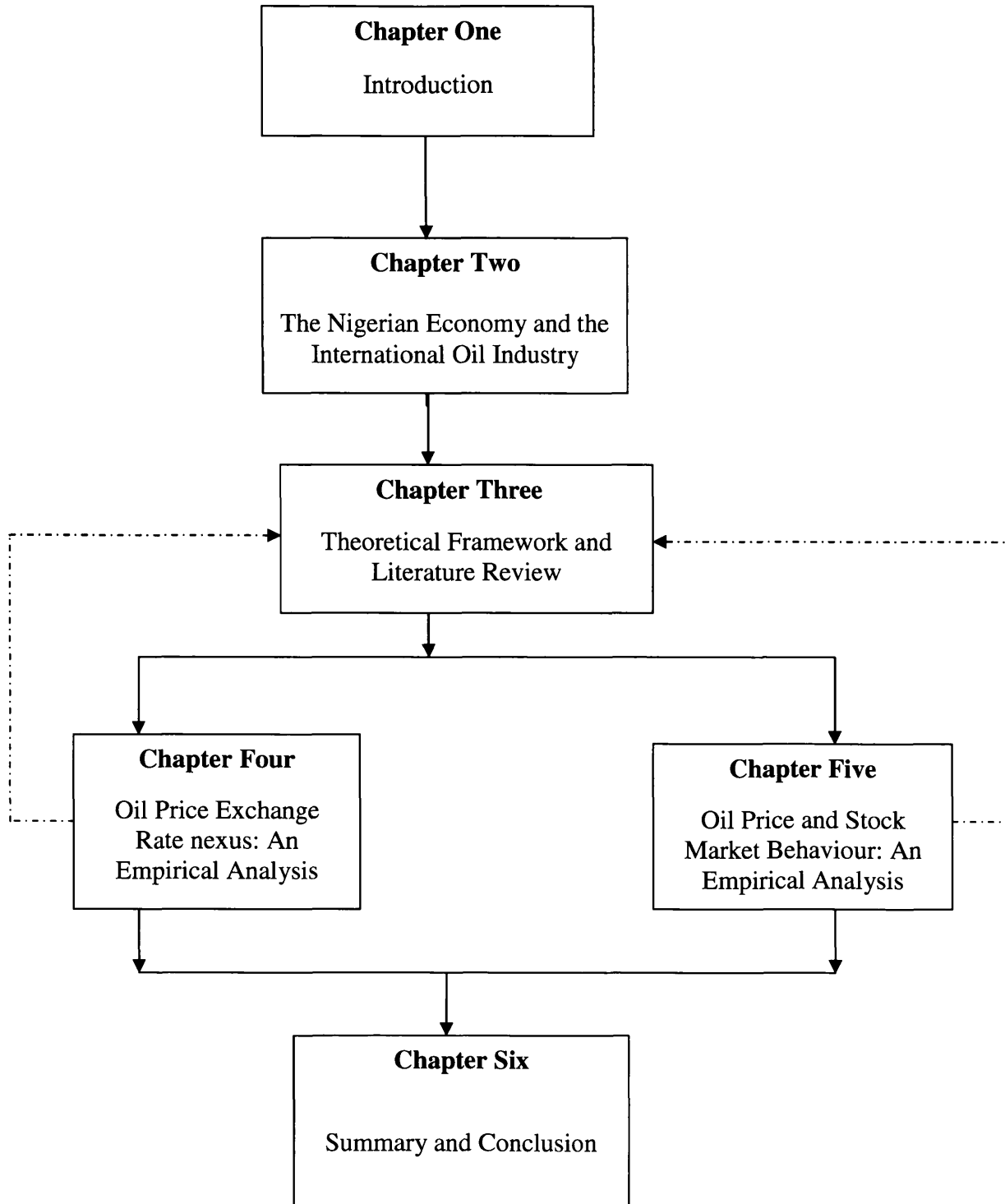
Chapter 4 is the first empirical chapter; it estimates the effects of real oil prices on real exchange rates using the Johansen framework and a SVAR framework, based on annual data from 1980 to 2010. A model is constructed to investigate the impact of real oil price on Nigeria's real exchange rates. The second part of

this chapter extends the preceding empirical analysis by employing GARCH class models to investigate the symmetric and asymmetric effects of recent oil price changes on the nominal exchange rate in Nigeria, using daily data from 2/01/2007 through to 31/12/2010.

Chapter 5 investigates the interactive relationship between oil price shocks and the Nigerian stock exchange, based on monthly data from January 1985 to December 2011. The chapter extends Adebisi et al (2009) and Asaolu and Ilo (2012) by employing a variety of econometric techniques: firstly an OLS, quantile regression analysis and a multivariate VAR analysis is conducted with linear and non-linear specification of the oil price shocks variable. Secondly, a DCC I-GARCH (1,1) is employed to investigate the time-varying correlation between stock market prices and oil prices in Nigeria.

Chapter 6 concludes the thesis with a summary of the study's main issues, recommendations on the implications oil price shocks for exchange rate management and stock market behaviour and indications of areas for further research.

Figure 1-1: Schema of thesis chapters



CHAPTER 2

THE NIGERIAN ECONOMY AND THE INTERNATIONAL OIL INDUSTRY

2.1 Introduction

The overall goal of this chapter is to review background information, relevant to the theme of this thesis, on the Nigerian economy and the world oil industry. Following this introduction, section 2.2 presents an overview of Nigeria's macroeconomic performance, then goes on to discuss issues around exchange rate management, the Nigerian stock market and the discovery of oil. Section 2.3 presents a history of the birth of the modern oil industry and section 2.4 considers the market for petroleum, while Section 2.5 traces the historical oil price development and further examines the issue of price-setting; current geopolitical issues, financial speculation and current oil prices, and the concept of the oil weapon.

2.2 An overview of the Nigerian economy

Nigeria is a resource-rich nation with, as of January 2011, an estimated 37.2 billion barrels of proven oil reserves - approximately 32 percent of Africa's total - and 187 trillion cubic feet (Tcf) of natural gas reserves the largest in Africa and ninth largest in the world (EIA). Nigeria is also the fifth-largest oil-exporting country within the Organization of Petroleum Exporting Countries (OPEC). According to the EIA (2010), Nigeria produces about 2.46 million barrels per day. The country is heavily reliant on its crude oil exports which account for 95

per cent of its total exports and foreign exchange earnings and about 80 per cent of government revenue in annual budgets - annual budgets are framed based on oil prices - and as a result its economy is highly susceptible to oil price fluctuations.

Despite being a net-oil exporting economy, Nigeria's four existing government-owned refineries are currently operating at less than half their capacity and thus the nation imports almost its entire fuel requirement. With local oil prices of N97 (about \$0.59 per litre), this demands a subsidy burden of more than \$4 billion per year (EIA). However, according to the IMF (2012) the country dealt with the global economic recession and a domestic banking crisis remarkably well; economic performance was robust in 2011 and is projected to remain so in 2012. Economic growth was strong and Nigeria witnessed an 8.3 per cent increase in non-oil GDP as well as an overall GDP growth of 6.7 per cent.

In a related development, according to data from the Central Bank of Nigeria, the country's real gross domestic product (GDP), at 1990 constant basic prices, grew 7.3 per cent relative to the 7.5 per cent achieved in the first half of 2010. On an annual basis, it leapt 7.9 per cent in 2010 relative to the 7.0 per cent achieved in 2009, an increase which largely echoed the growth in output of the non-oil sector. This was of course complimented by significant increase in oil output and its price in the international oil market (CBN, 2011a, CBN, 2011b).

Crude oil production including condensates demonstrated further improvement as average daily production grew to 2.14 million barrels per day (mbd) in the first half of 2011, compared with 2.06 mbd in the corresponding period of 2010.

The average spot price of Bonny Light (370 API), which is Nigeria's reference crude, rose to US\$113.86 per barrel an increase of 43.3 per cent (CBN, 2011b).

Table 2-1: Selected Macroeconomic and Social Indicators

Indicator	Jun-07	Jun-08	Jun-09	Jun-10	Jun-11
Domestic Output and Prices					
GDP at Current Mkt Prices(N'billion)	9,594.65	11,820.52	11,719.83	13,536.45	15,955.63
GDP at Current Mkt Prices(US\$ 'billion)	75.36	100.22	79.55	90.22	104.14
GDP per capita(N)	66,398.96	79,279.16	76,102.77	85,173.48	97,282.28
GDP per capita(US\$)	521.55	672.2	516.58	567.67	634.92
Real GDP Growth(Growth Rate %)	5.51	6.11	5.9	7.46	7.31
Oil Sector	-4.34	-3.3	-3.47	3.16	0.45
Non oil Sector	8.51	8.65	8.1	8.36	8.71
Oil Production (mbd)	2.14	1.94	1.76	2.07	2.14
Inflation Rate(%) (Year-over-Year)	6.4	12	11.2	14.1	10.2
Core Inflation Rate(%) (Year-over-Year)	9.6	3.6	8.5	12.7	11.5
EXTERNAL SECTOR					
Current Account Balance(% of GDP)	12.2	17.3	9.84	2.4	12.78
Average Crude oil price (US \$/barrel)	65.66	113.03	53.65	79.47	113.86
Average AFEM/DAS Rate(N/\$1.00)	127.94	117.94	147.32	150.04	153.22
Average Bureau de Change Exchange Rate(N/\$)	129.31	119.21	168.03	152.77	156.93
CAPITAL MARKET					
All Share Value Index(1984=100)	51,330.50	55,949	26,249.28	25,384.14	24,980
Value of Stocks Traded (Billion Naira)	666.2	106.3	301.5	437	373.5
Market Capitalization(Trillion Naira)	8.9	12.1	8.81	8.22	11.2

Source: CBN

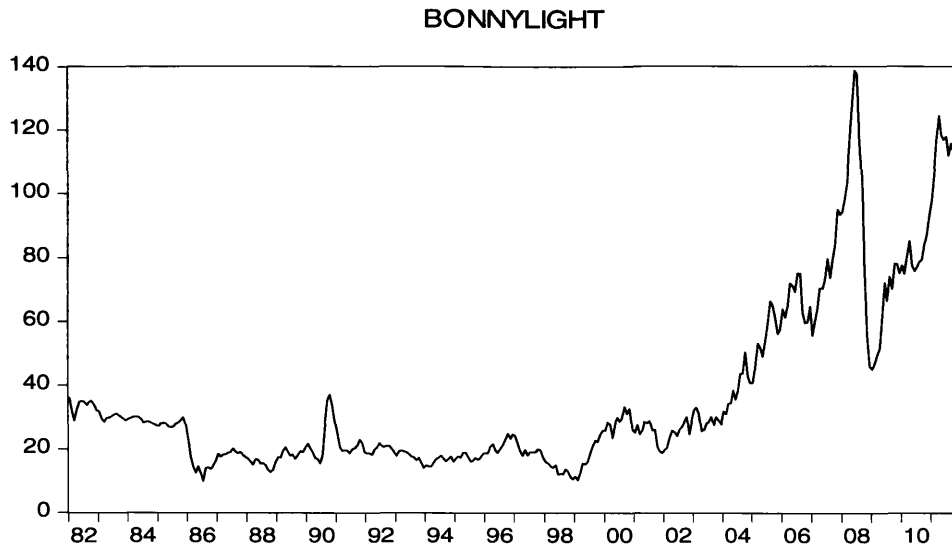


Figure 2-1: Price of Nigeria's reference crude (US\$ per Barrel)

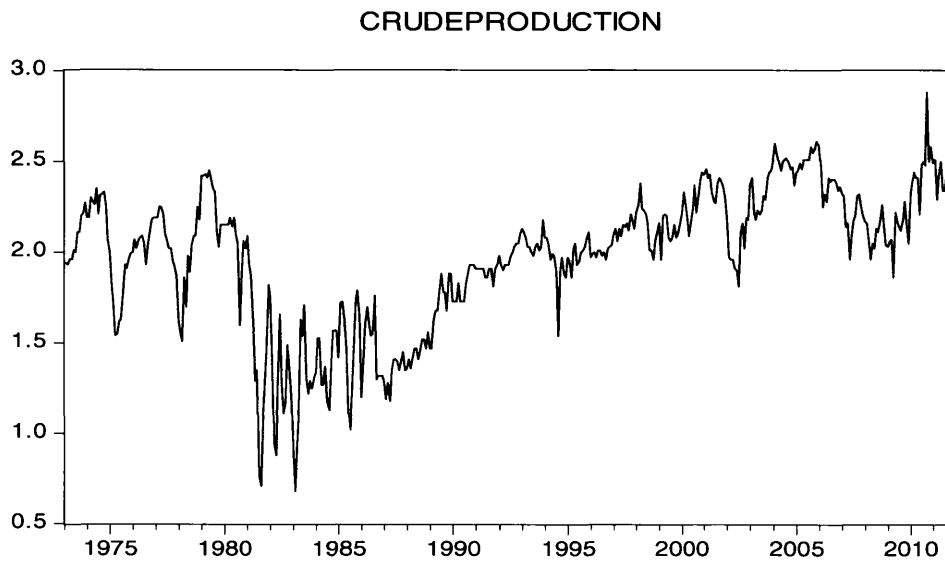


Figure 2-2: Domestic Crude Oil Production (Millions of Barrels per Day)

According to the central bank of Nigeria (CBN), in the first half of 2011 the total federally-collected revenue (gross) stood at N4,762.20 billion owing to oil

revenue. With Oil revenue making up 80.4 per cent of the N4,762.20 billion, while the remaining balance is accounted for by non-oil revenue.

In addition, there was a substantial rise in the autonomous foreign exchange inflows into the Nigerian economy during the first half of the year following the rise in crude oil receipts compared to the previous period. Similarly, foreign exchange outflow rose drastically. The CBN reports that a net inflow of US\$29.71 million into the economy was achieved at the end of the first half of 2011, compared with US\$21.72 million in the corresponding period of 2010; it also reports that US\$10.72 billion and US\$9.5 billion foreign exchange inflow and outflow was recorded through the bank, amounting to a net inflow of US\$1.16 billion during the quarter (CBN, 2011).

Furthermore, the CBN notes that in the first quarter of 2011, the WDAS spot rate averaged N152.55/US. The WDAS bureaux-de-change segment of the market recorded a 0.9 percent depreciation, with the average Naira exchange rate vis-à-vis the US dollar selling at N152.04 per dollar, while at the interbank segment, it depreciated from N151.65 per US dollar in Q4 2010 to N153.48. According to the IMF (2012) in November of 2010, the bank was forced to amend downward its soft band around the naira-US dollar exchange rate and this succeeded in reducing depreciation pressure on the naira.

Inflationary pressures persisted into the first half of 2011 as the consumer price inflation rate remained in the double digits; this is projected to increase temporarily in 2012 following an increase in fuel prices in January of 2012. The CBN reports that the year-on-year headline inflation dropped to 10.2 per cent at

end-June 2011 and similarly, the 12-month moving average dropped to 12.3 per cent at end-June 2011 down from 13.1 per cent.

According to the Nigerian stock exchange during the first three weeks of January 2011, the market performance was “very impressive with the Nigerian market ranking among the world’s best” (NSE, 2011:1). The Nigerian Stock Exchange All Share Index spiked to an 8 month high, opening at 24,770.52 and closing at 26,830.67. Market capitalisation value for the 264 listed securities in January 2011 stood at N10.583 trillion, with the 217 equities accounting for 81.13 per cent or N8.6 trillion of market capitalisations. During the month of January, the exchange saw transactions in 174 listed equities. When measured by turnover volume, the banking subsector was the most active, with 83,447 deals trading a volume of 8.1 billion shares valued at N76.8 billion (NSE, 2011).

2.2.1 Exchange rate management in Nigeria

Over the past five decades, exchange rate arrangements in Nigeria have experienced different regimes, from a fixed regime at independence in 1960, a pegged arrangement in the 1970s and early 1980s, and to a range of variants on the floating regimes⁵ since the IMF-inspired structural adjustment programme of 1986, when the determination of the Naira exchange rate was made to reflect market forces (Sanusi, 2004, Mordi, 2006). After the liberalisation of the market

⁵ Autonomous foreign exchange market (AFEM) in 1995 and interbank foreign exchange market (IFEM) in 1999

in 2002⁶ with the reintroduction of the Dutch Auction System (DAS), Nigeria operated a floating exchange rate regime, but in 2006 DAS was replaced with the Wholesale Dutch Auction System (WDAS) (Akanji, 2006). The WDAS has enhanced professionalism in dealings, narrowed premiums and succeeded in conserving foreign reserves (Sanni, 2006). Nigeria's exchange rate under WDAS stabilised and improved foreign exchange market operations in line with global best practices (Sanusi, 2011; CBN).

The schema in the next page summarises and reports events in exchange rate management in Nigeria from independence to the present day. Such frequent changes in exchange rate policy can be credited to the failure of the different exchange policies. After 1986, the government gave up the fixed exchange rate arrangement.

⁶ In an attempt to narrow the gap between the official and parallel market rates and evolve a realistic exchange rate, thereby conserving foreign exchange, the Dutch Auction System (DAS) was discontinued in 1990 and reintroduced in 2002.

Table 2-2: Schema of events in exchange rate management in Nigeria

	Year	Event	Remark
1	1959-1967	Fixed parity solely with British pound sterling	Suspended in 1972
2	1968-1972	included the US dollar in the parity exchange	Aftermath of the 1967 devaluation of the pound and the emergence of a strong U.S dollar
3	1973	Revert to fixed with British pounds	Devaluation of the U.S dollar
4	1974	Parity to both pounds and U.S dollar	To minimize the effect of devaluation of the individual currency
5	1978	Trade (import) weighted basket of currency approach	Tied to 7 currencies-British pounds, US dollar, German mark, French franc, Japanese yen, Dutch guilder, Swiss franc
6	1985	Referenced on the US dollar	To prevent arbitrage prevalent in the basket of currencies
7	1986	Adoption of second tier Foreign exchange Market(SFEM)	Deregulation of the economy
8	1987	Merger of the first and second -tier markets	Merger of rates
9	1988	Introduction of the interbank foreign exchange market	Merger between autonomous and the FEM rates
10	1994	Fixed exchange rate	Regulate the economy
11	1995	Introduction of the Autonomous foreign exchange market	Guided-deregulation
12	1999	Re-introduction of the interbank foreign exchange market(IFEM)	Merger of the dual exchange rate, following the abolition of the official exchange rate from January 1, 1999
13	2002	Re-introduction of the Dutch Auction System(DAS)	Retail DAS was implemented at first instant with CBN selling to end users through the authorized users
14	2006	Introduction of the Wholesale DAS	Further liberalised the market

Source: (Mordi, 2006)

2.2.2 The Nigerian stock market

The Nigerian Stock Exchange (NSE) started operating in 1960 with the creation of the Lagos stock exchange, which later in 1977 transformed into the Nigerian stock exchange (Osinubi, 2004). The Nigerian All Share Index and the market capitalisation of listed equities echoes the performance of the Nigerian stock exchange (Ajakaiye and Fakiyesi, 2009).

According to Olowe (2009), trading on the equity market between 1971 and 1987 was extremely limited, as government and industrial loan stocks dominated.

There were no restrictions on foreign investor participation in the market prior to 1972. The indigenization decree promulgated in 1972 and later amended in 1977 as the Nigerian Investment Promotion Decree restricted capital inflows in to 40 per cent of equity holding as a maximum, yet in contrast, during the privatisation era of 1989 the decree was further amended to encourage foreign participation. Total deregulation of the capital market was achieved through the Nigerian Investment Promotion Commission Act of 1995, the Foreign Exchange Act of 1995 and the Investment and Securities Act of 1999. Since then foreigners have participated in the market as operators and investors with no percentage limit on foreign holdings in any company (Osinubi, 2004).

As of January 2011, monthly trading statistics show that market capitalisation stood at N10.6 trillion and equity market capitalisation at N8.6 trillion (NSE, 2011). The index grew from 111.3 in January of 1985 to 343.0 in January 1990; to 2,285 in January of 1995, 5,752.2 in January of 2000 and finally to 23,078.3 in January of 2005. From that point on the Nigerian capital market was exceptionally bullish and share prices soared (Sere-Ejembi, 2008) with the index peaking at 65005.48 in March of 2008, only to close at 31,450 by December of the same year. The index further dropped to 19851.89 by March of 2009, the lowest it had been since November of 2003/in six years (CBN, 2010).

Over N406 billion was raised by banks from the capital market in the process of complying with the July 4, 2004 minimum capital requirement proposed banking reforms of the Central Bank of Nigeria. The value of equity traded as a proportion of total market capitalisation increased to 81.0104 in 2007 following the recapitalisation drive of the Nigerian Banking industry and inflow of banking

stocks into the stock market. In 2008, there was a 45.8 per cent decline in market capitalisation, in contrast to a growth of 74.7 per cent in 2007 (Olowe, 2009). Nigeria was not isolated from the effects of the global financial crisis triggered by the 2008, credit crunch within the US sub-prime mortgage market. Ajakaiye and Fakiyesi (2009) note that despite initial relative insulation, this was evident in the performance of the Nigeria Stock Exchange and the financial system as well as in the real sector.

As observed by Sere-Ejembi (2008), with the crash of the Nigerian stock market in March 2008 risk-averse institutional and individual foreign investors commenced divestment. The local investors then supported/followed the panicked disposal, further propelled by the tightness in the balance sheets of the deposit money banks due to the margin lending as well as prior stock price appreciation with no fundamental basis.

2.2.3 Discovery and nature of crude production in Nigeria

Shell Petroleum Development Company of Nigeria (formerly Shel D'Archy and later on Shell-BP) pioneered the search of oil in Nigeria in 1937. Concessions were for the whole country at onset but were later reduced to 40,000 square miles in and around the Niger Delta basin. Operations were suspended following World War II in 1941 and resumed in 1946. An exploration well drilled in Ihio in 1951 was unsuccessful; in 1953, oil was encountered in Akata and drilled, but this was suspended in 1954 (Oremade, 1986). Oil was then discovered in commercial quantity in 1956 at Oloibiri in the River Niger delta basin and has

played a dominant role in the Nigerian economy ever since (Odeyemi and Ogunseitan, 1985).

A close look at the export pattern reveals United States as the largest buyer of Nigerian Crude accounting for up to 40% in 2009.

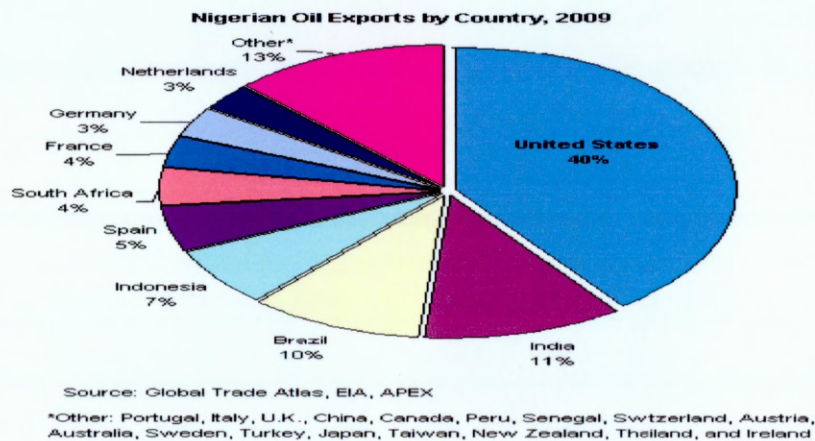


Figure 2-3: Nigerian exports by country (2009)

Source: <http://www.eia.gov/emeu/cabs/Nigeria/pdf.pdf>

2.3 Birth of the oil industry

The scarcity of coal and illuminating oil in the 19th century led to the development of the modern oil industry (Giebelhaus, 2004). These two issues, according to Labatt & White (2007) acted as stimulants in the quest for crude oil. However, societies were not unfamiliar with petroleum derivatives even before the 1800s, in particular in the form of natural seepage of asphaltic bitumen (Falola and Genova, 2005). Even Edwin L. Drake and associates were aware of

local tribes' long use of oil prior to their decision to drill in Northwestern Pennsylvania (Giebelhaus, 2004).

Edwin. L. Drake is considered to be responsible for the first large scale oil field operations, begun on the 27th of August 1859, in Titusville, Pennsylvania, in the Northeast United States. Drake is acknowledged as the first person to dig a well for the specific purpose of finding crude oil and his well is most commonly used to attribute commencement of the oil timeline (Jones, 2010).

Drake drilled for oil utilising techniques previously used to drill for water and struck oil at 69 feet near Oil Creek, a short distance from Titusville; this marked the beginning of the age of oil (Giebelhaus, 2004). Drakes' well led to an explosion of pioneer explorers, which within a short period led to the area being overrun with stills to produce kerosene. Within two years, kerosene found itself as an export item to Europe (Jones, 2010). Oil production in the US soared from 2000 barrels in 1859 to 500,000 barrels in 1860; and from this to 2.5 million barrels in 1865, 3.6 million barrels in 1866, 3.4 million in 1867 and 4.2 million by 1869(Giebelhaus, 2004).

Outside the United States, the giant oil field of Baku was discovered in Tsarist Russia in the 1870s. In 1885, oil was discovered in Sumatra, modern-day Indonesia. Mexico began to commercially produce oil in 1901 and started exporting it in 1911, followed by Venezuela in the 1920s, the Middle East in the 1930s, Africa in the 1950s and finally Alaska and the North Sea in the 1960s (Jones, 2010), Romania, Iran, and Burma as well as the Dutch East Indies were also small oil producers by 1914 (Jones G. , 1983).

At the start of the twentieth century, the introduction and adoption of internal combustion engines in the transport sector coupled with the increase in the number of motorcar owners led to a rise demand for oil (Fouquet, 2009). The motorcar industry impacted heavily on the oil industry as producers began to manufacture more petroleum than kerosene (Jones, 2010, Falola and Genova, 2005). In the words of Campbell (2005) “The automobile developed an unquenchable thirst for oil”. Labatt & White (2007) observed that Oil “revolutionalized land based transportation and made aviation possible”. US production rose from 63.6 million barrels in the 1900s to 134 million and then 209.6 million in 1905 and 1910 respectively (EIA).

In 1870, John D. Rockefeller formed the Standard Oil Company in Cleveland Ohio. The company traded in kerosene before expanding into the refining business. During the industry’s early stages, producers weakened by overproduction were taken over by refining and distribution companies led by the Standard Oil Trust (Eden et al., 1981). Rockefeller acquired 22 of the then existing 26 refineries. Standard Oil’s market share of refined output - which was only 4% in 1870 - soared to 25% in 1874. By the 1880s, the Standard Oil Company had spread to other states and emerged as the major refiner and supplier of petroleum products, owning 90% of refining capacity in the US.

At the peak of its reign, from 1890 to 1910, Standard Oil maintained product quality and prices, thus providing market stability (Yergin, 1991, Jones, 2010, Armentano, 1981). Standard Oil controlled enough of the market to become a price maker, and dominated the industry until the 1911 North American antitrust legislation forced it to divest all of its subsidiaries. Subsequently Standard Oil’s

domination of the oil industry in the US came to an end; as it was split into 37 companies more suppliers entered the market. As a consequence of the breakup, some of the new companies, and in particular Esso (which later became Exxon), Chevron, Mobil, Amoco, Conoco, Sohio and Arco grew to become some of the world's biggest oil companies (Campbell, 2005).

Of the thirty-seven (37) companies in the group, Esso (formerly Standard Oil of New Jersey, or Exxon), Mobil (developed from Standard Oil of New York) and Socal (Standard Oil of California) along with two other American (Gulf and Texaco) and two European companies (Shell and BP) dominated the world oil industry through the first half of the century (Eden et al., 1981). These seven major oil firms, who became known as the "Seven Sisters" or the "majors", achieved dominance through their control of world supply and distribution. According to Eden et al (1981) in the non-communist areas outside the United States, the Seven Sisters were responsible for 165 million tonnes of oil production in 1950 and 900 million tonnes in the late 1960s - representing 80 percent and 70 percent of the non-communist production respectively.

The Seven Sisters' tight hold on production and distribution came to an end in the 1960s and early 1970s when the Organisation of Petroleum Exporting Countries (OPEC) was formed. OPEC became an effective cartel during the early 1970s by successfully implementing production quotas among member nations, resulting in higher prices (Abdalla, 1995).

The Organization of the Petroleum Exporting Countries (OPEC) came into being on September 16th 1960 at the Baghdad Conference, with Iran, Iraq, Kuwait,

Saudi Arabia and Venezuela as members; its purpose was to defend its members in a weak international oil market. The event passed almost overlooked except by the few specialized petroleum media. The world did not foresee the importance the organization would play in the world some ten years later (Chalabi, 2004). The founding members were at the time responsible for 80% of internationally traded crude oil (Eden et al., 1981). They were later joined by Qatar, in 1961; the Socialist People's Libyan Arab Jamahiriya joined in 1962, as did Indonesia, although it suspended its membership from January 2009. The United Arab Emirates followed in 1967, with Algeria in 1969, Nigeria in 1971, and Ecuador in 1973 (although it also suspended its membership, in its case from December 1992 to October 2007). Last to join was Angola in 2007. Gabon was also a member between 1975 and 1994.

According to Eden et al (1981), at the time of OPECs formation the seven sisters dominated the international oil market. OPEC was formed after two successive unilateral deductions in the posted price for oil. The first was in February 1959 by 10% for Gulf oil and the second was by 7% by Exxon, followed by other companies in August 1960. OPECs member countries' immediate objective was to prevent further falls in oil revenue by maintaining price stability. OPEC also emphasized that companies could no longer unilaterally undertake price cuts without consultation (Chalabi, 2004). The formation of OPEC helped to safeguard the producers' interest and strengthened the price structure.

After its formation, oil companies continued to negotiate prices directly with each producer country until 1964, when OPEC were able to negotiate a four (4) cents per barrel additional royalty payment to each producer country. In June

1966, OPEC declared a Petroleum Policy Statement in member countries, emphasizing the right of member nations to unilaterally fix the price of their own oil and according the states the right to participate in concession holding agreements and partner in their own industry, thus giving them a bigger part to play in the development of their hydrocarbon resources. This was a turning point for OPEC and later proved to be an important move in shaping the structure of the oil industry (Chalabi, 2004).

OPEC's real impact was not felt until 1973, when its Arab members imposed an embargo on countries believed to be providing assistance to Israel during its war with its neighbours. From 1973, OPEC became a force in determining price without reference to either oil companies or consuming nations. In 1979, OPEC abandoned attempts to coordinate prices. According to Roeber (1993), OPEC successfully took over the system of centralised price management during the period 1974 to 1982 and less successfully from 1982 to 1986.

In 1983, OPEC introduced a quota system to share the burden of output cuts with production ceilings. OPECs administered system collapsed in 1986, when Saudi Arabia lost a significant amount of its market share and its exports in an attempt to defend OPEC's marker price, resulting in a price war. This led OPEC to abandon its fixed price target (Fattouh, 2010).

According to Fattouh (2007) OPECs pricing power is not constant, especially during instances of weak and tight oil market conditions. He observed that OPEC depends on other players' behaviour; it cannot determine the oil price, but its quota decisions do act as signals to the market about its preferred range of prices.

Fattouh (2010) summarized OPEC's evolving role from 1960 to 2010, observing that OPEC played the role of a trade union between 1960 to 1970; a price setter between 1973 and 1985; a residual producer and spare capacity holder from 1986 to 2006; an inventory manager in 2007 and since 2008, a signaler.

2.4 Market for petroleum

Before the 1970s, the oil market consisted mainly of the U.S domestic market and the international market. The US domestic market consisted of a number of small producers, refiners and marketers, and the international market included the seven majors (Lynch and Adelman, 2004). Prior to the Second World War, the Gulf of Mexico was the only place in the world where the number of transactions was large enough to create a market; during that period Texas was the largest producer of oil, accounting for two-thirds of all transactions occurring on the Texas coast (Massere, 1990). Thus product prices in the Gulf of Mexico logically served as a bench mark irrespective of the country concerned (ibid, 1990).

Prior to World War II and during most of the 1950s and 1960s, virtually all oil production, shipping, refining and marketing and transactions in the international oil market was controlled by the seven majors (Adelman and Lynch, 2004). Until 1973 oil prices were administered by the majors setting crude oil prices through a system of posting prices (Roeber, 1993). From then on, oil producing countries took over the system of negotiated price management which was already weakened by new oil producers. In the 1960s and early 1970s, petroleum was traded in a buyers' market and international transactions grew.

By the 1970s a great percentage of world oil was produced by national oil companies, mainly in OPEC nations, with oil sold on contracts to individual companies and in the world oil market (Adelman and Lynch, 2004). In 1979 the commodity market was formed after OPEC abandoned attempts to coordinate prices. The short term spot market quickly gained importance from the norm of long-term fixed price term contracts (Roeber, 1993). Concession rights substituted long-term sales contracts and government selling price substituted posted prices. According to Roeber (1993) prices were taken from open market interactions after the administered price system collapsed in the mid-1980s.

The spot markets for oil have existed in the United States for some time, as a result of the number of small producers; but on a global scale the spot market for oil had been small and largely confined to local and regional markets due to the high cost of delivery. Prior to the rise of the spot market, trading oil products on the spot was relegated to the Rotterdam, Mediterranean and Singapore regional markets. The increase in the number of small producers, coupled with the advancement in refining technology capacity to accommodate different types of crude, and the increasing preference of oil companies for trading their crudes in regional markets and buying in other markets - rather than shipping their products across continents - all led to more oil entering the world's spot market. From the 1980s to 2000, the volume of Spot trading rose from 3 to 5% of the world oil market to 30 to 35% , as the volume of oil entering the spot market increased (Adelman and Lynch, 2004).

The futures market for petroleum is still a relatively new one; it is in fact considered as a restoration of the 19th century market that was used to hedge and

speculate on the price of oil (ibid). An oil futures market had existed in New York in the mid 19th century and again in the early 1930s in California, but had collapsed once relative stability ensued, thus leaving no incentive for the emergence of a futures market (Treat, 2004). It resumed again in 1978 on the New York Mercantile Exchange (NYMEX) after the first oil shock (Adelman and Lynch, 2004). According to Cuublen (1986), the oil futures market was set up to enable traders to hedge their positions by offsetting some of the risks they take. NYMEX is the most actively traded futures market for crude and middle distillates.

2.5 Historical oil price development

From the outset, the price of oil fluctuated widely and has been characterised by “boom or bust”, with wide fluctuations occurring in the face of new discoveries which flood the market (Campbell, 2005). Early producers were quickly aware of the laws of supply and demand as they experienced the first oil glut. The profitable \$20 per barrel cost of “early crude” declined to \$12, to \$2 and then 10 cents in the beginning of 1862 but did eventually recover (Armentano, 1981) .

A global price for oil did not exist before the Second World War as production and consumption was within the United States alone (Adelman, 2002). The Marshal Plan, which was devised as a response to the devastation caused by World War II and the threat of the USSR, demanded a competitive market price of oil coming from the Gulf region to Europe. This involved a price cut to distant buyers like the US, which had become an importer, and to European and other buyers (ibid). In nominal terms the price of oil in the post-Second World War

period was less than \$3 a barrel and remained so for over a quarter of a century. Western Europe and Japan recovered on cheap oil following large discoveries by the Seven Sisters in the Middle East and North Africa (Franssen, 2007).

Standard Oil's (later Exxon) unilateral decision to reduce the posted price of oil in 1955 led to agitation for the creation of the Organisation of Petroleum Exporting Countries (OPEC) in 1960. OPEC's main objective was to enhance cooperation among member countries and resist the unilateral decisions of oil companies to alter posted prices. By the beginning of the 1970s US oil companies no longer controlled output and price; that power had been transferred to the Arab Gulf producing states. As part of OPEC (Organisation of Petroleum Exporting Countries) and in reaction to western policies, they began to control supply, thereby affecting price. During OPEC's first decade, 1960 to 1970, it succeeded in maintaining posted prices at a constant \$1.8. Following the Yom Kippur War which started on October 5, 1973 the US and other countries showed support to Israel, resulting in an oil embargo by Arab oil-producing states. Within 6 months prices soared by 400%, rising from \$2.50 to \$10 per barrel and causing a global downturn (Stanislaw & Yergin, 1993).

Equally in 1979 and 1980, following the revolutionary events in Iran and the Iran-Iraq war, prices more than doubled from \$14 per barrel in 1978 to \$35 in 1981 (Yergin, 1991). From 1982 to 1985, OPEC unsuccessfully attempted to set production quotas in order to stabilise prices, with Saudi Arabia acting as a swing producer, but members were not following the set production targets. Saudi Arabia retaliated in August of 1985 by linking their oil prices with the spot prices, leading to a price crash. In 1986, they plummeted to \$10 but later

recovered to \$18 (Stanislaw and Yergin, 1993). However, in 1990, the price of oil soared again following the invasion of Kuwait by Iraq and the subsequent first Gulf War. OPEC's strategy of slashing quotas in the face of increased non-OPEC production led prices to increase in 1999.

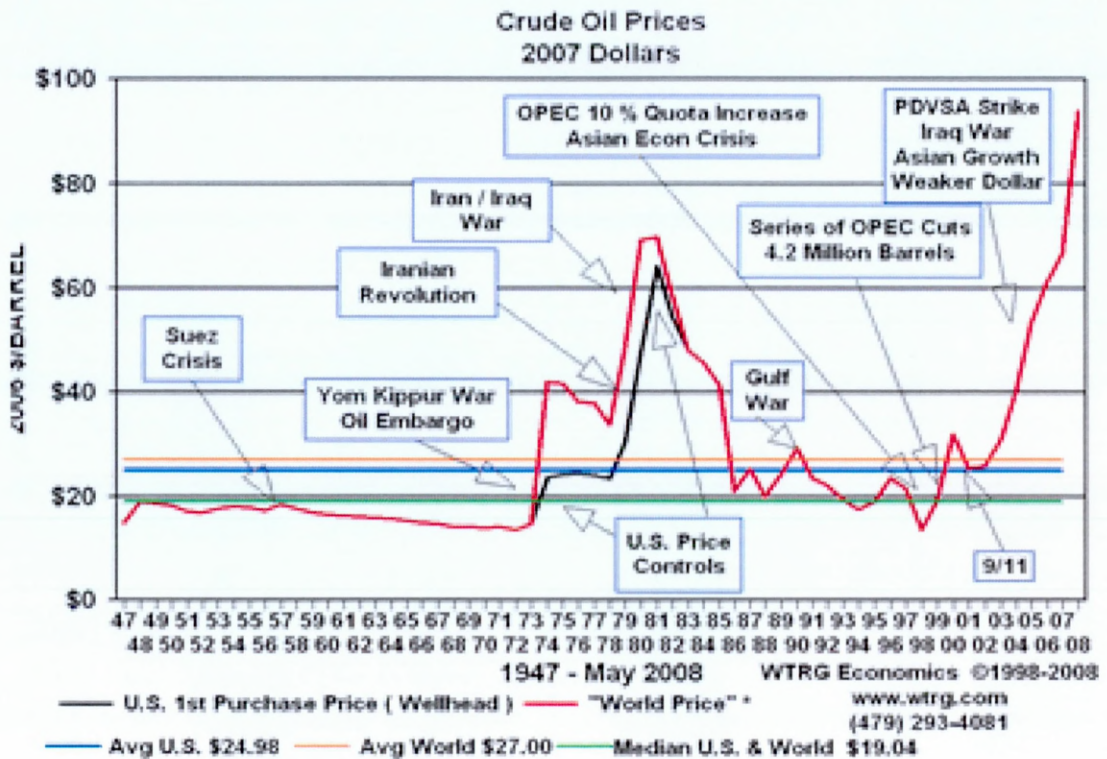


Figure 2-4: International Crude Oil prices

SOURCE: www.wtrg.com

In the early 21st century, there was a return to higher prices, owing to growing world demand and the political instability in the Middle East. By the end of the first decade of the 21st century a recession had led to a freefall in oil prices. Until 2003, experts had thought, following years of predictable patterns, that oil prices

would remain in the \$20 range until the end of the decade, with the possibility of a price crash in the year 2005 or 2006. Forecasters were shocked when oil prices rose by an average of \$10 a barrel in 2004 following increased demand from emerging economies (ibid). Experts continued to view the uptrend as unsustainable, and yet prices still soared by an average of \$15 a barrel in 2005 (Defina and Taylor, 1993) despite a fall in demand. Notwithstanding poor market fundamental oil prices remained high in 2006 (Franssen, 2007).

Oil prices doubled between 2003 and 2005 following the unforeseen increase in both oil demand and supply constraints - especially following Hurricanes Katrina and Rita in 2005. Ever since, high oil prices have been due to increased demand rather than supply disruptions (ibid). Between 2004 and 2008, the price of oil almost tripled. Oil has recently been trading at its year high; with benchmarks such as the UK Brent selling at \$85.21 per barrel it has so far averaged \$77.27 per barrel since the beginning of the year (EIA, 2010). In 2009 oil prices averaged \$61.73 per barrel. In July of 2008, oil prices peaked at an all-time high of \$143 per barrel before a free fall in price led to a cost of just \$33 per barrel by December of 2008.

2.5.1 Price setting

The market for oil has never been genuinely free, neither during the oligopoly of the Seven Sisters nor since the early 1970s when OPEC took control of the international oil trade (Kohl, 1991). According to Lynch & Adelman(2004), the price of oil has always been influenced by one institution or the other. In the late 19th century, the famous Standard Oil influenced the market through its

monopoly. After the antitrust law of 1911, the Texas rail company assumed the role of price setter by setting quotas based on perceived market situation. Other producer states in the US followed suit, imposing production quotas which temporarily stabilised the market. Price setting soon moved to the seven majors, as they grew and dominated the world oil industry. The majors introduced the 'Gulf plus', which consisted of the cost of oil in the Gulf of Mexico inclusive of the transportation cost to the point of sale; they also engaged in the practice of limiting production so as to avoid crashing prices. With the formation of OPEC and as independent oil companies began to move in to new virgin areas, the system of price setting began to fail in the 1960s.

According to Adelman and Lynch (2004), the world oil price was referred to as the posted price during the 1950s; this was a tax reference price with which firms pay taxes to the government while the actual price was determined by their tax payment plus the cost of production. By the mid-1970s the posted price had come into wide use. The posted price was the actual price and no longer symbolized the tax on production following the nationalisation of production operations by many nations. OPEC member countries would meet regularly and agree on a standard price to offer buyers. This method also crashed due to high oil prices after 1979, which led to a price war in 1985. Since then OPEC countries have resorted to controlling output in order to influence price and prices rise and fall to a large extent depending on the world market (Adelman and Lynch, 2004). The failure of the OPEC administered pricing system ushered in a new system to oil pricing in 1986, shifting from OPEC to the market. Market related pricing was first adopted by PEMEX, the Mexican national oil

company; currently it is widely accepted among oil exporting countries and remains the main method of pricing crude oil. The current system received wide criticism in light of the last oil price bubble in 2008, demanding a greater responsibility from producers and a return to administered pricing. But the reality is the current pricing system has generated a price range comfortable for key players (Fattouh, 2010).

2.5.2 Geopolitics, financial speculation and current oil prices

Over the years, oil prices have exhibited large upward and downward swings occasioned by geopolitical events, as a result raising the level of uncertainty, propelling speculation and making oil prices increasingly disengaged from fundamental valuation (Sornette et al., 2009). Lured by its high return, a number of speculators have entered the oil market. Oil prices have appreciated as a result of worries about supply disruption caused by conflicts that have afflicted the Niger Delta region in Nigeria, tensions in the Persian Gulf and so on (ibid). Furthermore as observed by Sornette et al (2009): Oil prices exhibited “a bubble like dynamics which is symptomatic of speculative behaviour” (Sornette et al 2009: 1575).

Oil has also been used as a political weapon. The first time oil was used in this way was in the 1940s during Japanese conflict with the United States, following Japan’s military aggression in Asia (Salameh, 2004). Ever since then, a similar accusation has been made of the Arab countries, primarily for using oil against western countries supporting Israeli aspirations for a state in Palestine (Aarts, 1999). In 1946 the Arab League (formed in 1945) unsuccessfully called for the

use of the oil weapon, as it failed to make much impact. The failure, Aarts observed, was as a result of the then limited demand for Arab oil, the Arab world's technical dependence on foreign oil companies and the Arab world's dependence on oil as a source of revenue. A similar call was echoed two years later, with the foundation of the state of Israel. Following the Suez crisis in 1956, Egypt blocked the Suez Canal, eliminating an importer oil feeder line. The crisis came to an end in 1957 following the successful oil lift energy supply by the United States.

In June of 1967, Arabian oil countries unsuccessfully raised the oil weapon against the US and Britain during the Six day Arab-Israeli war. On June 6, oil ministers of Saudi Arabia, Kuwait, Iraq, Libya and Algeria imposed an oil embargo on countries that supported Israel, with Arab oil dropping to 60% of capacity. The situation was made slightly more precarious as a civil war broke out in Nigeria in late June, leading to a further loss of 500,000 barrels per day from the market. By July of 1967, it was evident that the Arab selective oil embargo had failed to make the necessary impact as the United States increased its domestic production, accompanied by Iran, Venezuela and Indonesia. The western oil companies had also successfully swiftly diverted oil from non-Arab producers to those countries targeted by the embargo (ibid).

By the 1970s, the structure of the world oil industry was beginning to change, as the market started tightening up, and the US appeared unable, for the first time, to meet its rising demand. Much sooner than had earlier been predicted - Texas, Louisiana and Oklahoma were producing at peak capacity, and Middle Eastern oil and not American had become the supplier of last resort(Aarts, 1999).

On October 6, following the Yom Kippur War, Arab countries wielded the oil weapon successfully for the first time by pronouncing production cuts and placing embargos on western countries supporting Israel. On October 16, Arab Gulf oil ministers, plus Iran, raised the posted price of oil by 70% with the price per barrel increasing to \$5.11. The first real oil shock had occurred. The Israeli-Egyptian armistice of Oct 26 did not indicate the end of the embargo, as the major issue was not physical oil scarcity but uncertainty about the quantity of oil available, its location and its price and as such prices soared (Aarts, 1999). Oil rose from \$2.90 per barrel in September to \$11.65 in December, 1973.

According to Fattouh (2010), the latest price cycle of oil, which was characterised by swings and an increased volatility, have raised questions of the possibility that crude oil has become 'financialised', acquiring the characteristics of financial assets. He has observed that the increasing role that expectation of future market fundamentals plays in pricing highlights the 'financialisation' of crude oil. The oil price will deviate from its actual underlying fundamental value triggering an oil price bubble when there exists uncertainty about long term market fundamentals, and if the perceptions are highly exaggerated and inflated.

2.6 Conclusion

Al-Sabah (2006) noted that during the last century, oil played a major role in transforming economies of today's industrialised countries, powering engines of economic growth, hastening technological innovations, increasing productivity and expanding production possibilities thereby improving living standards of the people in those societies. Oil is hoped to make similar contributions in the

twenty-first century to emerging economies of the developing world. In the words of Mabro (2006) the strategic nature of oil, its critical importance and significance calls for continued research and debate to enhance understanding of fundamental issues and challenges.

Nigeria is an important oil producer. It is the largest producer in Africa and fifth largest in OPEC. Over the years, oil exclusively been the major provider of government revenue and foreign exchange earnings, Nigeria is dependent on oil revenues for its economic development and welfare of its citizens. Despite Nigeria's oil wealth and potential, Nigeria's oil income has not acted as a catalyst for growth in the economy; a lot of people live on less than a dollar a day, there are huge disparities in living standard. With per capita income of \$260 a year, Nigeria ranks among the poorest nations in the world. The country has been characterised by political instability, corruption, poor infrastructure, and inadequate macroeconomic management. Nigeria has not been successful in diversifying the economy from its overreliance on the oil sector. Commodity export nations have a tendency to rely heavily on their primary commodity exports and Nigeria is no exception. Nigeria's oil and gas wealth has often been linked with the increasing volatility in its exchange rate as well Nigeria's chronic tendency towards exchange rate over valuation (Garcia et al., 2006). According to Cashin et al (2004) commodity prices are an important source of persistent changes in the real exchange rate of commodity dependent countries. In theory, the exchange rate of an oil exporting nation may appreciate as a result of an oil price rise, as well as vice versa (see Akram (2004) and references therein).

CHAPTER 3

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

3.1 Introduction

This chapter provides the theoretical underpinnings and literature review. The chapter is set out as follows: the theoretical background is presented in Section 3.2. To this end, first, some theories that provide an overview of the transmission channels of an oil price shock are briefly discussed. Second, since an important aspect of our analysis refers to oil price exchange rate dynamics and stock market behaviour, a further part of this section reviews important aspects of the theoretical link between oil price and exchange rate. Finally, the last part of this section deals with the theoretical link between oil price and stock market behaviour. While section 3.3 presents some of the most important research contributions on the influence of an oil price shock on the macroeconomy. The section goes further and reviews literature on the link between oil price and exchange rates and between oil price and stock market behaviour.

3.2 Theories on the impact of an oil price shock

This section intends to give some theoretical background information on the impact of an oil price shock.

3.2.1 The Basic theory and transmission channels

The theoretical link between oil prices and macroeconomic variables is understood via a number of transmission channels. Lescaroux and Mignon

(2008), Lardic and Mignon(2006), Jones et al(2004), and Brown and Yucel (2002) among others provided a detailed insight of the various theories and transmission channels used in the literature to account for the oil price macro economy relationship. The main channels include: the supply side effect; income transfer effect; real balance effect; monetary policy; consumption, investment and stock price effect and the production structure and employment effect.

The supply side effect is premised on the belief that rising oil prices consequently leads to a reduction in potential output. The rise in price according to this premise, signals the scarcity of a basic input to production subsequently raising production cost and lowering output. The decline of productivity diminishes real wage growth and escalates unemployment and inflation rate. According to this theory consumers save less or increase borrowing to smooth out their consumption, if the rise in price is believed to be temporary and transitory or where the short term effect on output outweighs the expected long term effects thereby boosting the equilibrium real interest rate. Consequently, this will lessen the demand for real cash balance but raise inflation owing to reducing output growth and rise in real interest rate (Brown and Yücel, 2002, Lardic and Mignon, 2006) .

Second, another path through which oil price shocks can influence economic activity is the Income transfer and aggregate demand effect. According to this theory, wealth is transferred from oil importing countries to oil exporting countries as rising oil prices worsen the terms of trade for oil importing countries which leads to a transfer in purchasing power. As observed by Brown and Yucel(2002) and Lescaroux and Mignon(2008), the swing in purchasing power

causes a decrease in consumer demand in the oil importing nations but increases that of oil exporting nations. While on a global scale, there is a reduction in world consumer demand for goods produced in the oil importing nations and this leads to a rise in world supply of savings. The improved availability of which leads to a declining pressure on real interest rate which is capable of compensating the rising pressure being experienced in the oil importing nations. Investment the authors noted is stimulated by the sliding pressure on world interest rates which make up for the decrease in consumption leaving aggregate demand unchanged in oil importing countries. They emphasized that there will be a further decrease in GDP growth if prices are not downward flexible as a result of the decline in amount of money spent on consumption of goods produced in oil importing countries. The fall in consumption spending leads to a fall in the price level to yield equilibrium. If price fails to decline, consumption spending will decline by more than the increase in consumption. As a result, aggregate demand will fall leading to a slowdown in world economic growth.

Third, oil prices could impact on macroeconomic variables through the real balance effect. According to this theory, a rise in interest rate will hold back economic growth owing to rising oil prices, if the monetary authorities are unable to match the increased demand for money. Economic growth according to (Lescaroux and Mignon, 2008) is retarded as interest rate is boosted by the inability of the monetary authority to match increased demand for money with supply (Brown and Yücel, 2002, Lescaroux and Mignon, 2008).

Fourth, the relationship may result from the monetary policy effect. Monetary policy as observed by Brown and Yucel does shape the experience of an oil price

shock. They noted that inflation will rise at the equal proportion at which growth of real GDP slows if monetary authorities attempt to keep the nominal GDP growth constant. The rise in oil price generates inflation representing an inflationary shock which can be accompanied by second round indirect effects triggering price wage loops (Brown and Yücel, 2002, Lardic and Mignon, 2006).

Fifth, according to the consumption, investment and stock price effects, rising oil prices may impact negatively on consumption, investment and stock prices. Investment is affected through rising firms cost and, perhaps, by growing uncertainty, which leads to a deferral of investment decisions (Federer, 1996). Consumption on the other hand is influenced through its positive relation with disposable income. For Lescaroux and Mignon (2008), stock market prices may be influenced by oil price fluctuations by reducing profits of non-oil exporting firms subsequently leading to a drop in the firms' fundamental value. Given that the fundamental value of an asset is equal to the discounted sum of expected future dividends, the fall in the firm's fundamental value thus have implication for stock prices. This view is consistent with Huang et al (1996), who attribute the expected present value of discounted future cash flows and the price of a share in a company at any point in time to be equal and which of course could be affected by oil price changes.

Sixth is the production structure and unemployment effect. According to this theory, where oil prices increase is long lasting, a change in the production structure which impacts on unemployment may occur. Firms may decide to take on less oil intensive production methods thus leading to labour reallocations across sectors and thereby affecting unemployment in the long run. Research by

Lardic and Mignon (2008) noted how an upward oil price diminishes the rentability of oil intensive sectors. They observed that unemployment will be impacted deeply, if the price increase lasts an extended period and leads to changes in the production structure. Certainly, an oil price increase according to Lardic and Mignon (2008) can motivate firms to take on and construct methods of production that are less oil intensive as a result of the weak return on sectors that are intensive in oil inputs. In the long run, this will ultimately affect unemployment by generating capital and labour reallocations (Loungani, 1986, Davis and Haltiwanger, 2001).

Oil price shocks affect the macro economy for all of these reasons. However Bhattacharya (2009) contends that any endeavour which seeks to explain the theoretical link between oil price shocks and macroeconomic variables will demonstrate the simple fact that simple macroeconomy models predicts changes in macroeconomic aggregates that are too small. Bhattacharya (2009) contends that by relying on a purely private sector response, it will be difficult to explain the stagflation of the 1970s and both demand and supply side theories suffer from the same problem. He questions why an oil price shock should lead to negative effects like those experienced in the 1970s even where we expect a positive oil price shock to lead to a reduction in the demand for oil and energy intensive commodities. This he notes explains the introduction of secondary factors such as monetary policy to account for the impact of oil price shocks.

3.2.2 Theory on the impact of oil prices on exchange rates

Theoretically, oil price shocks may have an impact on exchange rates in many ways. A number of complimenting theories provide insight into this link. The issue of exchange rate determination in a commodity exporting country is of interest to our analysis. To this end, Cashin et al (2004) developed a framework to depict this relationship. This was a build-up on the works of Neary (1988), De Gregorio and Wolf(1994) and Chen and Rogoff (2003). Cashin et al (2004) employed a small open economy model which he assumed produced two different types of goods, a nontradable good and an exportable good called “primary good”. In the model, Labour is the only factor of production assumed to be employed by firms in the export and non-traded sector to produce these goods, in addition to undertake production, competitive firms have access to constant returns to scale technology. Labour is mobile across sectors, this ensures equal wages. The framework assumes only supply side factors are applicable and leaves aside the demand side effects and concentrates on the long run relative price determination. Furthermore both the non-traded and final tradable good which is imported and not produced locally are consumed by domestic consumers. While the final tradable good and a non-traded good are consumed by foreign households. The authors observed that the primary commodity along with an intermediate good not produced locally but produced only abroad are employed in the process of producing the final tradable good. They summarised real exchange rate determination with the following relation:

As usual, the real exchange rate is defined as: $RER=EP/P^*$

Where E is the exchange rate calculated as the quantity of foreign currencies per one unit of domestic currency, the domestic consumer price index is denoted by P and P* represents the Consumer Price Index in the foreign country. The RER is expressed as a function of terms of trade:

$$\frac{EP}{P^*} = \left(\frac{a_x}{a_I} \frac{a_N^*}{a_N} \frac{P^*}{P_I^*} \right)^\gamma \quad 3.1$$

Where P_X^*/P_I^* denotes the commodity terms of trade measured in foreign prices (i.e the price of the primary commodity in relation to the intermediate foreign good). While a_X/a_I^* accounts for the productivity differentials between the export and import (foreign) sectors and a_N^*/a_N corresponds to the productivity differentials between the local and foreign non traded sectors. The Balassa Samuelson effect is symbolized by the last two terms. A rise in the commodity sector productivity tends to raise wages which leads to an increase in the price of the non traded good which finally leads to the real exchange rate appreciation.

In the same line, to demonstrate the theoretical link between oil price and exchange rate Coudert et al (2008) employ a two sector model of exchange rate determination as in Cashin et al. (2004) and a three sector model of oil exporting countries used to demonstrate “Dutch disease”. According to the authors, “Dutch disease” models show that real exchange rate appreciation occurs following a rise in the price of natural resources leading to a decline in the productivity sector triggering a lower long run growth in such economies. Coudert et al (2008) further note that the oil sector increases in size as a result of the surge in oil revenue rubbing off negatively on the other sectors of the economy but then

followed by a spending effect owing to the rise in aggregate demand. Given that a proportion of the demand is for the domestically produced services, service price rises, but with prices of oil and manufacturing goods being determined abroad remains unaffected. All these lead to appreciation of the real exchange rate where labour is immobile between sectors. However, where there is labour mobility, workers will move to other sectors forcing a rise in wages in all sectors⁷. Labour mobility obstructs the correction in the supply of services to the shift in demand. Where the tradable sector fails to offset the rising wage with increased prices, profit margins will drop and this will result in a fall in employment as well as output produced by the manufacturing sector. However, where the resource sector is linked with the rest of the economy through production, the Dutch disease effect may be dampened and resource growth can boost non-traded goods production which could also compensate the movement towards real appreciation. According to Coudert et al (2008) a change in terms of trade in this model results in a proportional change in the real exchange rate.

An important early contribution was given by Krugman (1983) and Gulub (1983), who were first to develop theoretical models in which changes in oil prices leads to adjustments in exchange rate(Habib and Kalamova, 2007). Krugman (1983) suggested three closely related region models which he acknowledge to be oversimplified representations of the factors at work . Despite their simplified nature, Krugman (1983) contends that they do provide an explanation of the exchange rate effects of an oil price shock. In his first trade

⁷ if labour mobility allows the supply of services to adjust

balance model, Krugman assumed that all the income earned by OPEC is immediately spent, noting that “asymmetries determine the direction of exchange rate movement” (Krugman, 1983:260). Krugman’s second model built on trade balance determination focused on opening to the world to capital flows. In the second model, OPEC spending is gradually adjusted after the rise in oil prices. Here exchange rate may be pushed in different directions owing to the interplay between "real" and "financial" asymmetries. Finally, in his last model, Krugman relaxes the assumption of asset markets but introduces "rational" speculation.

In studying the determination of exchange rates, Krugman contends that it was misleading to apply a "small-country" approach to an oil shock. Krugman (1983: 259) argued that:

“It might seem obvious that for an oil importing country [that] a rise in the price of oil leads to currency depreciation;... [given that,] its direct effect is to worsen the balance of payments. But [what if]... the world consisted of several "symmetric" oil importers and OPEC,... [with] the oil importers [accounting] for equal shares of world oil demand, equal shares of OPEC spending, etc. [in this regard he noted] an oil price increase would leave exchange rates among the oil importing countries unchanged.”

Krugman’s argument was that though a rise in the price of oil directly deteriorates the balance of payments of an oil exporting economy, at the same it indirectly improves it. The improvement results from OPEC spending of its increased income to purchase goods or assets. For him, he argued, in the event of

a price increase, before a currency can be said to suffer depreciation following an oil price shock, it is important to know a country's import dependence; its relative import demand as well as its relative share of OPEC spending. For him, knowing that a country imports oil as well as its import demand inelasticity is not sufficient to make such conclusion. He summed up that for one to successfully quantify the implication of an oil shock, it is essential to work with a model that has at the minimum two oil importing countries and OPEC. Furthermore, the model should systematically allow for asymmetries between the oil importers.

Gulub (1983) study developed a stock/flow model of the effect of oil price increases on exchange rates. His model also focuses on the wealth transfer effects connected with increase in the price of oil price, and the implications of these wealth transfers for portfolio equilibrium, with the exchange adjusting to clear asset markets. He states that incomes, current-account balances, and saving are affected by a rise in the price of oil. These macroeconomic flows in turn affect asset stocks and their distribution among oil-importing and oil-exporting countries which in turn affect asset-market equilibrium. An oil price rise has the potential of creating a surplus in the current-account for OPEC countries and current-account deficits in the oil-importing countries in the short run. Because of differential portfolio preferences this reallocation of wealth may influence exchange.

Gulub observed that following the unexpected oil price increase in 1973-4, the dollar appreciated, but in 1979 following news about oil price rises, the dollar tended to depreciate. In an attempt to explain the differences in the response of

the foreign exchange market to oil price increases between the first and second oil shocks of the 1970s, he argued that the most important factor underlying this shift is a sharp increase in American dependence on OPEC oil. Less important factors, Gulub (1983) observed, included diversification out of the dollar on the part of OPEC and a decrease in the U.S. share of industrial country exports to OPEC. Gulub summed up that, overall, the response of the foreign exchange market appears to be explained by the fundamentals until when the pattern change again in the 1980. The large fall of American oil import volume in 1980, altered the market's perception of the current and future distribution of the oil deficits among industrial countries. As a result increase in the price of oil induced dollar appreciation against currencies other than the pound sterling.

In this thesis, the link between oil price and exchange rate is empirically investigated, the study will aim to find out whether oil price influence the exchange rate. The exchange rate determination model of Cashin et al (2004) is employed as one of the theoretical models.

3.2.3 Theory on the impact of oil prices on stock markets

A number of complementing theories offer insight in to the theoretical link between oil price and the stock market. According to Finance theory, as lucidly put forward by Ramos and Veiga (2011), since the impact of news should rationally be reflected in stock market prices. Then an increase in oil price increase is reflected in the stock price because an oil price rise raises the cost of running a business, diminishing profits and cash flows margins, which are the key drivers of stock prices.

According to Economic theory, as observed by Filis (2011), since the price of an asset is made up of its expected discounted cash flows, then any factor that can influence this should be capable of having a substantial effect on asset prices. A rise in oil price will therefore be accompanied by a reduction in stock prices because an oil price increase leads to increased cost, restraining profits and to a great extent causes a decrease in share value.

Narayan and Narayan (2010) employed the following simple theoretical realised stock returns model to depict the theoretical relationship between oil and stock prices.

$$R = \frac{d(E(c))}{E(c)} - \frac{d(E(r))}{E(r)} \quad 3.2$$

The model assumes stock prices to be the discounted values of expected future cash flows. R denotes the stock return; c denotes the cash flow stream; r denotes the discount rate; d(.) is the differentiation operator and E(.) represents the expectation operator. They noted that movements in expected cash flows and discount rates may influence stock returns. Narayan and Narayan (2010) argued that oil prices could influence stock prices through two channels. In the first channel, a rise in the price of oil price increases the cost of production, given its importance in the production process which subsequently leads to a fall in stock prices. In the second channel, expected oil prices are believed to affect stock prices through the discount rate which consists of both the expected inflation rate and the expected real interest rate.

Jones, et al (2004) argued persuasively that stock prices and returns reflect oil prices, given that ideally stock values reflect a market's best estimate of the future profitability of firms⁸, therefore stock value should mirror both the current and expected future impacts of an oil price shock (Bjornland, 2009). In the same context, Maghyreh (2004) notes that given the important role of oil in an economy, one would expect it to correlate with changes in stock prices. He demonstrated the gradual diffusion of innovation from the oil market into the equity markets. He specifically noted that oil is a direct or indirect cost of operation therefore if oil impacts on real economic activity, it will impact on company earnings as well. And if the stock market is efficient and makes the most of the cash flow implications of the oil price increases, this he noted will lead to a sudden drop in stock prices. Stock returns might however respond slowly, if the stock market is inefficient.

In the same vein, Bjornland (2009) reached similar conclusion noting that the determination of asset prices on the stock market is based on information on the future prospects as well as economic condition facing firms. And given that the present discounted value of the future net earnings of firms make up asset prices therefore stock market and returns absorbs both current and future impact of an oil shock.

Theoretically the most invoked rationale of using oil price changes as a factor affecting stock market returns according to Arouri et al (2010) is that value of stocks equal discounted sum of expected future cash flows. He established that

⁸ asset prices are the present discounted values of the future net earnings of firms

macroeconomic events that are prone to the impact of an oil influence these cash-flows and therefore variation in oil prices may influence stock market returns.

This view has been supported in the work of Arouri and Nguyen(2010), Arouri and Rault (2009)and Arouri et al (2011a)They noted that oil price fluctuations could impact on stock markets through several channels. Using the theory of equity valuation, they explained that, in theory the value of stock equals the discounted sum of the expected future cash-flows and oil price fluctuations may affect stock prices through their effects on corporate cash flow and earnings. For them, by discounting all expected future cash flows at the investors required cost of capital, the price of the stock is attained. They observed that given that corporate cash flow and discount rate mirrors economic condition which consequently can be affected by oil shocks thereby leading stock prices to respond to changes in oil prices. Equally, the theoretical analysis in these related studies (Arouri et al., 2011a, Arouri et al., 2010, Arouri et al., 2011b, Arouri and Nguyen, 2010, Arouri and Rault, 2009) have the same conclusion of the negative influence of an oil price increase on stock prices and stock returns.

For Sadorsky (2004) oil prices may affect stock prices in many ways. An increase in oil price may represent an inflation tax on consumers and producers which consequently raises the cost of production. Where it is not possible to fully pass on the increased cost to consumers, profits margins and dividends will decline. Since the income side of national income is made up of profits and dividends, there will be a corresponding decline in Gross domestic output. As a result, Sadorsky (2004)notes, the outlook for future earnings which is the main driver of stock prices is dampened by the poor profits and dividends and

consequently decreases stock returns. Consumers will be directly hit by the increased price of oil through higher domestic petroleum prices which shrinks consumers' disposable income; this causes a fall in demand of non essential commodities causing a fall in business activity. This decline in business activity leads to a reduction in profits margin, dividends and company earnings consequently leading to a drastic reaction in the economy as well as stock market.

According to Sadorsky (2004), the basic production function requires inputs on capital (K), labour (L), energy (E) and Materials (M). These according to Sadorsky (2004) constitute the basis for the KLEM model. Holding other factors constant, an upsurge in oil prices raises the cost of production and without any off setting effects will cause a decline in a company's profit and dividend. Because oil is a major resource input in the production process and an important global economy input, a rise its price tends to lower stock prices.

In a later study, Basher and Sadorsky (2006) noted that under an equity pricing model, the price of stocks at any point in time equals the expected present value of the discounted future cash flows. Basher and Sadosky (2006) observe that changes in the prices of oil, along with other factors of production (such as capital, labour and materials) affect cash flows. Rising oil prices increase production costs where there is lack of complete substitution effects between the factor inputs. Consequently, the higher production costs reduce cash flows and reduce stock prices. Secondly, they noted that since rising oil prices suggest inflationary pressures which the monetary authorities attempt to control through affecting interest rates. High interest rates will move investors away from the

stock market to the bonds market prompting a decline in stock prices. They summed up that; the overall impact of increasing oil prices on stock prices will be negative.

This relationship was also recently captured by Basher, Huang and Sadorsky (2011). They state that stock prices are directly impacted by oil prices through future cash flow or indirectly through interest rate used to discount the future cash flows. A rise in the price of oil increases cost of doing business since factors of production are not perfectly mobile. The rise in cost is passed on to consumers as higher prices for goods and services and this causes a decline in the demand for final goods and services thereby reducing profits. Policy makers and central banks see the rising oil prices as inflationary and respond by raising interest rate and this upsets the discount rate used in the stock pricing formula.

From the above review, theoretically oil prices can affect stock prices in several ways. As predicted above, we will therefore investigate whether oil prices influences the stock market using Narayan model as one of our theoretical models.

3.3 Review of literature

In this section, relevant literature on the impact of oil price shocks on macroeconomic variables is reviewed. There is now an extensive literature directed to verify the oil price macroeconomy relationship. The nature of the relationship has changed over time and different streams of research on the subject have emerged. A large part of studies to date on oil price macro economy literature has however concentrated on the relationship in oil importing

developed economies. There has been less research on oil exporting developing economies

3.3.1 Oil and the macroeconomy

This subsection will be presented in two parts, with the first part reviewing literature on US and other economies, while the second part will review literature on the Nigerian experience.

Part I: US and other economies

Early contributors to this literature date back to Bruno and Sachs (1982) who developed a theoretical and empirical model of the effects of input price shocks, and applied the model to the case of U.K. in the 1970s. According to Bruno and Sachs (1982) anti- inflationary policies and various supply shocks have been used to account for the rising unemployment and lower output growth in UK following the first oil price shocks. The first explanation, they noted was premised on a standard Keynesian view that the rising unemployment and falling output was a product of the anti-inflationary policies of macroeconomic demand management at that time which was either too expansionary or too contractionary.

While the second explanation attributed various supply shocks to the poor output performance. Higher raw materials prices (particularly oil) according this interpretation along other factors was responsible for lower output growth and increased unemployment. To achieve their objective, they employ a small non

linear theoretical model focusing on supply shocks particularly raw material price increase. Their results predicted a discrete decline in output and productivity after an input price rise, and a longer-run slowdown in productivity growth, real wage growth, and capital accumulation. The authors concluded that, since 1973 and throughout the OECD, ample evidence suggests a significant role for higher input prices in the slowdown in economic growth. Their empirical results confirm the important role of input prices in U.K. adjustment in the early 1970s. Furthermore, they pointed out that to account for the deep recessionary episodes of 1975 and 1980-1981, raw material price increase alone does not explain U.K.'s productivity problems but demand explanations were needed as well; they emphasized the important role for other supply and demand factors working through profitability and the incentive to produce and invest.

Darby (1982) study considered the oil price macroeconomic relation in an extended Lucas-Barro real income equation conducted for eight countries: the United States, United Kingdom, Canada, France, Germany, Italy, Japan, and the Netherlands. Employing quarterly data from 1957-1976, he finds that the results were mixed and confounded by price control and decontrol programs which were widespread at nearly the same time as the 1973-74 oil-price change. He could not attain steady estimates of both an oil-price coefficient and its standard error. Darby noted the world was just rising from the Bretton woods agreement and concluded that as consistent international data on 1979- 80 becomes available, some further untangling of the consequences of oil-price changes and price controls will be feasible.

James Hamilton's 1983 influential seminal paper confirms the impact of oil price shocks on the US economy. Using a six-variable VAR system, he states that all but one of the U.S. recessions since World War II, seven out of eight recessions with the exception of the 1960/61 have been preceded by a rise in the price of oil. Furthermore, he observed that even over the period 1948-72 the correlation was statistically significant and nonspurious, consistent with the notion that oil shocks were indeed a causal factor in at least some of the U.S. recessions prior to 1972 (Hamilton, 1983). The evidence since 1973 according to Hamilton (1983) was in itself sufficient to motivate a suspicion of a systematic relationship between oil prices and output, and he fails to find any evidence to suggest that a third set of influence over the period 1948-72 was accountable for both the oil price increases and the successive recessions.

Hamilton concluded that if some third macroeconomic variable was responsible, it was not apparent in his small version of the macroeconomy as none of the other six variables with the exception of import prices in Sims's (1980) macroeconomic system exhibited any unusual behaviour that could be used to predict the oil price dynamics. Furthermore, even import prices according to Hamilton could not by themselves have been used to predict subsequent downturns and using alternative specification the conclusion that over the period 1948 to 1972 import prices were statistically informative about future oil prices was not found to be robust.

Ever since Hamilton's influential paper, research has been wide spread in this area using different data sets and estimation procedures to verify his claim. Burbidge and Harrison (1984) use a seven-variable Vector Auto Regressive

(VAR) model similar to Hamilton and corroborate Hamilton's evidence in US, Japan and the UK. They test for the impact of oil price rises with monthly data from May 1962 - June 1982 for the US, Germany, Canada, Japan and the UK. By relying on the impulse response analysis they find that a substantial impact of oil price shocks on the US and UK industrial productions while in Japan, Germany and Canada it was relatively small. Price level impacts on the US and Canadian economies were substantial, while they were minor but still significant in the UK, Germany and Japan. They find the effects of the 1973-1974 set of oil-price shocks and the 1979- 1980 shocks to be significantly different. They also find the impact of oil-price innovations on both prices and output to be extensive in the months following the shock in the 1973-74 shocks. In the case of the 1979-1980 shocks, however, the influence of the oil price was quite minimal, except in Japan. However, their analysis also showed that the oil-price shock only exacerbated a recession that was inevitably coming and the industrial production decline in the mid-70s would have probably occurred in any event.

Gissler and Goodwin (1986) reinforced Hamilton's findings demonstrating the negative influence of oil price shocks on the US economy. They use data from 1961Q1 - 1982Q4 by testing for a regime shift in 1973 and finds that oil price shocks move the aggregate supply curve causing substantial real effects however with weak direct price effects. According to the authors, monetary policy on the other hand shifts the aggregate demand curve triggering significant price effects but long-run neutrality with respect to real GDP.

In line with the theoretical literature of a positive relationship between oil price and inflation rate, Hahn (2003) employed a VAR model to examine the impact

of oil price shocks, exchange rate shocks and non-oil import price shocks to Euro area inflation using data from 1970Q2 to 2003Q2. His results indicated that the shocks contributed to inflation in the Euro area with the largest and fastest pass through accounted for by non-oil import price shocks, this was followed by exchange rate shocks and oil price shocks.

Similarly, LeBlanc and Chinn (2004) using a Phillips curve framework attempt to analyse the inflationary effects of an oil price shock for Germany, France, United Kingdom, United States and Japan. Their statistical estimates suggest that oil prices had a modest influence on the U.S. Japan and European inflation rate. They observed that a 10 percentage oil price increase will lead to a direct inflationary increase of about 0.1 to 0.8 percent points in the U.S. and the E.U.

Duma (2008) study examines the effect of external shocks (exchange rate, oil, and import prices) on the SriLankan inflation rate. To achieve these objectives, he employed a VAR approach and he finds incomplete pass-through of external shocks to domestic price inflation. The author observed a small and sometimes negative oil price pass through to inflation. The low and incomplete pass-through according to him reflected the existence of administered prices containing subsidies.

In a similar study, Kiptui (2009) using a VAR also adopted a Philips curve approach to determine the influence of oil price on inflation in Kenya. He observed that oil price was strongly correlated with inflation in Kenya, and the correlation declined in the early 90's but began to rise after the liberalisation of trade in Kenya. He demonstrated the significant effect of the oil price on Kenyan

inflation rate with a short run pass through coefficient of 0.05 and long run pass through of 0.1. This implied a unit increase in oil price results in 0.5% and 1% rise in inflation in the short run and long run respectively. He therefore found incomplete and low pass through of oil price to inflation consistent with other studies. The findings of his study are in conformity with the theoretical predictions of the positive effect of an oil price shock on inflation.

There is a debate on whether an oil price shock is the main cause of recessions or whether there are some third set of influences. As observed by Ameli (2011), countries with tighter monetary policy experience less output growth after oil shocks raising an important question of whether the economic growth is retarded due to an oil price shock or because of the monetary policy reaction. Observers had noted that in the early post 1973 era monetary policy changed at almost the same time an oil shock occurred raising questions about how much was attributable to each (Jones et al., 2004).

In this respect using a “narrative approach” based on a VAR model over the period of 1948-1987, Romer and Romer (1989) study explored the role monetary policy plays in economic recessions. The authors relied on Federal Reserve records and isolated six exogenous monetary policy shocks based on actions of the Board of Governors and the FOMC (Federal Open Market Committee) which in response to high inflation, the Fed responded in a sharp contractionary direction. Romer and Romer (1989) demonstrated that these monetary policy shocks called “Romer dates” were typically followed by large declines in output. They concluded that six out of the eight post-war recessions were triggered by the contraction monetary policy shocks.

Dotsey and Reid (1992) employed a VAR to re-investigate the effect of oil price shocks and monetary policy shocks on the US economy. Employing quarterly data over 1954:1 to 1991:3, they explored the effect of oil price shocks and Romer's contractionary monetary policies. They demonstrated the negative implication of a positive oil price shock on industrial production, while monetary policy (M1) shocks are insignificant. The result of their impulse response and variance decomposition analysis demonstrated the significant influence of positive oil price shocks and interest rate shocks in explaining GNP changes. They noted that 5-6% of variation in GNP was accounted for by positive oil price changes and about the same rate was accounted for by the federal funds rate while interest rate accounted for the remaining 8%. They conclude that both a tight monetary policy and oil price increases were statistically linked to economic recession.

Similarly, Bernanke et al (1997) influential study links a substantial part of the impact of oil price shocks on the US economy to the tightening of monetary policy in response and not from the oil price increase per se. By utilising SVAR framework on monthly data and an impulse response function, they demonstrated that contractionary monetary policy in the US after an oil shock caused between two thirds and three thirds of the decrease in output. They therefore noted that monetary policy could potentially be employed to decrease recessionary costs of an oil price shock. From the impulse response functions, they demonstrated that monetary policy and not oil price shocks accounted for the larger part of the decline in GDP if not all following the 1973, 1979-80 and 1990 oil shock.

Hamilton and Herrera (2004) study challenged conclusions of the monetary policy effect of an oil price shock by Bernanke et al (1997). First, the authors questioned if the Federal Reserve actually had power to implement such a policy questioning if an increase in money creation would have succeeded in decreasing the federal funds rate to values seen in 1974. They saw as implausible the ability of the Fed to undertake the monetary policy needed to reduce 900 basis point output reduction losses from oil shocks. Second, the authors demonstrated that the size of the impact that Bernanke et al (1997) attribute to an oil shock is less significant than what is reported in the literature because of the shorter lag length that they employed. Hamilton and Herrera (2004) criticised that by employing no more than 7 months lags in their analysis, this succeeded in trimming the impact of oil price on output and employment. They demonstrated evidence in favour of a longer lag length and found that under such a specification a downturn was inevitable even with the aggressive Federal Reserve policy proposed. Hamilton and Herrera (2004) concluded that they are unpersuaded by the potential of monetary policy to prevent a recession as suggested by Bernanke et al (1997).

Bernanke et al (2004) responded to Hamilton and Herrera (2004) criticism using a modified VAR and still contend that they were still convinced that virtually all the negative impact in output following an oil price increase is caused by monetary policy. They observe that the adverse effect on output of an oil price shock is extensively reduced when the endogenous response of the funds rate is “shut off”. On the other contending issues raised by Hamilton and Herrera, the authors observe that the Federal Reserve could indeed bring about such huge

fluctuations in the nominal funds rate. On the second issue, they note the existence of a trade-off in the use of less lag length as it brings about the likelihood of omitted variables bias introducing greater imprecision even though it reduces sampling uncertainty. Furthermore, they noted that sampling uncertainty accounted for the weak effects of systematic monetary policy found by Hamilton and Herrera in models with larger lags.

Bernanke et al (2004) considered a different way to address the problem employing a quarterly version of the model and found weaker result than Bernanke et al (1997) but still considerably stronger than what Hamilton and Herrera reported. Bernanke et al (2004) concluded that while sampling uncertainty was more a problem to Hamilton and Herrera's 12 lag monthly model than their parsimonious framework. This however they noted does not undermine their key conclusion in Bernanke et al (1997) that the most important way to understand the dynamic effect of an oil shocks was by identifying the systematic component of monetary policy. Considerations like this have been raised by Barsky and Killian (2001), who contend that monetary policy rather than oil price shocks, interchanging between times of stimulation and restraint caused the great stagflation of the 1970s.

Another extension of the oil price macroeconomy relationship relates to the issue of asymmetric effects of oil prices. Early models implied a linear relationship and that oil price increase and decrease will induce recessions and booms in a similar mechanism. The early literature could not explain the recent findings of non-linear asymmetric effects (Zhang, 2008). After the 1980s, the economic activity responded asymmetrically to an oil price shock (Brown and Yücel,

2002). This led to a series of refinements in the specification of the functional form of the oil price macroeconomy relationship. There have been numerous contributions on the investigations of nonlinearity of oil shocks in the aftermath of the price collapse of 1985. By devoting attention to the weakening oil price economic growth nexus, Hooker (1996b) observed that oil price-macroeconomy relationship changed in a way which can't be well represented by simple oil price increases and decreases. He observed that up to 1973, oil price shocks Granger causes US macroeconomic variables, but when data is extended to the mid 1990's the relationship is not significant.

In an attempt to address the issue of non-linearity in the oil price macroeconomy relationship, Mork (1989) extends Hamilton's paper by separating real oil price increases and decreases in his specification to prove that the correlation between oil price changes and gross national product growth in U.S observed by Hamilton continues to hold when the model is extended to 1988 and when the oil price variable is corrected for the effects of price controls which characterised the variable used by Hamilton. Mork observed that GNP growth was indeed correlated with the state of the oil market. He also observed the large negative effect of oil price increases but did not observe the robust effects of decrease in the price of oil. Mork concluded that there was an asymmetry in the responses, and he was convinced of the different influence of oil price decrease from those of price rises.

To equally overcome the draw backs of estimation in early empirical models, Lee, Nee and Ratti (2001) proposed a nonlinear transformation known as scaled specification (SOPI) to normalize unexpected movements in real oil price. Using

a generalized autoregressive conditional heteroscedasticity (GARCH) model Lee, Nee and Ratti (2001) construct the conditional variation of oil price changes believing that oil price increases in periods when prices are unstable was less likely to cause a decrease in economic activity than when oil price changes are stable. They demonstrated that, provided proper account of oil shocks as well as real oil price movement variability is taken, it will be observed that the real oil price has not lost its predictive power for growth. They observed the asymmetric effects of oil price.

Hooker (1996b) contends that neither the Hamilton's linear relation between oil prices output nor the asymmetric relation proposed by Mork was consistent with observed economic performance at that time. He convincingly argued that since 1986, oil price changes were not the yardstick for macroeconomic analysis. He concluded that, employing data up to 1973 oil price "Granger cause" most macroeconomic economic variables but not from then subsequent. For Hooker, whatever happened to the oil price macroeconomy nexus occur after oil prices started falling in 1981 and require more than just data transformation to resolve.

Unlike previous studies and in reply to the important article by Hooker (1996b) Hamilton (1996) propose another non linear specification known as Net specification (denoted NOPI in the literature). Hamilton demonstrated the historical correlation between oil price shocks and economic recessions are consistent when you compare the net increase of oil prices in a year. He argued that Mork's suggestion did not provide a adequate way of treating the data when one views the net increase over the previous year, one will observe most of the changes in the price of oil were corrections to previous oil price declines and

therefore oil price changes were no longer reliable for analysing the relation between oil price and the macroeconomy subsequent 1986. He noted that since 1986, oil price increases have closely followed larger oil price decreases, therefore the best way to measure how unstable the changes were for consumers and firms spending decisions was “to compare the current price of oil with where it has been over the previous year rather than during the previous quarter alone”. He further observed that, after 1973 the macroeconomic effect of oil price increases had less effect than an increase of similar magnitude would have had before 1973. Hamilton concluded that his conviction has been strengthened by the evidence since 1983 on the effects of an oil shock.

Hooker (1996a) study acknowledges James Hamilton’s new measure ‘the Net oil price increase’ outperforms the oil price transformations considered in his earlier paper, but however argued that much of its predictive power came from the pre-1986 data rather than from the post-1986 data. This he observed is confirmed by the result of the impulse-response function showing the effects of a NOPI shock are much smaller after 1973 than before. He therefore argued for the need for cross-sectional components in the analysis in order to find the best oil price transformation as there was not much aggregate data available after 1986. Furthermore he noted that, it was counterproductive to rule out the effects from oil price declines.

Cognigni and Manera (2008) study investigated the relationship among oil price, inflation and interest rates using a structural cointegrated VAR model for G-7 countries. To achieve their objectives, they employed a structural VECM and

finds that structural oil price shocks affect output significantly only in the UK and Canada.

Jbir and Zouari-Ghorbel (2009) studied the impact of recent oil price shock to the Tunisian economy. By means of a vector autoregression (VAR) method and using both linear and non-linear specifications based on quarterly data over the period 1993Q1 to 2007Q3, they demonstrated that there was no direct impact of oil price shock on the economic activity. They postulated that oil price shocks influenced economic activity indirectly, with government spending being the most important channel by which the effects of the shock are transmitted.

Jimenez-Rodriguez and Sanchez (2004) study on the other hand empirically assessed the impact of oil price shocks on the real economic activity on the individual G-7 countries, Norway and the Euro area as a whole including OECDs two main Oil exporting countries. By using a Multivariate Vector Autoregressive analysis and using both linear and non-linear models on quarterly data from 1972Q3 to 2001Q4, they found evidence of non-linear relationship between oil prices and GDP. They find that positive oil price changes had a more profound impact on GDP than oil price declines, and in most cases with the later being statistically insignificant. In oil importing countries, they found that an oil price rise impacts negatively on GDP in all cases but Japan. Furthermore, they find varying effect of oil shocks on GDP growth for the two oil exporting countries of UK (negatively) and Norway (positively). Results from the vector autoregression were consistent with the expectation that the real GDP growth of oil importing economies suffered from increases in oil prices in both linear and non linear models.

Using a Phillips curve framework, Hooker (2002) examined the impact of oil price changes on U.S. inflation. Allowing for some of the asymmetries, nonlinearities, and structural break, he finds robust evidence that oil price rises directly contribute to core inflation before 1981 but little or no pass-through since that time. Moreover, in the period since 1979, monetary policy exhibited lesser, rather than greater responses to oil price changes, despite a greater sensitivity to changes in inflation.

Another issue in the oil price shock macroeconomy literature is the issue of the slowing down effect of oil price shocks whether there are changes in the fundamental relationship initially identified by Hamilton. Recent studies that attempted to test this hypothesis include Herrera and Pesavento (2009). The authors estimated a structural vector autoregression (VAR) model for the U.S. economy using quarterly data from 1959 to 2006. Breaking their sample in two, from 1959Q1-1979Q4 and 1985Q1-2006Q, they find a longer lived effect on macroeconomic variables in the 1959 to 1979 period.

In an attempt to explain why oil price shock up to 2008 had little effect on the world economy, Seagal (2011) contends that despite the popular notion of the importance of oil prices, they are not as important and that explains why the 2008 uptrend in prices had little impact on the global recession of 2008-9. He observed that over the last few years, the independent influence of oil price on macroeconomic cycles has been lower ever since the disappearance of second round effects from the 1980s. Blanchard and Gali (2007) using data from the U.S., U.K., France, Germany, Italy and Japan employed a VAR analysis to investigate the different effects of oil price shocks on inflation and economic

activity across time. Using two sub periods: pre-1983 and post-1984 period, they demonstrated that over time, there has been considerable decrease in the dynamic effects of oil shocks.

Naccache (2010) employs a VAR model inspired by Hamilton (Hamilton, 1983) and Mork (1989) to examine the oil price macroeconomy relationship carrying out recursive exclusion tests. By means of a new specification for the oil price variable, based on the concept of acceleration, he finds that the perceived “weakening of the oil price macroeconomy relationship” as claimed by various authors is attributed to the existence of slow oil price shocks as of the 1970s and 1980s. He contends that by permitting firms and households to adjust more progressively, these slow oil price shocks have marginal effect on the economy. He noted that although factors producing these slow oil price shocks are yet to be established, they are more likely to be attributed to demand shocks rather than oil supply disruptions. By focusing only on accelerating oil price increases and removing the slow oil price increases from his sample, he noted that since the early 1980s there has been a steady growth in the oil price accelerations–GDP relationship.

Gregorio et al (2007) based on a rolling vector autoregressions employed a traditional Phillips curve extended to include oil to investigate the evolution of the pass-through of oil price changes to general price level for 34 developed and developing economies. They note that in recent decades, there is proof of a significant fall in the pass-through of oil price changes to general inflation. They pointed out that the declining impact of exchange rate changes on inflation and falling oil intensity explains a major part of the drop in the oil pass-through

around the world. The factors according to them, explain why the current oil price shocks have had limited inflationary effects and limited consequences for output.

In a similar study, Chen (2009) using a state space framework investigated the causes of the recent weakening effect of oil shocks on inflation across 19 industrialized countries. He estimated a time varying pass through to account for the slow changes in oil price pass-through into aggregate consumer price measure of inflation. He observed a positive correlation between oil price pass through and energy imports, with the degree of oil price pass through varying across countries. He also found that over time the pass through coefficient was unstable.

Fernald and Trehan (2005) argue that, because the causes of the price jumps are different from the reasons in the 1970s, recent run ups in oil prices do not have the usual effect on the US economy. They observed that exogenous shocks such as crisis in the Middle East in the 1970s and the Iran Iraq war brought about a considerable reduction in world supply. However the latest run up at that period was occasioned by the endogenous response of prices to the strength of global demand. They argued that there was little reason to fear a recession when higher US demand was the cause of higher prices. However when the cause of the increase is exogenous, the story will be complicated.

Part II: Nigeria

As regards Nigeria which is the focus of this study, a number of heterogenous studies exist in the literature exploring this relationship. Ayadi (2005) study employed a vector autoregression model based on linear framework with data from 1980 through 2004 to investigate the effects of oil price changes on Nigeria's economic development. The author finds that oil price changes influence Nigeria's real exchange rate which in turn affect industrial production. He however contends that oil price changes were only marginally important in influencing industrial production in Nigeria. The findings of his study went contrary to the theoretical literature postulating the positive impact of oil price shock in exporting economies.

In the same vein, in another study on the Nigeria economy, Olomola and Adejumoh (2006) using the VAR method with quarterly data from 1970 to 2003 explored the effects of oil price shocks on real economic activity in Nigeria. Contrary to prior empirical findings in the literature reported for other countries, they find oil price shock is not an important factor influencing output and inflation in Nigeria. However, the findings revealed that oil price shocks did significantly influence the real exchange rates.

More recently and in contrast to the previous studies, Mahmud (2009) investigates the impact of oil price shocks on monetary policy aggregates in Nigeria by relying on a Structural VAR (SVAR) approach. His study extends the oil price macro economy literature for Nigeria by employing an SVAR as oppose to a traditional VAR. His results indicate that oil price shocks impact positively

on real sector growth as manufacturing sector growth increased in response to a positive oil price shock. Furthermore oil price shocks negatively impact on macroeconomic variables through second round effects of higher government expenditure and higher inflation second round effects of oil price shocks may be transmitted to other sectors of the economy through government expenditure.

Employing a VAR approach, Akpan (2009) analysed the dynamic relation between oil price shocks and major macro-economic variables in Nigeria. Akpan observed that positive as well as negative oil price changes considerably increased inflation rate in Nigeria. Positive oil price changes also directly improved real national income growth in Nigeria through higher export earnings, though part of this increase is affected by lower demand for exports as a result of economic recession experienced by trading partners. His findings point to a negligible impact of oil price fluctuations on industrial output growth. Furthermore, the real effective exchange rate appreciated significantly, a major symptom of the Dutch disease syndrome.

Aliyu (2009) paper employs the Johansen VAR-based cointegration technique on quarterly data from 1986Q1 to 2007Q4 to examine the relationship between oil price, real exchange rate volatility and economic growth. He finds Granger causality between oil prices to GDP to be unidirectional and there is bidirectional causation between real exchange rate and real GDP. He observed a positive relationship between oil price, appreciation of the exchange rate and real GDP growth.

Adeniyi (2011) examined the linkage between oil price shocks and economic growth in Nigeria using a different methodological perspective. Unlike previous studies on the Nigerian economy, Adeniyi employ a multivariate threshold autoregressive model (MVTAR) based on quarterly data from 1985 to 2008 . He finds that oil price did not contribute to significant variation in macroeconomic variables in Nigeria; he concluded only a small proportion of variations in macroeconomic variables is explained by oil price shocks .

Aliyu (2011) research draws attention to evidence of both linear and non-linear impact of oil price shocks on real GDP in Nigeria. By using Granger causality tests and multivariate VAR analysis for the period 1980M1 to 2007M12, he finds ample evidence that asymmetric oil price increase considerably influences Nigeria's real GDP growth and asymmetric oil price decrease adversely reduces the level of real GDP. Furthermore he finds that the positive impact on real GDP growth was of a greater scale than the negative influence of asymmetric oil price decreases.

In a recent study, Iwayemi and Fawowe (2011) using quarterly data for Nigeria over the period 1985:Q1 to 2007:Q4 examined the impact of oil price shocks on selected macroeconomic variables in Nigeria. They observed the asymmetric effect of oil price shocks and concluded that oil price shocks do not have a major impact on macroeconomic variables in Nigeria.

In another recent study, Chukwu etal (2011) assessed the linear and asymmetric impacts of oil price shocks on the Nigerian economy between 1970Q1 and 2008Q4. To examine the long-run and short-run influence of oil price shocks on

the supply-side of the economy, wealth transfer, inflation and real balance effect, they employed a vector error correction model and Granger causality test. Their findings demonstrated that an oil price shock is not a key contributing factor of macroeconomic activity in Nigeria. In addition, they observed that the impact of oil price shocks is less pronounced on economic activity than was found on the inflation rate.

3.3.2 Review on oil price shocks and exchange rates

In this section, the empirical literature on oil price exchange rate nexus is reviewed. A number of studies have looked at the role of oil price shocks in driving exchange rates movement. One stream of literature exploring this relationship usually proxy oil price to the terms of trade given that it is the main driver in oil exporting countries. Other studies have mainly concentrated on exchange rates of oil exporting countries where in theory it is expected that a positive oil price shock will lead to an appreciation of the currency in the long run. Changes in exchange rates of oil exporting countries have every so often coincided with large variations in the price of oil (Akram, 2000).

In the first respect Cashin et al (2004) study investigated the long run relationship between the real exchange rate of commodity-exporting countries and the real prices of their commodity. Utilising world prices of 44 commodities and national commodity export shares for the time period January 1980 to March 2002, they find evidence indicating that national real exchange rate and real commodity prices move together for about one-third of the commodity exporting countries. They noted that for these countries, long run deviations of real

exchange rates are significantly influenced by movements in real commodity prices.

Consistent with the previous study, Koranchelian (2005) study employs a vector error correction model (VECM) on annual data from 1970 to 2003 and finds real oil price together with Balassa Samuelson effect explain the long run evolution of the equilibrium real exchange rate in Algeria. Consistent with Cashin et al (2004), they observe that a rise in the price of oil and productivity differential is associated with an appreciation of the REER. The author concluded that real exchange rate movements in Algeria can be explained by oil price and relative productivity and like other commodity exporting countries there was a time varying long-run equilibrium exchange rate which is dependent on these fundamentals in Algeria.

Kutan and Wyzan (2005) using an extended version of the Balassa-Samuelson model including oil price find evidence that over the period 1996 to 2003 oil price changes considerably influenced the real exchange rate. Furthermore they observed the likelihood of the Balassa-Samuelson effect working through productivity changes to be present, even though their magnitude is of little economic significance. They reported that the impact of oil price changes on RER was larger than that of productivity. They conclude that there is statistically significant evidence of the Dutch disease syndrome in Kazakhstan and as oil and gas play a growing role in the economy this syndrome could assume increasing importance in the coming years.

Similar conclusions are reached by Zaldueño (2006) for Venezuela. The author set out to unravel the implication of oil prices from other factors underlying Venezuela's equilibrium real exchange rate. By estimating a vector error correction model (VEC) using annual data from 1950 to 2004, he finds that oil price as well as productivity differential significantly influenced the equilibrium real effective exchange rate in Venezuela.

Habib and Kalamova (2007) study investigates the impact of real oil price on the Norwegian, Russian and Saudi Arabian real exchange rates. Taking real oil price as a proxy to the terms of trade and controlling for the possible role of productivity differential, the authors find real oil price and real exchange rate for Russia to be positively related in the long run. In addition, they observed real effective exchange rate determination of the rouble was significantly influenced by productivity differential relative to the main OECD partners (accounting for the Balassa Samuelson effect). He described the Russian rouble as an oil currency since it shared a common stochastic trend with real oil price. Conversely, for Norway and Saudi Arabia, the authors find a minimal impact of real oil price on real exchange rate.

In conformity with the theoretical predictions of a positive effect of an oil price shock, Suseeva (2010) demonstrated a long run positive effect of the real oil price on the real bilateral exchange rate against Euro in Russia. Suseeva estimated a vector error correction model to explore the long run relationship between real exchange rate of Russia and the real price of oil. Employing monthly and quarterly data over the period 1995 to 2010, Suseeva demonstrated

that real oil price and the real bilateral exchange rate against the Euro move together in the long run.

In a study on Asian economies, Tsen (2011) demonstrated evidence showing real oil price and productivity differentials among others were important determinants of the real exchange in the long run. Tsen was concerned with the determination of the real exchange rate in Japan, Korea, and Hong Kong. Employing quarterly data over the period 1960:Q2-2009:Q4; 1976:Q4-2009:Q4 and 1990:Q4-2009:Q4 for Japan, Korea, and Hong Kong respectively, he finds varying impacts across economies. Tsen demonstrated the importance of Productivity differential, terms of trade, the real oil price, and reserve differential in the long run determination of the exchange rates. For Japan, increases in the real oil price lead to a decline in terms of trade while the opposite case was for Hong Kong. In the case of Korea, a real exchange rate appreciation is observed as a result of an increase in terms of trade.

Amano and van Norden (1998) investigated the importance of real domestic oil prices for real exchange rate movements for Germany, Japan and the United States in the post Bretton woods period. They were concerned with finding out the ability of real oil prices to explain movements in the U.S. real effective exchange rate. They estimated a vector error correction model on monthly data from 1972M2 to 1993M1. The result of their findings is in line with the theoretical literature of the positive impact of oil price on exchange rates. The authors observe that oil price and exchange rate move together in the long run with unidirectional causality running from oil prices to the exchange rate.

Chaudhuri and Daniel (1998) study uses cointegration and causality test with data from 16 OECD countries from 1973:M1 to 1996:M02 to show that real oil prices were responsible for the non-stationary behaviour of the US dollar real exchange rates over the post Bretton woods era. The finding also suggests that the 1978 oil price increase resulted in a long swing in the real exchange rate equilibrium path; however the oil price crash of 1986 did not lead to comparable situations in Germany and Japan signifying the changing nature of the relationship.

In the second context, most studies exploring the effects of high oil prices on the economies of oil exporting economies falls in to two broadly related categories. First, the literature on the “curse of natural resources” which contends that in terms of economic development resource rich countries underperforms resource rich countries. Second, is the literature on the “Dutch disease” which is concerned with the macroeconomic effects of oil price shocks such as the appreciation of the real exchange rate (Mohammadi and Jahan-Parvar, 2010).

In this respect, Akram (2000) study explored when the oil price affects the Norwegian exchange rate. In contrast to previous studies, he investigates the possibility of a non-linear relation between oil price and the nominal value of the exchange rate. Employing samples of daily, monthly and quarterly observations of different lengths and a variety of techniques he finds a negative relation which is non-linear between oil price and the Norwegian exchange rate. Akram observed that a rise in the price of oil tends to raise the value of the Krone while a fall tends to reduce the value of the Krone. He contends that the effect of oil prices on exchange rates tends to depend on whether oil prices display a falling

or rising trend. Furthermore his results demonstrated that the imposition of linear oil price effects leads to gross underestimation of the exchange rate response to a change in oil prices.

Similar findings are drawn by Spatafora and Stavrev (2003) in a study of the Russian economy confirming the sensitivity of Russia's equilibrium real exchange rate to long run oil prices. By employing a small structural model tailored to the Russian economy they find some dependence of Russian Equilibrium real exchange rate on oil prices. They also confirmed a link between equilibrium exchange rate and productivity.

Aleisa and Dibooglu (2002) use a structural VAR with monthly data from 1980:1 to 2000:02 to reach the same conclusion for Saudi Arabia. They demonstrated the role of oil price shocks in explaining real exchange rate movements in Saudi Arabia, but noted that oil production shocks rather than real oil price shocks were responsible for real exchange rate movements.

Similarly by use of a structural VAR that is identified through long run restrictions, Bjørnland (2004) estimated the equilibrium real exchange rate in Venezuela, an oil exporting economy. The author uses quarterly data from 1985Q1 to 1999Q1 to estimate a well specified VAR; plotting the impulse response functions he finds that in the long run a positive oil price shock in Venezuela appreciates the real exchange rate. However, this long run effects is small and insignificant, with the first two quarters initially depreciating but appreciating gradually towards its new long run equilibrium level. His findings are consistent with the literature concerning a large oil producing country.

Similarly Akram (2004) finds strong evidence of non-linear relationship between oil prices and the Norwegian exchange rates. The author observed that oil price negatively influenced the value of the Norwegian exchange rate, and this impact was robust when oil prices are below 14 dollars and are falling. Akram presented a model which considerably improves the forecasts compared with those from a similar model.

Chen and Chen (2007) using a monthly panel data of G7 countries from 1972:1 to 2005:10, show that real oil prices have been the dominant source of real exchange rate movements. Their results were robust to different measures of oil prices. Their study also found that real oil prices have substantial forecasting power for real exchange rates. In their empirical analysis, they found that in the long run, oil prices could capture permanent innovations in the real exchange rate.

Huang and Guo (2007) using a four dimensional structural VAR model investigated to what extent oil price shocks among other macroeconomic shocks impact the trend movement in China's real exchange rate growth. Their empirical results showed that with China's swelling demand for imported oil, real oil price shock will result to a minor appreciation of the real exchange rate in the long run. They observed that the reverse effect is attributed to China's lesser dependence on imported oil than its trading partners and governments rigorous energy regulation which has prevented a synchronization of the real domestic oil price movement with world markets. Moreover, the authors found that the real exchange rate response to structural shocks is in conformity with theoretical

predictions of a positive supply shock leading to depreciation whereas a positive real demand shock leads to an appreciation of the Chinese real exchange rate.

An important paper by Narayan et al (2008) utilising a generalised autoregressive conditional heteroscedasticity (GARCH) and exponential GARCH (EGARCH) framework estimated the relationship between oil price and exchange rates in Fiji based on daily data from 2000 to 2006. Their results reveal a positive relationship between an increase in oil prices and nominal exchange rate. They observed that during the period under study, not surprisingly an oil price increase leads to an appreciation of the Fijian dollar vis-à-vis the US dollar because following an oil price rise and increase in inflation over the same period, the Reserve bank of Fiji raised official interest rate twice, first in 2005 and then in 2006.

Using data over the period 1980:1 to 2008:11, Aziz (2009) explored evidence of whether a link exists between oil price and real exchange rate for a panel of three oil exporting countries and five oil importing countries. The author estimated a dynamic panel allowing for considerable heterogeneity across the sample focusing mainly on the pooled mean group. The results of his empirical analysis suggest a significant positive impact of real oil price on the real exchange rate for a panel of net importing countries which suggest that any future oil price shocks would cause real depreciation in the long run. However there was no evidence of long run relationship between real oil price and real exchange rates.

Different findings are drawn in a similar a study conducted by Ghosh (2010) by means of a GARCH (1, 1) and EGARCH for India. Employing daily data for the

period July 2, 2007 through to November 28, 2008, the author finds that a rise in oil price leads to a depreciation of the Indian currency. Ghosh (2010) pointed out the symmetric effect of oil price shocks in India contrary to other studies that have established asymmetric effects. He concluded that oil price shocks have permanent effects on exchange rate volatility.

Lizardo and Mollick (2010) provided evidence that from the 1970s to 2008, oil prices considerably explained changes in the value of the U.S dollar against major currencies. They found that when oil prices go up, the currencies of oil importers such as Japan suffer depreciation. On the other hand, in net oil exporters such as Canada, Mexico and Russia increase in oil prices leads to a significant depreciation of the US dollar.

Extending the analysis Arouri and Jawadi (2010) employed linear and non-linear models to investigate the oil price US exchange rate relationship. Utilising monthly data from 1973:1 to 2009:10, the authors observe that over the study period oil price exerted a negative influence on the US exchange rate. Their empirical findings suggest the two variables are strongly linked in the short run but not in the long run. The two variables were not linked together in the long run and exchange rates are not fundamental determinants of oil prices. Using a non linear framework, the authors demonstrated evidence of non linearity in the oil price exchange rate relationship.

As regards Nigeria, which is studied in this study, there are limited studies that have looked exclusively at the oil price exchange rate nexus in Nigeria. Work by Nikbakht (2010) has shown a strong evidence of a long run positive linkage

between real oil price and real exchange rate in a panel of seven OPEC countries (including Nigeria). By using monthly data from 2000:01 to 2007:12, the author finds real oil prices have been the dominant source of real exchange rate movements. He concluded that Economists and governments in these countries should consider this powerful linkage in their economic planning and decision making.

Mohammadi and Jahan-Parvar (2010) examined the long run and short run dynamics between real oil prices and real exchange rates for a sample of 13 oil exporting countries including Nigeria. Employing Cointegration and threshold and momentum-threshold autoregressive (TAR and M-TAR) models on monthly data to allow for asymmetric response, the authors failed to find a strong link between oil prices and real exchange rate. Empirical results did establish a long run effect and evidence of Dutch disease in Bolivia, Mexico and Norway. The authors concluded that their empirical results demonstrated a weaker assessment of the effect of oil prices on exchange rates than those reported in the literature.

Similar results are obtained by Ozsoz and Akinkunmi (2012) in a study on the Nigerian economy. They demonstrated the positive influence of world oil prices on Nigeria's exchange rate. The authors employed monthly data over the period 2002 to 2010 to estimate a VEC model providing additional insight on the oil price exchange rate nexus for Nigeria. The result of their impulse response demonstrated a permanent appreciation of the real exchange state which stabilises about two years after the initial oil price shock. By analysing the impulse functions they observe that a rise in oil price leads to a permanent appreciation of the Real Exchange Rate which stabilizes about two years after the

initial shock. The results of the Variance decomposition show that over the long term (one and a half year period) only 85% of the variance in the log of arithmetic real exchange rate is explained by its own shocks with oil price explaining a sizable portion of the RER (8.5%).

More recently, Coleman et al (2011) using cointegration techniques and allowing for non linear dynamics investigated the importance of real oil price as a determinant of real exchange rates for a pool of African countries including Nigeria. Coleman et al (2011) found that for some countries shocks in the real price of oil is of importance for real exchange rates determination even in the long run. They observed that in practice the literature on the oil price exchange rate relationship is based on linear cointegration techniques but non linearity modelling may be more appropriate. The authors failed to find evidence of the important role of oil price for real exchange rate determination in Nigeria and they concluded that having the status of an oil exporter does not imply the existence of a long run relationship and due to different economic structures oil price plays different roles for each of the countries.

Adeniyi (2011) using daily observations from January 2, 2009 to September 28, 2010 estimated a GARCH (1, 1) and EGARCH (1, 1) model to investigate the oil price exchange rate dynamics in Nigeria. The study did not explore the GARCH (M) and EGARCH (M) models. The author found that doubling oil prices resulted in exchange rate depreciation in both the GARCH and EGARCH models. Even though Adeniyi's study is limited to Nigeria, his findings are generalisable to other oil exporting economies.

As can be seen the results of the above review are quite heterogeneous and the current studies are far from being conclusive and further studies need to be undertaken. The connection of oil price to exchange rate behaviour is controversial with some studies claiming a statistical link and some denying any. Recent efforts at exploring the relationship have adopted new approaches including incorporating non linearity in modelling exchange rate dynamics (Koranchelian, 2005).

The aim of this study is to contribute to the current literature exploring the oil price exchange rate nexus. The above review of literature raises the following specific research questions for Nigeria, which are of interest to this research:

What is the dynamic relationship between oil price shocks and the real exchange rate in Nigeria? and

What is the influence of recent oil price changes on nominal exchange rate in Nigeria during periods of extreme volatility?

Table 3-1: Summary of literature on oil price shocks and exchange rates

Study/Author	Data	Methodology	Results/Conclusions
Cashin at al (2004)	44 commodity exporting countries; monthly data from 1980:01 to 2002:03	Cointegration and Granger causality	Real commodity prices are important determinants of long run deviations from real exchange rate in about one-third of the commodity-exporting countries
Koranchelian(2005)	Algeria; annual data from 1970 to 2003.	VECM	Increase in oil price and productivity differential is associated with an appreciation of the REER
Kutan & Wyzan(2005)	Kazakhstan; Annual 1996 to 2003	ARCH	Oil price changes had significant effect on the real exchange rate and and has a much larger effect than productivity
Zalduendo(2006)	Venezuela; Annual 1950 to 2004	VEC	Oil price among other play a significant role in determining a time varying real exchange rate
Habib & Kalamova(2007)	Norway Russia Saudi Arabia	VAR/VEC	Established a long run positive relationship between real oil price, real exchange rate and the productivity differential for Russia. There was no impact or at best a marginal impact for Norway and Saudi Arabia
Suseeva(2010)	Monthly and Quaterly; 1995 to 2010	VEC	Find a long run positive relationship between the real oil price and the real bilateral exchange rate against Euro in Russia.

Tsen (2011)	Japan Quarterly 1960:Q2-2009:Q4, Korea, 1976:Q4-2009:Q4, and Hong Kong 1990:Q4-2009:Q4,	VAR/VEC	Productivity differential, terms of trade, the real oil price, and reserve differential are found to be important in the real exchange rate determination in the long run. The impacts of these variables on the real exchange rate determination are different across economies
Amano & van Norden(1998)	Germany, Japan and the United States; monthly 1972 M2 to 1993M1	Cointegration and causality	Positive relationship between oil price and exchange rates.
Chaudri & Daniel (1988)	16 OECD countries; Monthly 1973:M1 to 1996:M02	Cointegration	Real oil prices were responsible for the non stationary behaviour of the US dollar real exchange rates over the post Bretton woods era
Akram(2000)	daily, monthly and quarterly observations of different lengths 1972:2 to 1997:4	VAR	The effect of oil prices on exchange rates tends to depend on whether oil prices display a falling or rising trend. And imposition of linear oil price effects leads to gross underestimation of the exchange rate response to a change in oil prices.
Spatafora & Stavrev(2003)	Russia	Cointegration	Found some dependence of Russian Equilibrium real exchange rate on oil prices. They also confirmed a link between equilibrium exchange rate and productivity.
Aleisa & Dibooglu(2002)	Saudia Arabia; monthly data from 1980:1 to 2000:02	SVAR	Real shocks play an important role in explaining real exchange rate movements. but oil production shocks rather than real oil price shocks were responsible for real exchange rate movements

Bjornland(2004)	Venezuela; Quarterly data from 1985Q1 to 1999Q1	SVAR	Long run positive oil price shock in Venezuela appreciates the real exchange rate.
Akram(2004)	Norway	Non linear technique	Confirms a negative relationship between oil prices and the value of the Norwegian exchange rate
Chen and Chen (2007)	G7; monthly 1972:1 to 2005:10	Panel	Real oil prices have significant forecasting power for real exchange rates
Huang and Guo(2007)	China	SVAR	Positive supply shock leading to depreciation where as a positive real demand shock leads to an appreciation
Narayan et al(2008)	Fiji; Daily 2000 through 2006	GARCH	A positive relationship between an increase in oil prices and nominal exchange rate
Aziz (2009)	3 oil exporting and 5 oil importing countries Monthly 1980:1 to 2008:11	Panel	A positive and statistically significant relationship between real oil price and real exchange rate for a panel of net importing countries. While he found no evidence of long run relationship between real oil price and real exchange rates for a panel of net oil exporting countries.
Ghosh(2010)	India; Daily July 2, 2007 through November 28, 2008	GARCH	Oil price increase leads to a depreciation of the Indian currency.
Lizardo & Mollick(2010)	Major Currencies; Annual 1970s to 2008	VAR/VEC	When oil prices go up currencies of oil importers such as Japan suffer depreciation. On the other hand, in net oil exporters such as Canada, Mexico and Russia, increase in oil prices leads to a

			significant depreciation of the US dollar
Arouri and Jawadi(2010)	US; Monthly data from 1973:1 to 2009:10	Linear and non linear models	Oil price exerts a negative influence on US exchange rate
Nikbakht(2010)	Panel of 7 OPEC countries including Nigeria; monthly data from 2000:01 to 2007:12	Pool test unit root, cointegration	Real oil prices have been the dominant source of real exchange rate movements.
Mohammadi and Jahan-Parvar(2010)	13 oil exporting countries including Nigeria	Threshold and momentum-threshold autoregressive TAR and M-TAR	Failed to find a strong link between oil prices and real exchange rate but their empirical results did establish a long run effect and evidence of Dutch disease in three countries (Bolivia, Mexico and Norway)
Ozsoz & Akinkunmi(2012)	Nigeria; monthly data over the period 2002 to 2010	VEC	Demonstrated the positive influence of world oil prices on Nigeria's exchange rate.
Coleman et al (2011)	Pool of African countries including Nigeria	Linear and non linear techniques	Failed to find evidence of the important role of oil price for real exchange rate determination in Nigeria
Adeniyi (2011)	Nigeria; Daily observations from January 2, 2009 to September 28, 2010	GARCH	Found that doubling oil prices resulted in exchange rate depreciation in both the GARCH and EGARCH models

From the above, looking at the summary we can deduce the heterogeneous nature of the findings in the literature. Despite over thirty years of empirical research there is still no consensus. The literature on the effects of fluctuations in the price of oil on the macroeconomy developed following the first oil price shock of 1973, since then a large literature has extensively and convincingly documented the relationship. Research in this area is ongoing, has gone on several directions with different streams of literature analyzing the relationship between oil price changes and different macroeconomic variables such as output/economic activity, exchange rates, productivity, inflation, interest rates e.t.c. However the largest part of the extant literature has dwelt on developed/industrialised oil importing economies particularly the United States. Notwithstanding the large empirical literature on the oil price nexus, a general conclusion from the literature is lacking and contradictory reports are still being reported.

According to Malliaris and Kyrtsov (2009) there is a renewed and growing interest in employing new econometric tools and computational techniques in this area of research. Oil price shocks have different effects for oil exporting and oil importing countries. This relationship weakens over time suggesting asymmetric or non linear effects. There are only a few studies on the Nigerian economy that has explicitly examined the relationship between oil prices, exchange dynamics and stock market behaviour. In addition, there are still analytical and methodological gaps that exist in the literature on the Nigerian economy.

3.3.3 Review on oil price shocks and stock market behaviour

In this section, the empirical literature on the linkage between oil price and the stock market is reviewed. Despite the amount of literature that has explored the influence of oil prices on macroeconomic variables; less attention has been paid to the role of oil price fluctuations on stock market behaviour. Furthermore very few studies have to paid attention to inquiring about this relationship for Nigeria. The bulk of the literature on oil price stock market behaviour has concentrated more on developed economies.

Jones and Kaul's (1996) initial study employed a standard cash flow / dividend valuation model to explore the response of the stock markets of Canada, Japan, UK and the US to an oil price shock. They examined stock market efficiency focusing on how stock prices change in response to oil price changes. The authors observe a negative impact of oil price on stock markets with oil prices constituting a risk factor for stock markets. The authors found that while the reactions of stock markets may perhaps be explained by the impact of an oil price shock in US and Canada, the outcome for Japan and the UK was indecisive.

Sardosky (1999) contributed further to the investigation employing monthly data over the period 1947:1 to 1996:4. He demonstrated evidence attributing the larger fraction of the forecast error variance in real stock returns is explained by oil price movements. He reported a significant negative initial impact on stock returns, as well as a change in the dynamics rather than in the response to the system. Sadorsky demonstrated a significant relationship of oil price shocks on real stock returns however the impact was strongest after 1986.

Papapetrou (2001) study employed a vector autoregression (VAR) approach to study the effects of oil prices on stock returns in Greece. Using monthly data for the period 1989:1 to 1999:6, Papapetrou finds a negative oil price effect on stock returns. He finds that oil prices are important in explaining oil price dynamics.

Using an unrestricted Vector Autoregressive (VAR) with daily data spanning January 1, 1998 to April 31 2004 for 22 emerging economies Maghyereh (2004) finds that inconsistent to earlier research in developed economies, oil price shocks were not important factors affecting stock index returns in emerging economies. Furthermore he observed that the emerging economies stock market return fail to rationally signal shocks in the crude oil markets as the stock markets are inefficient in the transmission of new information of the oil market. Maghyereh concluded that in light of his results then the importance of oil price in emerging economies was grossly overestimated.

Nandha and Faff (2006) using a generalised methods of moment based approach demonstrated the long and short run oil price sensitivity of Indian, Pakistani and Sri Lankan equity returns. Their empirical results showed no sensitivity in the short run(weekly) while several industries(e.g chemicals, engineering and machinery, food processors and transport) showed significant sensitivity in the long run.

An analysis by Park and Ratti (2008) using a multivariate VAR with linear and non linear specification estimated the implication of oil price shocks and its volatility on the real stock return of 13 European countries and the US.

Employing monthly data over the period 1986:1 to 2005:12, they observed that increased volatility of oil prices was important in lowering real stock returns in numerous European countries but not for the U.S. Secondly, for oil exporting countries like Norway, they observed a statistically significant positive response to an oil price increase. The authors also established evidence for the asymmetric effects of oil price on real stock return in the U.S and some European countries.

In contrast to the earlier study, Cong et al (2008) employed a multivariate vector autoregressive VAR based on monthly data from 1996:1 to 2007:12 to investigate the effect of oil price volatility on real stock returns of China. Except for the manufacturing index and some oil companies, the authors did not find any significant relationship between oil price shocks and most stock market indices. They also find no evidence of the asymmetric effects of oil price shocks on oil companies' stock returns. In addition, they contend that increased volatility does not influence most stock returns but is capable of fueling speculative activity in the petroleum, chemicals and mining index which then raises their stock returns.

In a study on the Nigerian economy, Adebisi et al (2009) employ a multivariate VAR to investigate the role of oil price shocks and exchange rates on real stock returns. Utilising quarterly data over the period 1985:1 to 2008:4 the authors find a significant negative relationship between real stock returns and an oil price shock. In addition, oil price volatility "granger cause" variations in the stock market. Their finding was not consistent with the postulation of the positive impact of oil price shocks on stock returns in oil exporting countries.

Asaolu and Ilo (2012) study examines the effect of world crude oil prices on the Nigerian stock market return. Employing a vector error correction model (VECM) on annual data from 1984 to 2007, they observed a long run relationship between the Nigerian stock market return and oil price. However, a rise in the oil prices exerts a negative influence on the return performance of the market. Although this is in line with theory, they considered this result abnormal for an oil producing economy like Nigeria.

Employing a two regime Markov-switching EGARCH model on monthly data over January 1989 to December 2007, Aloui and Jammazi (2009) examined the effect of crude oil stocks on stock markets in the UK, Japan and France. Consistent with the general literature, they find that soaring oil prices were significant in explaining both the volatility of stock returns and the probability of transmission across regimes.

Using a structural VAR, Bjornland (2009) study finds a positive effects of oil price changes on the stock market. The study observed that as the country's income rises, investment and expenditure also increases resulting in higher productivity and lower unemployment with the stock market responding positively in the same direction. In a quite novel attempt, Arouri and Rault (2009) demonstrated a long run positive relationship between oil prices and stock markets in Gulf corporation countries by implementing Smith et al (2004) bootstrap panel unit root test and the Westerlund and Edgerton(2007) proposed panel cointegration test. They observed that with the exception of Saudi Arabia, oil price was positively correlated with stock prices. They noted that the case of Saudi Arabia was puzzling as the country is a major player in the world energy

market, is reliant on oil export and its stock market should be susceptible to an oil price shock.

The negative influence of oil prices on stock markets has also been documented by Miller and Ratti (2009). Employing a VECM approach on annual data from 1971 to 2008, they observed a negative impact on stock markets in the long run. Furthermore, their study showed interestingly that the negative effect was almost zero for the years after 1999 suggesting the changing relationship between oil prices and stock market is explained by the fact that oil price and stock market bubbles appeared since 2000.

By means of a nonlinear framework Jawadi and Leoni (2009) study oil market efficiency hypothesis. The study employed monthly data for the period December, 1987 to March, 2008 on the USA, France, Mexico and the Philippines. They demonstrated a long run relationship between oil price and stock markets, in addition to evidence of linear linkage between stock markets and oil price. This suggests that the oil market is not efficient. Secondly, they propose a new nonlinear cointegration technique (the switching Transmission Error Correction models. They contended that the oil price is nonlinear, mean-reverting toward the equilibrium and with an adjustment speed that rises depending on directions of deviations toward the stock market equilibrium. They specified two distinct oil price regimes: a “pure chartist regime” where the oil price adjustment is decided by its prior predisposition and a “stock market follower regime” where the adjustment is more activated.

Chen (2010) study investigates the role of oil prices in stock market fluctuations. In particular instead of exploring the influence on stock return, his study explores whether oil price pushes the stock market into a recession (bear territory). He employed time varying transition probability Markov switching models. By employing monthly data on the standard and poor S&P 500 price index from 1957M1 to 2009M5 they demonstrated that an increase in oil prices leads to a higher probability of a bear market emerging.

Filis (2010) study reached the same conclusion. He employed a unified statistical framework (cointegration and VECM) to explore the relationship between macroeconomy, stock market and oil prices. Filis then employed multivariate VAR and examined cyclical components of the series. Using monthly data from 1996:1 to 2008:6, the author demonstrated a significant negative effect of oil prices in both the VECM result and the cyclical components analysis.

Imarhiagbe (2010) analysed the impact of oil prices on stock prices of six selected major oil producing and consuming countries. The author employs daily data from January 26, 2000 to January 22, 2010 and estimated a vector error correction model (VECM). He presented evidence of a long run relationship between oil prices and stock prices in Russia, Saudi Arabia, China, India and the United States. He observed that stock prices and oil prices were weakly exogenous only in the case of China and there was no evidence for other countries. This implies that for China these variables are non responsive to past period deviations from the long run relationship.

By means of daily data for the period 2000–2008, Narayan and Narayan (2010) model the impact of oil prices on Vietnam's stock prices. They find that oil prices have a positive and statistically significant impact on stock prices. However, the authors observed that the Vietnamese stock market was dominantly affected internal and domestic factors than oil price. In the long run both exchange rate and oil price had both apposite and significant impact on stock prices, while in the short run both exchange rate and oil price were important factors affecting stock return. The authors contend that this finding of a positive relationship is inconsistent with the theoretical postulation of the relationship between oil price and stock prices.

Basher et al (2011) investigate the dynamic relation between oil price, exchange rates and emerging stock Markets. Using a structural vector autoregression model they find that in the short run positive oil price shocks tend to depress emerging stock prices. They also found evidence to suggest a rise in emerging market stock prices increases oil prices. They argue that while Stock prices are negatively linked to a positive oil price shock and the oil prices respond positively to a positive emerging market shock.

Unlike previous studies which focus on US, European and major Asian stock markets Arouri and Rault(2009) explore the sensitivity of stock prices to oil prices in Gulf Corporation Council (GCC) member countries. They implement the panel data approach of Konya (2006) based on SUR systems and Wald test with country specific bootstrap critical values. Employing weekly data over the period June 7, 2005 to May 25 2010 they demonstrated a bi-directional causal relationship for Saudi Arabia. For other GCC member countries, they find that

stock market price does not “Granger cause” oil price changes while on the other hand oil price shocks Granger cause stock price changes. They recommended that investors in the oil market should follow changes in the Saudi stock market while investors in the GCC should follow changes in oil prices more closely.

Ramos and Veigna (2010) in a panel analysis using monthly data from December 1988 through June 2009 for 18 countries investigated the puzzle of asymmetric effects of oil price. Their empirical results demonstrated that the non linear effects are different depending on the status of a country being net importing or net exporting. They observed that price rise positively influences the stock market of oil exporting countries and negatively influences on the stock market of energy dependent countries. Their finding was consistent with findings that oil exporting countries benefit economically from oil price increases.

Evidence by Le and Chang (2011) reveals different implications of an oil price shock on stock market in different countries. By examining the responses of the stock markets to oil price fluctuations in developed and emerging economies of Singapore, Japan, Malaysia and South Korea. The authors showed results varied significantly across markets suggesting different stock markets respond differently to oil shocks. While oil price fluctuations had a positive effect on stock market in Japan, it had a negative effect in Malaysia and was inconclusive for Singapore and South Korea. The study concluded that stock market inefficiency appeared to have slowed the response of stock market to oil price surges.

Consistent with the literature on the positive effect of an oil shock on stock returns, Ono (Ono, 2011) in a recent study using a VAR model with data over the period 1999:1 to 2009:9 examined the influence of oil price shocks on real stocks return for BRIC countries(Brazil, China, India and Russia) using both linear and non linear specifications. The results of his empirical analysis demonstrated that real stock returns responded positively to oil price indicators in China, India and Russia. The results of the variance decomposition indicated that for China and Russia the contribution of oil price shocks to volatility in real stock return was relatively large. In addition results indicated asymmetric effects of oil price in India.

Taking a different approach, in another recent study on G7 countries, Lee and Zeng (2011) in quite a novel empirical framework investigate the impact of oil price changes on real stock returns. The empirical analysis simultaneously takes into account parameter instability and different quintiles. They find a diverse response of stock markets to oil price shocks. Generally, they observe that oil price shocks do influence real stock returns. They observed a negative influence in most G7 countries.

Masih et al (2011) drew attention to the importance of oil price fluctuations and volatility on equity market performance for South Korea. Using a VEC model with monthly data from May 1988 to January 2005, they find that a long run equilibrium relationship between oil price and stock return does exist. In addition oil price movements considerably impact the stock market. They observed that after shocking oil prices and oil volatility the stock market rises and then

decelerates improving to its long run equilibrium level after approximately 9 months. During which period oil price spreads its effect on the stock market.

Whereas Arouri et al (2011a) study attempts to shed light on volatility spill-over's between oil and stock markets in European equity markets. The results of their empirical findings using sector stock prices showed significant volatility spill-over's between oil price and sector stock returns. They made use of a recent multivariate vector autoregressive generalised conditional heteroscedasticity. They find that conditional volatility transmission between oil and stock market represented by DJ Stoxx Europe 600 index was affected by innovations in the oil market. They concluded that there was considerable volatility transmission between oil and stock markets in Europe and the spill-over effects were more obvious from oil to stock markets.

There exist a limited number of studies that have concentrated on investigating the time varying correlations between stock market prices and oil prices. In this respect, the first approach to explore this relationship was by Ewing and Thompson (2007) who examined the cyclical comovements of crude oil prices with output, consumer prices, unemployment, and stock prices. Their study investigates the extent to which crude oil price was leading, lagging or was synchronous of several cycles of some important macroeconomic variables. Using monthly observations from January 1982 through November 2005 they find that oil prices were procyclical and lag stock prices by 6 months. They also noted the existence of limited research investigating the oil price stock market interaction. They provided evidence to suggest that the stock market may provide useful information on other markets in relation to oil prices.

In the same respect Aloui and Jammazi (2009) study develop a two regime Markov-switching EGARCH model introduced by Henry (2009) to look at the role of Crude Oil market volatility shocks in explaining the equity markets behaviour of UK, France and Japan over the sample period January 1989 to December 2007. The empirical approach, they observed, allows the variance of stock returns to switch across different regimes and the regime, at any given date, is presumed to be the outcome of a Markov chain whose realizations are unobservable. Their findings show that oil price increase significantly influences both the volatility of stock returns and the probability of transition across regimes. They observed that real stock returns display significant evidence of regime switching, with strong evidence of two regimes in the data: relative to low mean/high variance regime and the other to high mean/low variance regime. Furthermore, they provide evidence that common recessions coincide with the low mean/high variance regime. The first regime is consistent with low mean–high variance regime and tends to be dominant only for Japan. Whereas the second regime which appears to be dominant for UK and France is consistent with high mean–low variance.

In a study on the Russian economy Bhar and Nikolovann (2010) employ a dynamic bivariate exponential general autoregressive conditional heteroscedastic (EGARCH) to explore the dynamic correlation between stock market and oil prices. They were able to identify three major events; the September 11 2001 terrorist attack, the 2003 war in Iraq and the 2006 Iraqi civil war as events which had had a negative correlation with the Russian stock market and oil prices. Their analysis demonstrated the important role of global oil price returns on Russian

equity returns and volatility. In addition, dynamic correlation analysis highlights Russia's importance in the international geopolitical scene and its positioning as a reliable supplier of oil during times of turmoil in the Middle East.

Cifarelli and Paladino (2010) applied a multivariate CCC-GARCH model to provide evidence of the negative relation between oil price changes with stock prices and exchange rates. In particular the authors empirically assess if speculation influenced oil price dynamics. Using a modified CAPM based on Shiller (1984) and Sentana and Wadhvani (1992), they observed a negative relationship between oil price shifts, stock price and exchange rate changes. They concluded that speculation played a considerable role in the oil market, which they observed was a clear evidence to suggest the oil market is not a fundamental-driven market.

Choi and Hammoudeh (2010) cited in Filis et al (2011) study supplements previous regime-switching studies on WTI crude oil and employed a symmetric DCC GARCH model. The study observed two possible volatility regimes for the strategic commodity prices of Brent oil, WTI oil, copper, gold and silver, and the S&P 500 index. The dynamic conditional correlations (DCCs) results indicate that since the 2003 Iraq war, correlations among all the commodities prices has witnessed an increase, but correlations between commodity prices and the S&P 500 index has experienced a decrease. They observed the rise in commodity correlations reduces their hedging substitutability in portfolios. Furthermore they noted that the weakened correlations between the commodities and the S&P 500 index will enable investors and portfolio managers can use them in their risk diversification strategies.

Filis et al (2011) employ a DCC- GARCH- GJR model which has not been applied before on monthly data to investigate the dynamic correlation between stock market and oil prices for six oil importing and exporting countries. The authors investigate both contemporaneous and lagged time varying correlation considering the origins of oil price shocks. They demonstrated that the origin of an oil shock is an important determinant of the correlation magnitude between oil price and stock markets. They observed that while aggregate demand side oil price shocks such as the latest global financial crisis, Asian crisis and Chinese economic growth tend to cause a negative correlation between oil and stock markets, precautionary demand side oil price shocks such as second world war, Iraq war and the September 9, 2003 terrorist attack tends to have a negative correlation between oil and stock market. They concluded that the time varying correlation of oil and stock prices do not differ for oil exporting and importing economies, that oil price shocks in periods of world turmoil have significant effect on the stock market prices irrespective of whether the economy is a net importing or net exporting economy. However oil price shocks originating from OPEC production cuts and Hurricanes do not have a significant impact on the correlation between oil price and the stock market.

This literature is growing and the empirical evidence of this relationship is mixed. They are evidences of asymmetric effects with oil price declines not necessarily having a positive effect on stock returns(Sadorsky, 1999, Ramos and Veiga, 2010). According to Filis et al (2011) depending on the nature of a shock, an oil price shock (demand or supply side) could affect the stock market due to the uncertainty it creates to the financial world. The stock market is believed to

respond positively to demand side shocks and negatively to shocks originating from the supply side. The findings of the nature of relation are heterogeneous. Lack of unequivocal evidence on the nature of the relationship creates an obvious deficiency that affects applied research and policy making (Papapetrou, 2001).

From the above review of Literature, the following Questions arise From the above discussion, the study therefore draws the following research questions:

What is the impact on oil price shocks on stock market behaviour in Nigeria ?
and

What is the dynamic correlation relationship between oil price and the stock market in Nigeria?

All these questions are of interest and are germane to this study. This study will try to answer these questions. Answers to these questions will have implications not only to Nigeria but other oil exporting economies.

Table 3-2: Summary of literature on oil price shocks and stock market behaviour

Study/Author	Data	Methodology	Results/Conclusions
Jones and Kauls (1996)	Canada, Japan, UK and the US; Quaterly data; various lengths	Regression	The reactions of stock markets could be explained by the impact of an oil price shock in US and Canada, the outcome for Japan and the UK was indecisive.
Sadosky(1999)	monthly data over the period 1947:1 to 1996:4	VAR	Oil price shock had a negative and statistically significant initial impact on stock returns
Papapetrou(2001)	Greece; monthly data for the period 1989:1 to 1999:6	VAR	Finds that a negative oil price effect on stock returns
Maghyreh(2004)	22 emerging economies; with daily data spanning January 1, 1998 to April 31 2004	VAR	Inconsistent to earlier research in developed economies, oil price shocks do not have significant impact on stock index returns in emerging economies
Nandha and Faff(2006)	Indian, Pakistani and Sri Lankan	GMM	Their empirical results showed no sensitivy in the short run(weekly) while several industries(e.g chemicals, engineering and machinery, food processors and transport) showed significant sensitivity in the long run.

Park and Ratti(2008)	U.S and 13 European countries; Monthly data over the period 1986:1 to 2005:12	VAR	Volatility of oil prices significantly depressed real stock returns in many European countries but not for the U.S. Secondly, for not exporting countries like Norway, they observed a statistically significant positive response to an oil price increase.
Cong et al (2008)	China; monthly data from 1996:1 to 2007:12	VAR	Increased volatility does not affect most stock return and finds no evidence of asymmetry
Adebiyi et al (2009)	Nigeria; quarterly data, 1985:1 to 2008:4	VAR	Oil price volatility explains variations in the stock market.
Aloui and Jammazi(2009)	UK, Japan and France; Annual January 1989 to December 2007.	Markov-switching EGARCH model	Soaring oil prices had a significant role in determining both the volatility of stock returns and the probability of transmission across regimes
Bjornland(2009)		SVAR	A positive influence of oil price on the stock market
Aroui and Rault(2009)	GCC countries;	Panel techniques	With the exception of Saudi Arabia, oil price increases have positive impact on stock prices.
Miller and Ratti(2009)	annual data from 1971 to 2008	VECM	A negative relationship between oil prices and stock markets
Jawadi Leoni(2009)	USA, France, Mexico and the Philippines, monthly data; December, 1987 to March, 2008	Non linear framework	Demonstrated evidence of linear linkage between stock markets and oil industry and confirm the existence of significant long-run relationships between oil and stock markets. Furthermore, oil price is nonlinear, mean-reverting toward the equilibrium

Chen (2010)	USA; monthly data from 1957M1 to 2009M5	Markov switching models	They demonstrated that an increase in oil prices leads to a higher probability of a bear market emerging.
Filis (2010)	Greece; monthly data from 1996:1 to 2008:6	VECM and cyclical component analysis	Demonstrated the stock market receives a negative and significant effect from oil prices in the VECM result while the cyclical components analysis suggest that oil prices exercise a significant negative influence on the stock market.
Imarhiagbe(2010)	Six selected major oil producing and consuming countries; daily data from January 26, 2000 to January 22, 2010.	VECM	Finds a long run relationship between oil prices and stock prices in Russia, Saudi Arabia, China, India and the United States stock prices and oil prices were weakly exogenous.
Narayan and Narayan(2010)	Vietnam; daily data for the period 2000–2008	GARCH models	Oil prices have a positive and statistically significant impact on stock prices.
Basher et al(2011)	Emerging markets; Monthly data from 1988:01 to 2008:12	SVAR	Stock prices respond negatively to a positive oil price shock and the oil prices responds positively to a positive emerging market shock.
Arouri and Rault(2011)	Gulf Corporation Council (GCC) member countries; weekly data over the period June 7, 2005 to May 25 2010	Panel data technique	Stock market price does not Granger cause oil price changes while on the other hand oil price shocks Granger cause stock price changes
Ramos and Veigna	18 countries; monthly data from December 1988	Linear and non linear	They observed that price rise had a positive influence on the stock market of oil exporting countries and a negative influence

(2011)	through June 2009	techniques	on the stock market of energy dependent countries.
Le and Chang(2011)	Singapore, Japan, Malaysia and South Korea.	VAR	While oil price fluctuations had a positive impact on stock market in Japan, it had a negative impact in Malaysia and was inconclusive for Singapore and South Korea.
Ono(2011)	Brazil, China, India and Russia Monthly 1999:1 to 2009:9	VAR	Real stock returns responded positively to oil price indicators in China, India and Russia
Lee and Zeng(2011)	G7	Quintiles	They find a diverse response of stock markets to oil price shocks. Generally, they observe that oil price shocks do influence real stock returns
Masih et al(2011)	South Korea; monthly data from May 1988 to January 2005	VEC	Oil price movements significantly affect the stock market.
Arouri et al(2011)	US	Multivariate vector autoregressive generalised conditional heteroscedasticity	They find that conditional volatility transmission between oil and stock market represented by DJ Stoxx Europe 600 index was affected by innovations in the oil market. They concluded that there was significant volatility transmission between oil and stock markets in Europe and the spill-over effects were more apparent from oil to stock markets.
Ewing and Thompson(2007)	monthly observations from January 1982 through November 2005	Cyclical components and filters	By relying on cyclical components of oil prices and stock prices the authors find that oil prices were procyclical and lag stock prices by 6 months.

Aloui and Jammazi(2009)	UK, France and Japan; Annual January 1989 to December 2007	Two regime Markov-switching EGARCH model	Rises in oil price have a significant role in determining both the volatility of stock returns and the probability of transition across regimes.
Bhar and Nikolovann(2010)	Russia	Dynamic Bivariate EGARCH	Their analysis shows that global oil price returns have significant impact on Russian equity returns and volatility
Cifarelli and Paladino(2010)	US	CCC-GARCH model	Provide evidence of the negative reaction between oil price changes with stock prices and exchange rates
Choi and Hammoudeh(2010)	US	DCC GARCH model	The study finds two possible volatility regimes for the strategic commodity prices of Brent oil WTI oil, copper, gold and silver, and the S&P 500 index, but with varying high-to-low volatility ratios. The dynamic conditional correlations (DCCs) indicate increasing correlations among all the commodities since the 2003 Iraq war but decreasing correlations with the S&P 500 index.
Filis et al (2011)	Six oil importing and exporting countries	DCC- GARCH- GJR model	Aggregate demand side oil price shocks tend to cause a negative correlation between oil and stock markets, while precautionary demand side oil price shocks tend to have a negative correlation between oil and stock market. They concluded that the time varying correlation of oil and stock prices do not differ for oil exporting and importing economies, that oil price shocks in periods of world turmoil have significant effect on the stock market prices irrespective of whether the economy is a net importing or net exporting economy

Looking at the table above, the issue of the potential impact of oil price shocks on the stock market is still not resolved. The findings are so heterogeneous that a clear cut conclusion cannot be reached. Empirical research in this area is therefore still unresolved. The relationship between oil price and stock price at the macro level has been examined in several developed countries and there has been less research on this relationship in Nigeria. This study will examine if a relationship exists for Nigeria. The case of Nigeria is interesting because Nigeria has the largest and most active stock market in sub Saharan Africa. There is also a renewed interest in employing new estimation techniques in this area of research.

CHAPTER 4

OIL PRICE EXCHANGE RATE NEXUS: AN EMPIRICAL ANALYSIS

4. 1. Introduction

The preceding review of literature has shed light on the important linkage between oil price and exchange rate, this empirical chapter builds on that background. The chapter is presented in two parts: In the first part both cointegration technique and an SVAR framework is employed to assess whether real oil price has an impact on the real exchange rate of the oil exporting Nigerian economy. In the second part, GARCH class models are employed to examine the symmetric and asymmetric effects of oil price returns on exchange rates returns during periods of extreme oil price fluctuation.

4.2 PART I: ESTIMATING THE REAL EXCHANGE RATE OF AN OIL EXPORTING ECONOMY: EMPIRICAL EVIDENCE FROM NIGERIA

As mentioned earlier, this section investigates whether real oil price has an impact on real exchange rate in Nigeria. While the main emphasis is on real exchange rates, the effect of productivity differential on Nigeria's real exchange rate is also estimated. Following Habib and Kalamova (2007), Nigeria's productivity differential against its thirty⁹ major trading partners is constructed

⁹ The list of major trading partners as well as main importers of Nigerian crude include Australia, Austria, Benin Brazil, Cameroun, Canada, China, Cotedevoire France, Germany, Ghana India, Ireland, Italy, Japan, Netherlands, New Zealand, Niger, Peru Portugal Senegal South Africa, Spain, Sweden, Switzerland , Thailand, Turkey, U.A.E, U.K and U.S constituting more than 86%of the trade between Nigeria and the world.

and included as an explanatory variable of the real exchange rate model. Productivity differential is used to capture the Balassa Samuelson effect. According to the Balassa-Samuelson hypothesis formulated by Balassa (1964) and Samuelson (1964), an improvement in the productivity of “tradable’s” relative to “non tradable’s” if larger in other countries could lead to the appreciation of the real exchange rate.

Given the unresolved and heterogeneous nature of the relationship between oil prices and exchange rates, it is of interest to examine if the volatility of oil price affects Nigeria’s exchange rate. Moreover, less attention has thus far been paid in the oil price macroeconomy literature to the relationship between oil prices and exchange rates¹⁰ (Arouri & Jawadi, 2010 and Coleman et al, 2011).

This study aims to contribute to the literature on the Nigerian economy by first looking at the long run relationship between real oil price, productivity differentials and real exchange rate. Second, the study employs an SVAR framework using short run restrictions to test whether real oil price has an impact on real exchange rate in Nigeria. The approach of this study has many advantages over previous studies on the Nigerian economy. First, economic theory is employed in the long run identification of the contemporaneous coefficients. Second, the study employs an SVAR framework which is largely absent in existing literature on the Nigerian economy. Furthermore, from another methodological point of view, Nigeria’s productivity differential against 30 of its

¹⁰ The literature on oil price macroeconomic dynamics is vast; a small segment of this literature has looked at the influence of oil price fluctuations on exchange rate movements which is the key issue considered in this empirical chapter.

main trading partners is constructed. Additionally, the study adds to the scant literature on the Nigerian economy, the largest part of the literature as observed by Suseeva (2010), is concentrated on understanding the sources of real exchange rate fluctuations in developed countries and evidence on the behaviour of less developed economies is limited.

As a preview of the empirical results, the study finds a long run relationship between real exchange rate, real oil price and productivity differential. A strong positive relationship between real oil price and real exchange rate is observed, which provides evidence in favour of the expectation of the positive effect of oil price on exchange for an oil exporting economy. Results suggest a negative long run relationship between real exchange rate and productivity differential. Estimating a structural vector autoregressive model (SVAR) with short-run restrictions, results indicate that oil price shocks have a positive impact on productivity and the real exchange rates in Nigeria albeit not statistically significant. The rest of this section is organized as follows. Following this introduction, section 4.3 describes the empirical model discussing data and the econometric methodology. Section 4.4, presents and discusses the empirical results, while section 4.5 summarizes the major findings and draws conclusions from the section.

4.3. Empirical model:

4.3.1 Data and its properties

Annual data on real effective exchange rate based on relative CPI and average crude oil spot price obtained from the International Financial Statistics of the

International Monetary Fund are employed by the study. The annual data ranges from 1980 to 2010 for a total of 31 observations. The study period is dictated by data availability. All variables were expressed in natural logarithms prior to econometric analysis.

Drawing on the related existing literature, the annual real oil price is constructed as the nominal average price of Brent crude in dollars deflated by the IMF index of the unit value of manufactures exports. This is in line with Deaton and Miller, 1996; Cashin et al,2004; Habib and Kalamova,2007 and Suseeva,2010. Following Habib and Kalamova (2007), the productivity differential variable is calculated as the trade weighted relative productivity differential against trading partner's productivity, where Productivity is defined as PPP GDP per capita ¹¹, the data for which was obtained from the Direction of Trade statistics (DOTS). Data on GDP per capita based on PPP (purchasing power parity) are from the World Bank World Economic Indicators.

The formula for calculating the weights¹² is the following:

$$W_i = \frac{X_i + M_i}{\sum_{i=1}^n X_i + \sum_{i=1}^n M_i} \quad 4.1$$

Where:

¹¹Weights are calculated for Nigeria's thirty major trading partners based on the total volume of trade using country specific trade shares as weights. $PROD = \prod_{j=1}^n (\text{productivity}_i / \text{productivity}_j)^{w_{ij}}$, where productivity_i and productivity_j denotes productivities of Nigeria and the trading partner

¹² Average weighted productivity differential of 30 major countries- partners in trade is calculated, for period t is calculated in the following way: $PROD = (\text{GDPc}_{it})^{w_{2t}} \dots (\text{GDPc}_{it})^{w_{30t}}$

W_i = weight of country i in the overall trade volume of the country.

M = Import of Nigeria from country i ;

X = Export of Nigeria to country i

$\sum_{i=1}^n X_i$ = Exports of Nigeria to 30 major trading partners;

$\sum_{i=1}^n M_i$ = Imports of Nigeria from its 30 major trading partners

A priori, the coefficient of terms of trade (oil price) is expected to have a positive effect on the REER as an improvement in the terms of trade will tend to increase the real exchange rate through income and wealth effects (see AlShehabi and Shuang, 2008). The coefficient of the productivity differential is expected to have a positive sign since productivity gains are believed to lead to higher real exchange rate.

Table 4-1: Summary Statistics

	LREER	LROILPMUV	LPROD
Maximum	6.432215	-0.463468	-0.964337
Minimum	4.059603	-2.268752	-1.490759
Std. Dev.	0.68024	0.510696	0.10791
Skewness	1.052754	0.335166	1.312051
Kurtosis	2.74319	1.901261	5.69312
Jarque-Bera	5.623897(0.06)	2.070717(0.35)	17.67351(0.00)

Table 4.1 presents the descriptive summary statistics for the real exchange rate, productivity differential and real oil price. It is apparent from the standard

deviation that REER has the highest volatility even higher than the real oil price. The distributional properties of our productivity differential variable appear to be non normal. The Jarque-Bera statistic and its associated p value reject the null hypothesis that the variable is normally distributed. All series have positive skewness and kurtosis for productivity differential indicate leptokurtic distribution.

4.3.2 Methodology

4.3.2.1 Unit root test

The analysis of this study starts by ascertaining the order of integration of the variables to detect the presence and form of non stationarity. When dealing with time series data, it is necessary to first establish the order of integration of individual series. This is because non stationary series have different properties over time and it is difficult to generalise to other time prediction thereby rendering regression coefficients and forecasting meaningless¹³. Many financial time series like exchange rates and levels of stock prices appear to have a unit root (Kozhan, 2009).

The study perform two standard tests- the Augmented Dickey-Fuller test (ADF) and Phillips-Perron (PP) test. The Augmented Dickey Fuller (ADF) test is based on the following regression equation:

¹³ The main cause of spurious regression is when variables are not stationary. A stationary time series is one with a constant mean over time, a constant variance and constant covariance for a given lag over time. If for any reason any of these is not satisfied then the stochastic process is non stationary and as a result regression coefficients will not be make sense and forecasting is also meaningless as the behaviour of the series is greatly influenced.

$$\Delta x_t = \gamma_0 + \gamma_1 x_{t-1} + \sum_{j=1}^p \gamma_{1+j} \Delta x_{t-j} + \varepsilon_t \quad 4.2$$

Where x_t is the series being tested, the null hypothesis is that x_t is non stationary (random walk with drift). There are different test specifications with regards to the assumption of an intercept and a deterministic trend. Lags of Δx_t are included to remove potential serial correlation from the residuals. If $\gamma=1$, then we have a random walk model (nonstationary). If the null that the series is not a random walk is rejected this implies stationarity. Phillips and Perron(1988) developed a generalization of the ADF test termed as PP test by allowing for mild assumptions which takes into account the less restrictive nature of the error process (Asteriou and Hall,2006). The test regression of the Phillips-Perron (1988) (Z statistics) is

$$\Delta x_t = \phi x_{t-1} + \alpha + \beta t + \mu_t \quad 4.3$$

One advantage of the PP test over the ADF test is that there are robust to general forms of heteroscedasticity in the error term μ_t , as it corrects for any heteroscedasticity and serial correlation in the error term (Kozhan, 2010).

If x_t is not stationary, the first difference of $x_t(\Delta x_t)$ is taken. If x_t is stationary, then x_t is said to be integrated or order 1, this is denoted as I(1). If a variable is I(d), d is the order of integration. Most economic time series are integrated or order 1, ie, I(1).

4.3.2.2 Cointegration analysis

Having established the order of integration of our variables, the Johansen (1988, 1992) systems procedure is used to test for cointegration and the presence of a long-run relationship and to determine the number of cointegration vectors. Regression of nonstationary variables can lead to spurious or non-sense regression. For a regression to be non-spurious, the whole relationship should be stationary rather than just the individual variable. When this happens, we say the variables are cointegrated¹⁴. A group of non stationary I(1) time series is said to be cointegrated if a certain linear combination of them is stationary. The Johansen method for testing for cointegration is based on the properties of a Vector Error Correction Model (VECM) and takes the form:

$$\Delta z_t = \Pi z_{t-1} + \sum_{j=1}^p D_j \Delta z_{t-j} + v_t \quad 4.4$$

Where the vector of I(1) endogenous variables $Z_t = [LREER_t, LPROD_t, LROILPMUV_t]$, ΔZ are all I(0) variables v_t is a (3 x 1) vector of white noise error terms. D is a (3x3) matrix of coefficients of deterministic terms. The Π matrix is 3x3 matrix containing information regarding the long run relationships¹⁵. The Π matrix is decomposed into $n \times r$ matrices of α and β such that $\Pi = \alpha\beta'$, with the Columns of matrices β representing the r linear

¹⁴ Many time series are non stationary but move together over time implying the series are bound by some relationship in the long run even though they may deviate from their relationship in the short run, the association will return in the long run.

¹⁵ It is a 3 x 3 matrix that has reduced rank when the variables in X_t are cointegrated

combinations of X_t that are stationary or cointegrated¹⁶ and the columns of α is the vector of speed of adjustment¹⁷ to equilibrium coefficients (Asteriou and Hall, 2006).

Since there are three variables there can be at most two linearly independent cointegrating vectors i.e. $r \leq 2$. If π has a full rank then all the time series in Z_t are stationary, if the rank of π is zero then there are no cointegrating relationships. If $0 < \text{rank}(\pi) = r < k$. This suggests Z_t is $I(1)$ with r linearly independent cointegrating vectors and $k-r$ non stationary vectors.

There are five models in practice, depending on whether Z_t and or the cointegration have an intercept and or deterministic trend: (1) The first model assumes that there are no deterministic trends in Z_t and no intercepts in the cointegrating vectors; (2) The second model assumes that there is no deterministic trend in Z_t but there are intercepts in the cointegration vectors; (3) The third model allows for deterministic trends in Z_t and intercepts in the cointegration vectors; (4) The fourth model allows for deterministic trends in Z_t and in the cointegration vectors; (5) The fifth model assumes that there are quadratic trends in Z_t and deterministic trends in the cointegration vectors. The five hypotheses are tested using the maximum eigen value statistics and the trace statistics proposed by Johansen (1988, 1991) which take the form

$$\lambda_{\text{trace}}(r) = -T \sum \ln(1 - \hat{\lambda}_i) \quad 4.5$$

¹⁶ β' is the transpose of the cointegrating vectors, a matrix of long run coefficients.

¹⁷ Error correction coefficients

and

$$\lambda_{\max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad 4.6$$

Where T is the number of observation, λ_i are the ordered eigenvalues and λ_r is the eigenvalue corresponding to r cointegration vectors (Wang, 2003). The λ_{trace} is a joint test with the null that the number of cointegration is less than or equal to r against the alternative that there are more than r. While λ_{\max} has as its null hypothesis that the number of cointegrating vectors is r against the alternative of r+1 (Brooks, 2008). To determine whether the system includes a constant or deterministic trend when choosing between model 3 and 4, the study employs the procedure proposed by Johansen (1991)¹⁸. Johansen (1991) proposed a likelihood ratio test based on the smallest eigen values of the estimated Π matrix (Crowder and Hamed, 1993).

Pesaran and Shin (2002) explain that the Johansen cointegrating framework always gives rise to two identification problems: the first one is the traditional identification of the contemporaneous coefficients and the second one is the long-run identification of coefficients which usually occurs when all variables are I(1).

¹⁸ The test statistics proposed by Johansen is express as: $Q = -T \sum_{i=r+1}^p \ln \left[\frac{(1 - \hat{\lambda}_i^*)}{(1 - \hat{\lambda}_i)} \right]$

Where $\hat{\lambda}_i^*$ are the eigenvalue estimates for specification with deterministic trend $H_1(r)$ and $\hat{\lambda}_i$ for specification with a constant term and no trend in the cointegrating vectors $H_1(r)^*$. Q is asymptotically distributed as $\chi^2(p-r)$ and r represents the number of cointegrating vectors.

4.3.2.3 The SVAR model

A structural vector autoregression (SVAR) similar to Bjornland(2009) with the following general form is also employed:

$$A_0X_t = A_1(L)X_t + B\varepsilon_t \quad 4.7$$

Where X_t represents n-vector of relevant variables as follows:

$$X_t = [LREER_t, LPROD_t, LROILPMUV_t]'$$

The A_0 and B are 3×3 matrices of coefficients with $A_1(L) = \sum_{i=1}^q A_1 L^i$ representing matrices polynomial in the lag operator. The matrix A describes the impulse response of endogenous variables to structural shocks, denoted by $\varepsilon_t = [\varepsilon_t^{lroilpmuv}, \varepsilon_t^{lprod}, \varepsilon_t^{lreer}]'$. The matrix B contains the structural form parameter of the model. ε_t is a n-vector of serially uncorrelated, zero mean structural shocks with an identity covariance matrix $\Sigma_\varepsilon = E[\varepsilon_t \varepsilon_t'] = 1$.

Reduced form VAR

The reduced form of the VAR model can be represented as:

$$X_t = C(L)X_t + U_t \quad 4.8$$

Where $C(L)X_t = A_0^{-1} A_1(L)$ with $A_0 U_t = B\varepsilon_t$. The residuals u_t in the reduced form VAR model are also presumed to be white noise, but they may be correlated with each other due to the contemporaneous effect of the variables across equations.

Identification and contemporaneous restriction

The SVAR system is presented below with the variables on the left hand side of the system representing relevant residuals (u's) obtained in the reduced form VAR. On the right hand side of the system are the 3 structural innovations (ϵ_s) representing shocks to the real exchange rate, productivity and real oil price respectively. In the system of equations, X is used to denote the coefficients to be estimated.

$$\begin{bmatrix} ULROILP_t \\ ULPROD_t \\ ULREER_t \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ X & 1 & 0 \\ X & X & 1 \end{bmatrix} = \begin{bmatrix} X & 0 & 0 \\ 0 & X & 0 \\ 0 & 0 & X \end{bmatrix} \begin{bmatrix} \epsilon_{LROILP_t} \\ \epsilon_{LPROD_t} \\ \epsilon_{LREER_t} \end{bmatrix}$$

As can be observed, the identifying restriction on the above matrices on the A and B matrices are simple zero exclusion restrictions. Matrix A is restricted to be a lower triangular matrix with ones on the main diagonal and B to be a diagonal matrix. In this form the model is exactly identified. It is necessary to impose $2K^2 - K(K + 1)/2$ restrictions on the A and B matrix for just identification. In this case, $K=3$ and consequently we need 12 restrictions. Counting the restrictions given above, the model is just identified. There are 6 restrictions for A (3 zeros and 3 ones) and additional 6 zero restrictions for B. Using the above identification restrictions, the variables are ordered as follows: real exchange rate, productivity differential and real oil price. Row (1) in the SVAR system depicts external shocks emanating from oil price volatility. Row (2) depicts productivity and is assumed to be contemporaneously affected by oil price shocks. While row (3) in the SVAR system depicts a contemporaneous response of real exchange rate to both external shocks emanating from oil price shocks

and productivity. Thus oil price affects productivity and the real exchange rate but not vice versa and productivity affects real exchange rate.

Impulse response functions are derived and used to examine the dynamic responses of the variables to various shocks within the SVAR system. To choose the lag length order for the identified VAR, the Schwarz information criterion is the basis for choosing the proper number of lags. The dynamic effect of real world oil prices, productivity differential and exchange rate can be analyzed by variance decomposition and impulse response functions.

4.4 Empirical results and discussions

4.4.1 Unit root and cointegration results

As mentioned in the previous section, since our data have a time series dimension, the model is likely to suffer from spuriousness caused when variables are non-stationary¹⁹. However, models with non-stationary variables can be non-spurious if they are cointegrated and a vector error correction model(VECM) can then be used to search for a long run relationship between real oil price and real exchange. The existence of cointegration is a prerequisite for estimating VECM using the Johansen procedure, which only works with I(1) variables.

Prior to the cointegration analysis, the integration property of the variables is investigated using two standard unit root test. Table 4.2 summarizes the results of

¹⁹ Spurious regression is caused when some or all variables in the model are nonstationary. If the model is not spurious or non-sense, it means that the variables in the model are cointegrated. Variables are cointegrated when a long term relationship exists among them, and the regression results are hence valid.

the unit root tests based on the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) test²⁰.

Table 4-2: Augmented Dickey Fuller test and Phillip Perron

<i>Variables</i>	<i>ADF</i>		<i>PP</i>	
	<i>(i)</i>	<i>(ii)</i>	<i>(i)</i>	<i>(ii)</i>
LREER	-1.66	-1.42	-1.78	-1.62
ΔLREER	-4.14*	-4.19**	-4.03*	-4.48*
LROILP	-0.94	-0.92	-0.93	-1.36
ΔLROILP	-5.77*	-5.77*	-5.84*	-8.23*
LPROD	-1.91	-1.30	-3.79*	-2.88
ΔLPROD	-4.82*	-5.28*	-4.82	-5.28*

*Note * and ** indicates significance at the 1 and 5 % levels, NC=not consistent
(i) With an intercept (ii) with an intercept and trend*

In the analysis both (i) an intercept and (ii) an intercept and trend is included in the estimation. As noted by Habib and Kalamova (2007) and Taylor (2003), identifying the integrational properties of the real exchange rate could be a difficult task due to their near unit root behaviour as both stationary and non stationary data generating processes may characterise the real exchange rate.

It can be seen from table 4.2 that for LREER LPROD and LOILP, the ADF and PP test statistic and the critical values obtained from the test table for different

²⁰ First, prior to formal unit root tests, the data was visualised on a graph to see whether they are stationary or not as a preliminary analysis, as well as to help to determine whether we need a constant or time trend or both in the ADF and PP test.

1%, 5% and 10% significance levels are given. If the test statistics is less than the critical values (in absolute terms) at either 1%, 5% or 10%, there is not enough evidence to reject H_0 . This is also confirmed by the p-value which is no more than 5%. Not rejecting H_0 implies that variable is not stationary. We can see that LREER and LOILP are not stationary when they are defined in levels. But first-differencing the series removes the non stationary components in all cases, therefore, we reject H_0 , concluding that the first difference of the variables is stationary although the level was not stationary.

Using both ADF and PP unit root tests, the common suggestion is that the real effective exchange rate (REER) and real oil price (ROILP) are non-stationary in their levels and stationary at their first difference. The result of their unit root test is unequivocal regarding the order of integration as all tests indicate the presence of a unit root in each series as the null of non stationarity cannot be rejected for any series. However, there is a slight disagreement for Productivity differentials (PROD), the PP test result for Productivity differentials (PROD) using intercept fails to reject the null that the variable is non-stationary, while the ADF test concludes that the variable is integrated to order(0)²¹. However the trend in the variable allows us to treat the variable as I(1). Overall, it is concluded that all our variables are non-stationary at levels and stationary at first difference²². Since the variables are stationary after the first difference, we say they are integrated of order 1, denoted as I(1). If the three variables are to be modelled in first

²¹ There is an exception for PROD for the model with intercept, where the PP test indicate it is I(0)

²² Looking at the graph for lprod, in deciding whether to include time trend and/or intercept in the test, it is decided that a trend exist for lprod .

difference, then this model will not be spurious or nonsense as the variables are stationary.²³

As noted by Asteriou and Hall(2007), for any model using non stationary time series data, cointegration becomes an overriding requirement, because in theory cointegration can only exist when there is really a relationship linking the variables. Proceeding with the cointegration analysis, Table 4.3 reports the results of the Johansen cointegration test. A VAR in levels is first estimated to determine the optimal lag length as cointegration is sensitive to the specified lag length. Choosing the lag length is very important as the wrong lag length could affect the outcome. Starting with two lags due to the limited number of observations, the maximum lag is limited to one in the lag length selection process based on LR, SC and HQ after having checked for the absence of residual serial correlation. The VAR also satisfy other stability condition and there was no root lying outside the unit circle. The existence and number of cointegrating equations depend upon the rank of the (k×k) Π matrix. The value of r or number of cointegrating equations is determined with a likelihood ratio (LR) test, using either: the Trace test or the Maximum Eigenvalue test.

²³ However, to obtain consistent estimates of the coefficients, it is necessary for the whole relationship given in a model to be stationary instead of individual variables. If the whole relationship is stationary, we say that the variables are cointegrated. That is, there a long term relationship between those 3 variables and estimating model will be consistent even if the variables are not stationary individually.

Table 4-3: Johansen maximal eigen values test and trace test

LNREER LNROILP LNPROD

Null Hypothesis	Alternative	Test statistic	p-value
Trace test			
r=0	$r \leq 1$	30.75	0.01
r=1	$r \leq 2$	2.64	0.88
r=2	$r \leq 3$	0.11	0.75
Max.eigenvalue test			
r=0	$r \leq 1$	28.11	0.00
r=1	$r \leq 2$	2.53	0.88
r=2	$r \leq 3$	0.11	0.78

Table 4-4: Cointegration vector

Cointegrating Eq:	CointEq1
LREER(-1)	1.000000
LPROD(-1)	4.631069 [13.0967]
LROILPMUV(-1)	-0.948019 [-3.26350]

(t-Statistics in [])

From table 4.3, there is a long run relationship between variables of interest, the empirical result rejects the null of no cointegration but cannot reject the hypothesis that there is at most one cointegrating equation.

$$H_0: r = 0 \quad H_1: r \geq 0$$

P-value (0.01) < 0.05, reject H_0 , implying that there are more than 0 cointegrating vectors.

$H_0: r = 1$ $H_1: r \geq 1$

P-value (0.88) > 0.05, do not reject H_0 , implying that there are not more than 1 cointegrating vectors, there is 1 cointegrating vector. On the basis of the λ_{trace} and λ_{max} , there is evidence of one cointegrating vector and is significant at 5% and 1% respectively.

The real exchange rate, real oil prices and productivity differential are therefore linked together by a long run equilibrium relationship as real oil price and productivity differential adequately capture innovations in the real effective exchange rate. In other words, the real exchange rate co-move with oil price and productivity differentials, as they are cointegrated, confirming results from Habib and Kalamova(2007) and Cashin et al(2004).

The result of the cointegrating vector (β) can be expressed as:

$$\text{LREER} = -4.63\text{LPROD} + 0.94\text{LROILPMUV}$$

The long-run coefficient elasticities of the cointegrating vectors are examined to check the validity of the result in relation to economics and econometric criteria²⁴. Economic theory expects a positive relationship between LREER and LROILPMUV and a positive relationship between LREER and LPROD. Therefore we check if the signs are consistent with theory.

²⁴ The sign and significance of the estimates is checked

The t-stat for LPROD is 13.09(=4.63/0.35) implying that LPROD is significant. The t-stat for LROILPMUV is -3.26(=-0.94/0.29) implying that LROILPMUV is significant. The coefficient of α should always be a negative fraction, $-1 < \alpha < 0$ for the equation of interest (LREER in this case). The adjustment coefficients for LREER is negative but not significant²⁵ (t-stat = $-0.08/0.06 = -1.27$). The adjustment coefficient for LPROD is negative and significant (t-stat = $-0.04/0.008 = -5.62$). The adjustment coefficient for LROILPMUV is negative and insignificant (t-stat = $-0.06/0.05 = -1.21$). Insignificant adjustment coefficient implies that the corresponding variable is weakly exogenous. Hence LREER and LROILPMUV are weakly exogenous. This means that there are no short run adjustments from other variables to determine LREER and LROILPMUV. LREER and LROILPMUV are not determined by the system of equation. It means that LREER and LROILPMUV are given from outside the model and are hence exogenous. On the other hand LPROD is endogenous and is determined by the system of equations.

The long run equilibrium relationship is presented in table 4.4 above. The long run parameters of the estimated system are given by the matrix after normalizing by the coefficient of the real effective exchange rate. In the long run, oil price (LOILP) exercises a significant positive influence on the real exchange rate (LREER). This long run positive relationship is as expected, positive and relatively large; it could be explained by the fact that Nigeria is an oil exporting country. Therefore, as predicted by the theoretical literature of the positive effect

²⁵ indicating a non valid equilibrium for LREER

of oil price on the exchange rate of oil exporting countries, oil price has a positive effect on exchange rates. A 1% change in real oil price will lead to a 0.94% increase in the real effective exchange rate. The findings are in line with the theoretical predictions of the positive effect of oil price on exchange rates of oil exporting economies. The result that there exist a positive long run relationship between oil price and exchange rates is consistent with the findings of Habib and Kalamova(2007) and Suseeva(2010). This positive relationship has also been confirmed in a number of similar studies on the Nigerian economy, it is in line with the empirical findings of Olomola and Adejumo (2006) and Jahan-Parvar and Mohammadi (2010) who support the existence of a significant long run relation between oil prices and exchange rates in Nigeria.

On the other hand for Productivity differential, no significant positive effects on real exchange rate were found. Productivity differential exerts a negative and significant- influence on real exchange rate. Thus in Nigeria, the Balassa-Samuelson effects do not seem to play an important role in driving the real exchange rate indicating that higher productivity in Nigeria's traded goods sector vis a vis its trading partners decreases the real exchange rate in the long run. A 1 % increase in productivity differential will lead to a 4.3% decrease in the real effective exchange rate in the long run.

In recent years owing to high global oil prices and increased exports, oil rich Nigeria experienced large inflows of foreign exchange. A modest appreciation of the CPI based REER since 2000(Figure 4. 2). The real appreciation could be attributed to the large inflows of foreign exchange in the form of oil revenue during that period, or a response to productivity gains. Empirical results also

indicate that the Nigerian currency- the Naira could be described as an “oil currency” as results indicate a long run positive and significant relationship between real exchange rate and real oil price. Real exchange rate commove with oil price and productivity differentials in the long run. Secondly, there is a lack of support for the Balassa-Samuelson effect as indicated by the negative and significant coefficient on the productivity differential. The observed real exchange rate appreciation is attributed to improvements in oil prices and not the Balassa Samuelson effect. Policy makers need therefore to focus attention on the implication of real exchange rate appreciation due to foreign exchange inflows arising from oil revenue which is an indication of “Dutch disease” both in medium and long term.

Krugman (1983) and Gulub(1983) have long noted the influence of oil revenue through wealth effects on the exchange rate (Coudert et al, 2008). The Nigerian economy is a “commodity economy”, as oil exports have maintained the largest share of Nigeria’s total exports for decades. Salehi-Isfahani (1989) had observed that real appreciation rather than increase in oil revenues was responsible for the phenomenal rise in Nigerian imports in the 1970s. Nigeria’s real exchange rate needs to be moderated as a result of oil price fluctuations. Some level of real appreciation is inevitable given high oil prices , Nigeria’s exchange rate policy has contributed to nations ‘boom and bust’ cycles over the past 30 years (Budina, et al, 2006).

4.4.2 SVAR model estimates

Additionally, short run restrictions are imposed and a SVAR²⁶ is estimated in order to further understand the contemporaneous effect of oil price shocks on stock markets. The parameters of the SVAR are obtained in a number of stages. First a reduced form VAR is estimated to obtain the OLS residuals, then using the SIC criteria the lag length is determined. The SIC suggest a lag of one year. In the second stage, the contemporaneous matrix is identified. From the structural VAR, impulse response functions and variance decompositions can be computed to analyse the dynamic causal relationship between the price and real exchange rate. The impulse response shows how the variables in the system respond to a structural shock. The outcomes of the impulse response functions with respect to structural shocks in real oil price are reported in Figure 4.1, the response forecast period is ten years.

²⁶ A structural vector autoregressive (SVAR) model imposes restrictions on the response of variables on each other based on an underlying VAR model thus giving impulse response and variance decomposition a more causal meaning.

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

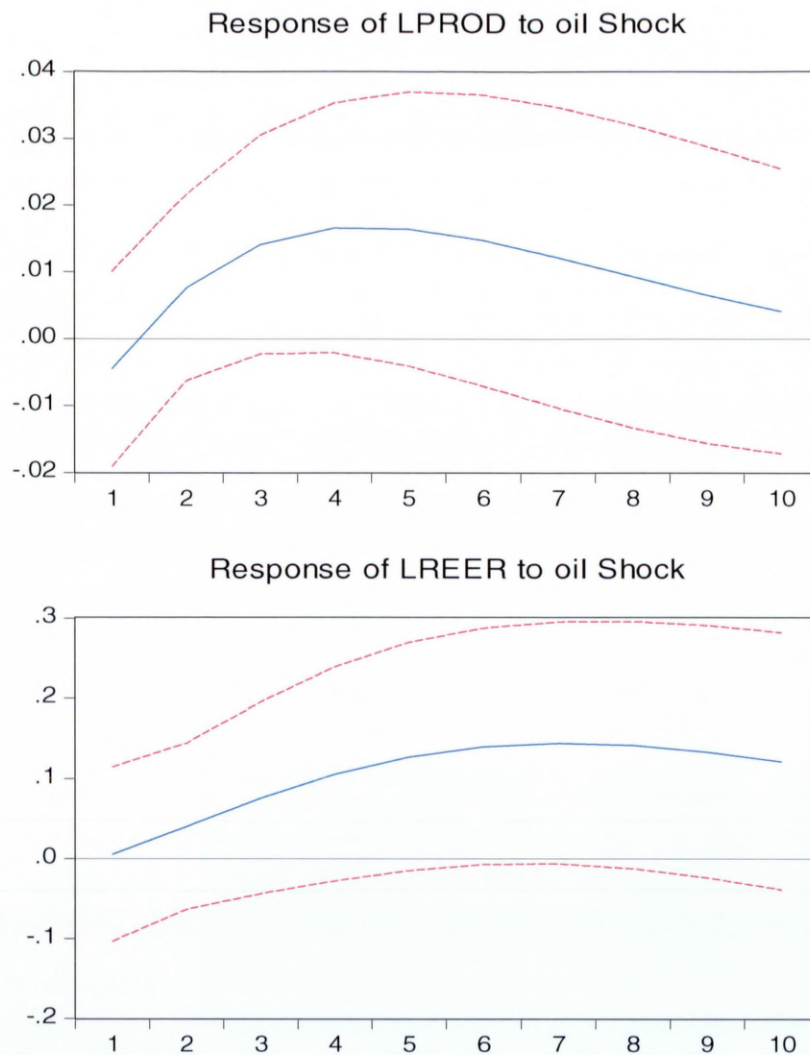


Figure 4-1: Showing the response of productivity and real exchange rate

An inspection of Figure 4.1 shows that the graph of the impulse response run according to economic theory, the response function shows that a positive structural shock to real oil is followed by an increase in productivity and the real exchange rate which lasted for the 10 year period without dissipating. Both effects are however not statistically significant. The literature on the dynamic impact of oil price shock on exchange rate though still controversial largely

points to the positive effects of oil price. This study finds that a onetime positive shock to real oil price also has a positive effect on REER and productivity differential which lasted the 10 years forecast period without dissipating. This suggests that an increase in the real oil price may boost government revenue, hence appreciating the Nigerian currency. The response of REER and productivity may be due to the fact that Nigerian is a net oil exporting economy. An insight that can be drawn from the impulse response is that the effect is consistent with the theory of the positive effects of oil price on REER of an oil exporting economy. According to the literature an oil price increase leads to the appreciation of the real exchange rate of oil exporting economies. Also according to the literature, productivity gains could also lead to higher real exchange rate. The effects are however not statistically significant.

The forecast error variance decompositions of all the variables included in the model are illustrated in Table 4.4, it shows the percentage of variation in a particular variable that is accounted for by other variables in the model. The forecast error variance is a useful tool to examine the interactions of variables included in the model over the impulse response horizon. Oil price was found to be exogenous in the model as oil price is not significantly accounted for by productivity and REER. The results for real oil price shows that most of the variance of oil is explained by its shock.

Table 4-5: Variance decompositionVariance Decomposition of LROILPMUV:

Period	S.E.	Shock1	Shock2	Shock3
1	0.254232	100.0000	0.000000	0.000000
2	0.350643	99.47806	0.003929	0.518012
3	0.416928	98.61466	0.027039	1.358298
4	0.465223	97.65374	0.080034	2.266222
5	0.500594	96.73173	0.164139	3.104135
6	0.526140	95.91770	0.273214	3.809082
7	0.544167	95.23987	0.397183	4.362947
8	0.556533	94.70190	0.525028	4.773071
9	0.564748	94.29316	0.646957	5.059881
10	0.570019	93.99539	0.755701	5.248906

Variance Decomposition of LPROD:

Period	S.E.	Shock1	Shock2	Shock3
1	0.039443	1.316247	98.68375	0.000000
2	0.049674	3.162996	93.88440	2.952602
3	0.056564	8.634697	83.54784	7.817467
4	0.062045	14.33264	73.07116	12.59620
5	0.066341	18.70395	64.88848	16.40757
6	0.069491	21.55058	59.29855	19.15087
7	0.071627	23.17973	55.81580	21.00446
8	0.072959	23.98064	53.82968	22.18968
9	0.073718	24.28506	52.81475	22.90019
10	0.074109	24.33648	52.37324	23.29028

Variance Decomposition of LREER:

Period	S.E.	Shock1	Shock2	Shock3
1	0.293316	0.029685	3.737967	96.23235
2	0.368823	1.187256	2.410287	96.40246
3	0.408015	4.366879	2.183129	93.44999
4	0.434317	9.713976	2.418273	87.86775
5	0.456963	16.48159	2.680523	80.83788
6	0.479052	23.49055	2.782508	73.72695
7	0.500702	29.77338	2.723620	67.50300
8	0.520951	34.86122	2.578921	62.55986
9	0.538801	38.69951	2.421064	58.87942
10	0.553655	41.45053	2.293296	56.25618

Factorization: Structural

An inspection of Table 4.4 shows that oil price accounts for over 40 percent of the variation in REER while Productivity account for less than 3 percent of variations in REER over the 10 year forecast period. This points to the importance of real oil price in explaining Nigeria real exchange rate dynamics. Real oil price also account for 24% of variation in Nigeria's productivity differentials over the forecast period with Nigeria's real exchange rate accounting for 23.29%.

4.5 Conclusion

In this chapter both cointegration and an SVAR framework are employed to explain whether the real exchange rate is affected by movements in the real price of oil, controlling for the possible role of productivity differentials against 30 major trading partners. The main aim and purpose of this chapter is to capture the effects of crude oil prices on the Nigerian economy over the period 1980 to 2010 covering the periods of the various oil shocks of 1983, 1990, 2008 etc.. Results indicate:

- A long run equilibrium relationship does exist among real oil price, productivity differential and the real exchange rate. This implies that real oil price, productivity differential and real exchange rates co-move together, as they are cointegrated. There is a positive long run relationship between real oil price and real exchange rate, as well as a negative long run relationship between real exchange rate and productivity differential.

- Results from the VECM suggest that real oil price exercises a significant positive influence on Nigeria's real exchange rate, as results show a positive long run relationship which provides evidence in favour of theory on the link between oil price and exchange rate in oil exporting economies.
- The study fails to provide supportive evidence for the Balassa Samuelson hypothesis. The Balassa Samuelson effects do not seem to be playing an important role in driving Nigeria's real exchange rate. A negative relationship is observed which fails to capture the implication of the underlying economic theory.
- Results from the SVAR analysis point to the positive effect of oil price on productivity and real exchange rate albeit not statistically significant.
- According to the impulse response functions it can be concluded both productivity and REER show strong response to an oil price shock and the effect is instantaneous
- The main conclusion of the research is that real oil price significantly affects the real exchange rate. This conclusion confirms the linkage between oil price and exchange rates in Nigeria. Such conclusions are supported and explained by economic theory. An implication of this result is that given Nigeria is a net oil exporting economy, increased exports and high oil prices may lead to increased revenue and foreign exchange inflows and further lead to real exchange rate appreciation. The result is appealing, given that it implies that the Nigerian currency could

be described as an oil currency, thus the result of this study has important policy implications

4.6 PART II: INVESTIGATING THE OIL PRICE EXCHANGE RATE NEXUS DURING PERIODS OF EXTREME OIL PRICE VOLATILITY: EVIDENCE FROM NIGERIA

The previous part of this chapter presented evidence on whether real oil price had an impact on Nigeria's real exchange rate. The main objective of this section is to extend the preceding empirical analysis and examine the effect of oil price fluctuations on nominal exchange rates during periods of extreme oil price volatility. To achieve this objective the study employs GARCH class models using daily data from 2/01/2007 through to 31/12/2010 and investigates the symmetric and asymmetric effects of recent oil prices changes on nominal exchange rate. The Generalised Autoregressive Conditional Heteroscedasticity (GARCH) and Exponential GARCH (EGARCH) models were introduced by Bolerslev (1986) by extending Engles ARCH framework and have been popular since the early 1990s. The study aims to contribute to the literature on the Nigerian economy by examining the symmetric and asymmetric effects of oil price shocks on nominal exchange rates in Nigeria. Despite the significant number of studies on the Nigerian economy. There are still analytical and methodological gaps that exist in the literature on the Nigerian economy.

This study differs from the previous studies on the Nigerian economy in terms of approach by employing GARCH class models. It extends Adeniyi (2011) study

by employing a larger data set, including periods of extreme oil price volatility²⁷. The rest of this chapter is organized as follows. Following this introduction, section 4.7 describes the data and the econometric methodology. Section 4.8, presents the empirical results while the summary of the major findings and conclusions are drawn from the chapter in section 4.9.

4.7 Data description and methodology

4.7.1 Data

The study uses daily data for the empirical analysis. Daily Brent crude spot oil price data are collected from U.S energy departments Energy Information Administration (EIA) website, while the daily naira-dollar exchange rate is obtained from DataStream international database. The daily data span the period January 2, 2007 to 31st December, 2010. The study follows the procedures of Narayan et al (2008) and Ghosh, (2010) and employs nominal data for our analysis as we do not require real values to discern daily behaviour of oil price and exchange rate.

Daily nominal return on exchange rate is denoted $grex_t$, while the daily nominal returns on oil price is denoted $groilt_t$. The Daily returns were computed as follows:

$$grex_t = \log(er_t / er_{t-1}) \quad 4.9$$

²⁷ Adeniyi (2011) used daily observations from January 2, 2009 to September 28, 2010 to investigate the oil price exchange rate dynamics in Nigeria. Adeniyi (2011) study did not cover the oil price fluctuations that occurred in 2008 when oil price rose to an all-time high of \$148 per barrel in July of 2008 before collapsing as low \$31 per barrel by December of the same year. Furthermore the present study employs the GARCH-M/E-GARCH-M models

$$\text{groil}_t = \log(\text{brent}_t / \text{brent}_{t-1})$$

4.10

Where gex_t are the daily returns on exchange rate, er_t represents naira-dollar exchange rate for period's t and er_{t-1} is the lag of naira-dollar exchange rate. For the nominal oil returns, groil_t represents the daily returns on oil price, brent_t is the daily spot price for brent crude for the periods t and brent_{t-1} is the lag of the daily spot price for brent crude.

4.7.2 Methodology

In order to investigate the potential linkages between recent oil price changes and exchange rate in Nigeria, we estimate a generalised autoregressive conditional heteroscedasticity (GARCH) and exponential GARCH (EGARCH) model using daily data.

4.7.2.1 Unit root test

Our analysis starts by ascertaining the order of integration of the variables. Many financial time series like exchange rates and levels of stock prices appear to have a unit root. The study performs two standard tests- the Augmented Dickey-Fuller test (ADF) and Phillips-Perron (PP) test (see section 4.3.2.1).

4.7.2.2 The GARCH and EGARCH model

The Generalised Autoregressive Conditional Heteroscedasticity (GARCH) and Exponential GARCH (EGARCH) models are used to estimate the relationship between recent oil price changes and exchange rates. Bolerslev (1986) introduced the GARCH model by extending Engles(1982) framework and have been popular since the early 1990s. The GARCH model has become a

benchmark in modelling financial data, especially daily log returns, they are widespread tools for dealing with time series heteroskedastic models. Since the dependent variable is the return on exchange rate and the independent is the return on oil price. Heteroscedasticity will be an issue but instead of considering this as a problem to be corrected, ARCH and GARCH models²⁸ treat heteroscedasticity as a variance to be modelled (see Engle,2001). The main advantage of GARCH over ARCH is that, ARCH (p) modelling requires a large number of parameters, while GARCH (1, 1) is usually sufficient.

The specification of the GARCH (1, 1) takes the form:

$$\text{grex}_t = \alpha + \zeta \text{groil}_t + u_t, \quad u_t \sim N(0, \delta^2) \quad 4.11$$

$$h_t = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta h_{t-1} \quad 4.12$$

The mean equation is a function of a constant, one regressor and an error term. Where u_t is white noise $(0, \delta^2)$. The variance equation for GARCH (1, 1) is written as a function of a constant term, the ARCH term which captures news about volatility from the previous period measured as the lag of squared residuals from the mean equation and the last period forecast period. The coefficients α_1 and β are positive to ensure the conditional variance h_t is always positive (Roman, 2010). The non- negativity restrictions are needed to guarantee that $h_t > 0$ in all periods and the upper bound $\alpha + \beta < 1$ is needed in order to make the h_t stationary and therefore the unconditional variance finite (Soderlind, 2011). Due to persistent volatility of many financial time series the condition $\alpha + \beta < 1$ may

²⁸ are designed to deal with just this issue

not be met but a unity sum of bound α_i and β_j leading to the integrated GARCH (IGARCH). However even if a GARCH is not covariance stationary, Nelson (1990), Bougerol and Picard (1992) and Lumsdaine (1991) in Wang (2003) observed that standard asymptotically based inference procedures are generally valid, it is strictly stationary or ergodic.

This study also consider an alternative GARCH equation, the (GARCH-M) GARCH-in-mean by incorporating the conditional variance in to the mean equation and it takes the following form

$$\text{gret}_t = \alpha + \zeta \text{groil}_t + \lambda h_t + u_t \quad 4.13$$

Higher order GARCH (q,p) can be estimated with the variance equation taking the form:

$$h_t = \alpha_0 + \sum_{i=1}^q \alpha_i u_{t-i}^2 + \sum_{i=1}^p \beta_i h_{t-i} \quad 4.14$$

Nelson (1991) first proposed the Exponential GARCH or EGARCH model due to the perceived problems with standard GARCH (p,q) model. The EGARCH captures asymmetric responses of the time varying variance to shocks²⁹. The representation of the EGARCH variance takes the form:

$$\ln(\sigma_t^2) = \alpha_0 + \phi \ln(\sigma_{t-1}^2) + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \chi \left[\frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right] \quad 4.15$$

²⁹ It also ensures that the variance is positive

Where α_0 , ϕ , γ and χ are the parameters to be estimated. The left hand side is the log of the conditional variance, thus the leverage effect is exponential as opposed to quadratic with the estimates of the conditional variance guaranteed to be non negative³⁰.

As discussed by Wang et al (2011), the EGARCH benefit from the non negativity constraint which Nelson viewed as too restrictive in linear GARCH model which requires all the explanatory variables in a GARCH to be positive. The coefficient α_0 denotes the mean of the volatility equation, ϕ represents the size effects which indicate how much volatility increases regardless of the shock direction. The estimate of χ is used to evaluate the perspective of shocks.

The absolute value of $\chi < 1$ ensures stationarity and ergodicity for EGARCH (P,Q). γ is the asymmetric response parameter, it is the sign effect which determines whether shocks give rise to higher volatility than negative shocks or vice versa. Wang(2003) observed that in contrast to standard GARCH model where shocks of the same magnitude (positive or negative) have the same effect on future volatility, in the EGARCH model γ is expected to be positive in most cases such that a negative shock increases volatility and while a positive shock eases uncertainty. As observed by Soderlind(2011), the EGARCH (exponential GARCH) is an asymmetric model, the $|\mu_{t-1}|$ term is symmetric (both positive and negative values of μ_{t-1} affect the volatility in the same way). The linear term in μ_t .

³⁰ Being written in terms of log make $h_t > 0$ hold without any restrictions on the parameters

γ_1 modifies this to make the effect asymmetric. If $\gamma < 0$, then the volatility increases more in response to a negative μ_{t-1} than to a positive μ_{t-1}

4.8 Empirical analysis

4.8.1 Unit root test

The analysis of the daily series begins with examining the descriptive statistics of the variables as well the integrational properties of our variables. From Table 4.5, it is clear that the Jarque-Bera test decisively rejects the null hypothesis of normal distribution at the 1% significance level. The returns on exchange rate indicate positive skewness. Kurtosis indicates that the distribution of both return series is peaked (leptokurtic) relative to normal.

Table 4-6: Descriptive statistics

	GREX	GROIL
Mean	0.000164	0.000455
Median	0	0.000935
Maximum	0.048415	0.181297
Minimum	-0.03174	-0.16832
Std. Dev.	0.005408	0.025869
Skewness	2.469465	0.050997
Kurtosis	28.03867	8.811666
Jarque-Bera Probability	27328.65 0	1417.599 0
Sum	0.16562	0.45821
Sum Sq. Dev.	0.02942	0.673211
Observations	1007	1007

Figures 4.2 and 4.3 below present the graphical representation of returns on exchange rate and oil price. We can clearly observe volatility pooling in both series and seems to be more dominant in the returns to oil price. We next verify the integrational properties of our variables.

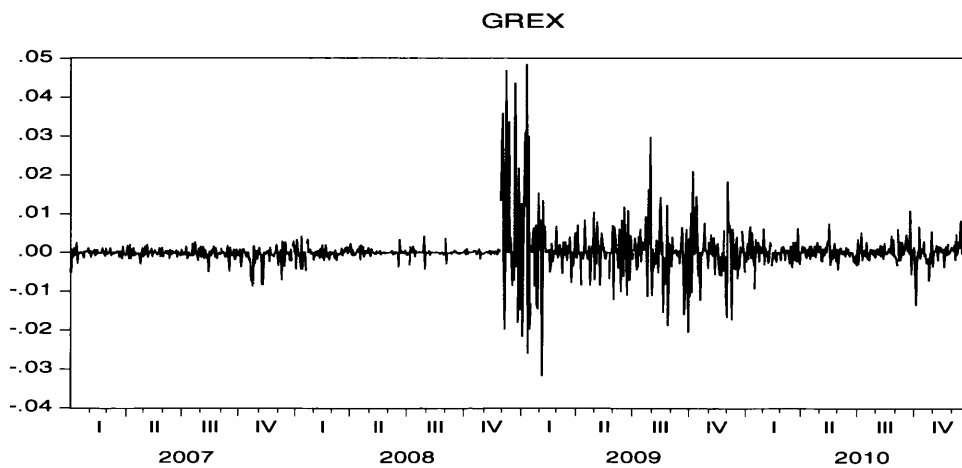


Figure 4-2: Return on exchange rate

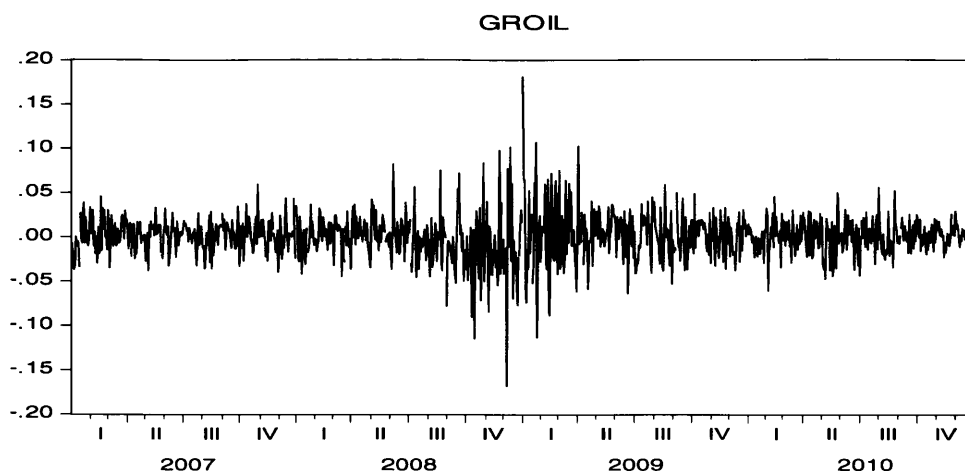


Figure 4-3: Return on oil price

Table 4-7: Unit root test

Augmented Dickey Fuller Test and Phillip perron

<i>Variables</i>	<i>ADF</i>		<i>PP</i>	
	<i>(i)</i>	<i>(ii)</i>	<i>(i)</i>	<i>(ii)</i>
grex	-34.73*	-34.73*	-34.64*	-34.64*
groil	-31.15*	-31.13*	-31.15*	-31.13*

*Note * indicates significance at the 1% levels
(i) With an intercept (ii) with an intercept and trend*

Table 4.6 presents results on the level of integrations of our variables using the Augmented Dickey Fuller (ADF) and the Phillips Perron (PP) method. We include both (i) an intercept and (ii) an intercept and trend in the estimation. From Table 4.6, we can observe that the results indicate that all our variables are stationary at levels and we are able to reject the null hypothesis of unit root in the variables irrespective of whether we use a trend or intercept in the regression.

4.8.2 Garch model

First equation (4.11) is estimated using the ordinary least square (OLS) technique. From table 4.7, it can be observed that the coefficient of $groil_t$ is not statistically significant and there is strong evidence of autoregressive conditional heteroscedasticity (ARCH) in the residuals clearly indicating the need for respecification of the model. GARCH class models are therefore estimated using maximum likelihood assuming normally distributed errors.

From the GARCH (1,1) model, note that the coefficient of the lag conditional variance(β) and the lag squared residual (α_1) are positive and statistically significant as observed from the second column of Table 4.7. From the mean equation of the GARCH (1, 1) model, it is clear that $groil_t$ is statistically significant at the 1% level. A 10% increase in the oil price return leads to a 0.09% depreciation of the Nigerian currency vis-à-vis the US dollar. The residuals for the GARCH (1,1) model are white noise and there are no serial correlations in the residuals. In GARCH (1,1)-M equation, the estimated parameter on mean equation has a positive sign but is not statistically significant suggesting that exchange rate volatility has no impact on exchange rate itself. There are no feedbacks from the conditional variance to the conditional mean.

The third column from Table 4.7 presents the results of the EGARCH (1,1) model. From the mean equation we can observe that the coefficients $groil_t$ is statistically significant at 1% level and a 10% increase in oil price returns leads to a 0.10% depreciation of the Nigerian currency-vis-à-vis US dollar. From the variance equation, the asymmetry term γ is statistically significant and therefore

suggesting that Shocks to exchange rate have asymmetric effects with positive shocks giving rise to higher volatility (Narayan et al, 2008). In a nutshell, positive and negative shocks have different effects. The parameter χ which measures volatility persistence is positive and statistically significant. The coefficient is also close to 1 suggesting that shocks have permanent effect on exchange rate volatility. The mean equation of the EGARCH (1, 1)-M model indicates that an increase in oil price has a negative impact on nominal exchange rate. Note that the variance term (GARCH) in the mean equation is significant. The residuals for EGARCH and EGARCH –M models are free from serial correlations and ARCH effects.

Table 4-8: Estimation results

Parameter/Model	OLS	GARCH(1,1)	GARCH(1,1)-M	EGARCH (1,1)	EGARCH (1,1)-M
I. Mean equation					
α	0.0001**	-0.0001*	-0.0001	-7.18E-05*	-0.0001
	0.0001	5.47E-05	(5.78 E-05)	4.23E-05	-4.33E-05
ζ	-0.007**	-0.0099	-0.0098	-0.011	-0.011
	0.006	(0.0007)	0.0007	0.0006	(0.0007)
λ	-	-	3.94**	-	10.69
			5.53		3.62
II. Variance equation					
α_0	-	1.78E-08	1.78 E-07	-0.75	-0.72
		(1.90 E-08)	(1.90 E-08)	0.04	-0.05
α_1	-	0.33	0.32	-	-
		0.02	-0.02		
β	-	0.73	0.74	-	-
		0.012	-0.01		
ϕ	-	-	-	0.46	0.46
				0.02	0.02
γ	-	-	-	0.11	0.11
				0.01	0.01
χ	-	-	-	0.96	0.96
				0.003	0.003
III. Diagnostics					
Q-statistics (6)	17.09	6.27	6.21	7.47	8.06
	[0.009]	[0.39]	[0.39]	[0.27]	[0.23]
Q-statistics (24)	52.17	21.76	20.67	15.43	24.32
	[0.00]	[0.59]	[0.65]	[0.21]	[0.44]
Q-statistics (36)	52.17	21.76	37.51	44.42	43.6
	[.00]	[0.59]	[0.40]	[0.15]	[0.18]
ARCH-LM(6)	34.81	1.31	1.24	0.34	0.21
	[0.00]	[0.24]	[0.27]	[0.91]	[0.97]
ARCH-LM(24)	18.28	0.7	0.68	0.97	0.72
	[0.00]	[0.84]	[0.87]	[0.49]	[0.82]
ARCH-LM(36)	13.34	0.5	0.48	0.74	0.56
	[0.00]	[0.99]	[0.99]	[0.86]	[0.98]

*Figures in () are standard error and that in [] are probability values
*,** denotes statistically insignificant at 5% and 10% , respectively*

Overall, the main finding to come out from the empirical analysis is that an increase in the oil price return led to the depreciation of the Nigerian currency vis-a-vis US dollar during the study period. The finding of this study is not consistent with the theoretical literature of the positive effect of oil price on exchange rate. The result contrasts with the findings of Narayan et al (2008) in Fiji but are consistent with the findings of Adeniyi (2011) on the Nigerian economy and the findings of Ghosh(2010) on the Indian economy. Despite being an oil exporting economy oil price fluctuations over the study period led to a depreciation of the Nigerian currency vis a vis the US dollar. This is surprising given that oil exporting nations may experience exchange rate appreciation when oil price rises and depreciation when oil price falls (see Reboredo, 2011).

However, it should be noted that although a major oil producer, Nigeria imports almost all of its petroleum product needs from the international oil market due to its insufficient and poorly managed refineries. According to the IEA, in 2009 only 0-15% of refining capacity was operational. In addition, domestic petroleum product prices are regulated in Nigeria. Petroleum imports and subsidized consumption regulated at 65 naira (\$0.44; £0.29) a litre cost the Nigerian government at least \$4 billion (£2.6 billion) annually constituting a huge fiscal challenge. Adenikinju (2009) noted that due to the oil price hike and depreciating exchange rate the size of fuel subsidy tripled from N 278.9 billion (US\$2.3 billion) in 2007 to N633.2 billion (\$5.37billion) in 2008 with oil subsidy moving from being an implicit subsidy to a significantly increasing explicit cost representing about 1.3 to 1.4% of GDP.

4.9 Conclusion

This study explored the oil price exchange rate nexus for Nigeria over the period January 2, 2007 through to December 31, 2010 to further provide insights into the relationship. During this period oil price trended upward reaching an all time high of \$145 per barrel in July of 2008 before declining, crashing as low as \$33 per barrel in December of 2008. Prices then began the year 2009 at below \$40 a barrel averaging \$61.73 per barrel for the year peaking at \$78 in November of 2009. In 2010, oil price began the year 2010 at \$79.05 per barrel peaking at \$93 per barrel. The macroeconomic effect of these fluctuations on exchange rate movements is of importance to policy makers in Nigeria. The empirical evidence in this chapter shows that:

- Exchange rate volatility has no impact on exchange rate itself.
- Shocks to exchange rate have asymmetric effects with positive shock giving rise to higher volatility
- In sum, it is found that an increase in oil price return over the study period led to a depreciation of the Nigerian currency vis-à-vis the US dollar
- It is found that during periods of extreme oil price volatility, the response of exchange rate return to oil price return is not in conformity with theoretical predictions for an oil exporting economy.
- These results are of interest for policy maker in promoting exchange rate policies.

- The modelling strategy employed in this study can be interpreted as shedding light on the oil price exchange rate dynamics in Nigeria

CHAPTER 5

OIL PRICE SHOCKS AND STOCK MARKET BEHAVIOUR: AN EMPIRICAL ANALYSIS

5.1 Introduction

This chapter investigates the interrelation between oil price changes and stock returns in Nigeria, an oil exporting economy. The chapter is presented in two parts, first employing a multivariate VAR, traditional OLS and a quantile regression (QR) method; the study undertakes a systematic investigation of the impact of oil price changes on the stock market. Second, the chapter employs a DCC-IGARCH (1,1) to investigate the dynamic correlation relationship between international crude oil prices and the Nigerian stock market.

5.2 PART 1: ESTIMATING THE IMPACT OF OIL PRICE SHOCKS ON STOCK MARKET ACTIVITIES IN NIGERIA

In this section, a multivariate vector autoregressive (VAR) model and a quantile regression model is employed on monthly data from January 1985 through to December 2011 to investigate the relationship between recent oil price changes and stock market returns in Nigeria. The period of analysis is set for this period in order to analyse the impact of the dramatic increase and decrease in oil prices on stock returns during this period.

There are a limited numbers of studies that have examined the oil price-stock return relationship, and much of this literature has tended to focus on oil importing developed economies particularly the U.S economy. Although there

are currently a large number of studies that have examined the influence of oil prices on macroeconomic variables in Nigeria (e.g see recent studies like Aliyu, 2009; Ayadi, 2006; Chukwu, 2010; Asaolu and Ilo, 2012; Coleman et al, 2011; Adebisi et al, 2009; Olomola and Adejumo, 2006, Ozsoz and Akinkunmi, 2012 e.t.c), however, only Adebisi et al (2009) and Asaolu and Ilo(2012) provide information as regards the impact of oil prices on stock prices in Nigeria. Consequently, this study intends to fill this gap.

As observed by Ramos and Vega (2010), “there is inconsistent evidence on the importance of oil prices for stock markets”. This was also noted by Killian and Park (2007), who observed that the empirical evidence of the impact on an oil price shock on stock prices is mixed as there is still no consensus on the relation. Pescatori and Mowry(2008) opine that, market commentators often assume a direct negative relationship between crude oil prices and stock market behaviour. This is because higher oil prices lead to higher production, transportation and heating cost which drags down corporate earnings, raising inflationary concerns which ultimately affects consumer’s discretionary spending. Given the above scenario, Pescatori and Mowry(2008) note that it is rational then to assume oil prices and stock markets behaviour to be negatively correlated. Similarly, Basher and Sadorsky (2006), summed up that the overall impact of rising oil prices on stock prices will be negative. They noted that since oil along with other factors of production constitute important components into the production process, then changes in the prices of these factors affect cash flows. Thus rising oil prices, according to Basher and Sadorsky (2006) can be said to increase production costs and consequently, the higher production costs reduce cash flows and reduce

stock prices. Furthermore, they noted that since rising oil prices suggest inflationary pressures which central banks control through affecting interest rates, the high interest rates make bonds look more attractive than stocks leading to a fall in stock prices.

The present study will extend understanding on the dynamic relationship between oil prices and stock market return in Nigeria by employing higher frequency and updated data as well as a large variety of estimation techniques. The investigation of such a relationship in Nigeria is interesting for several reasons. First, the relationship could be significantly different from what has been documented for other net importers and net exporters due to the peculiarities in Nigeria. An oil price shock is said to have different impacts on an economy owing to the relative position of the country being a net importer or net exporter as well its sectoral composition. Although a major oil producer, Nigeria imports almost all of its petroleum product needs from the international oil market due to its insufficient and poor managed refineries. According to the IEA, in 2009 only 0-15% of refining capacity was operational. Chukwu et al (2011) observed that Nigeria imports about 89 per cent of its refined oil thus simultaneously being in the category of oil importing economies.

Secondly a study of this nature is interesting, given the importance of oil in the production process and recent findings that high oil prices affect stock prices positively in oil exporting countries (eg. See Bjornland, 2009, Fayad and Daly, 2011), this study will promote greater understanding of the implications of oil price changes in Nigeria. Third, given the empirical evidence of the impact on an oil price shock on stock prices is mixed as there is still no consensus, a view held

by many, then a re-examination of the oil price stock market relationship in Nigeria is therefore important.

As a preview of the empirical analysis, results from the VAR and quantile regression models shows that oil price changes do not play important roles in affecting real stock returns. The balance of this chapter is organised as follows: following this introduction, section 5.2 presents the data and the econometric methodology. In section 5.3, I discuss the empirical results, while I summarize the major findings and draws conclusions in section 5.4.

5.3 Data and empirical methodology

5.3.1 Data

Data for this study are monthly for the period 1985:1 to 2011:12 and were sourced from the IMF International Financial Statistics (IFS) database and central bank of Nigeria website. Our macroeconomic variables include: the industrial production index (lipi), the real oil price expressed in local currency (lroilp), short term interest rate(lint), CPI inflation rate (inf) and real stock returns (rsr). The data were constructed as follows:

- The real stock returns (denoted rsr) is calculated as the difference between the continuously compounded return on the All share Price index of the Nigerian stock exchange and the inflation rate specified by the log difference in the consumer price index. Data for Nigeria is obtained from the 2010 annual statistical Bulletin of the central bank of Nigeria and

supplemented with central Bank of Nigeria monthly reports. All-Share Index is the market capitalization weighted index representing the performance of all eligible companies listed on the Nigerian Stock Exchange's main market.

- For the short term interest rate (denoted *rint*), the 3 months deposit rate is employed, the data for which is obtained from the IMF international financial statistics database.
- Inflation rate denoted (*inf*) is measured as the log first difference of the consumer price level calculated from the CPI series obtained from the IMF international financial statistics
- Industrial production index (denoted by *lipi*) is used as a proxy for economic activity. The series is retrieved from the central bank of Nigeria Quarterly reports. Because the series are reported at a higher frequency (i.e. quarterly) than the specified frequency of my analysis (monthly). The data is first converted to the required frequency using cubic spline interpolation method by means of EViews.
- Real oil price (denoted by *lroilp*) is defined as the nominal average monthly world crude price in US dollars transformed to National currency using the market exchange rate and then deflated with the corresponding domestic Consumer Price Index to obtain the real oil price. All data were retrieved from the IFS.

Oil price measures

In line with the literature, given the relationship between oil price and stock return could be non linear, both linear (symmetric) and the three nonlinear (asymmetric) specifications of oil prices are employed in this study. Specifically, the asymmetric specification pioneered by Mork (1989), the Scaled specification pioneered by Lee, Nee and Ratti (1995) and the Net specification pioneered by Hamilton (1996) are considered.

The Notations of different oil price measures used in this chapter expressed in national currency are as follows:

- $lroilp$: log of real oil price
- $d(lroilp)$: log difference of real oil price
- poc : positive log difference of real oil price
- noc : negative log difference of real oil price
- $sopi$: scaled oil price increase
- $nopi$: Net oil price increase

Figure 5.1 shows the evolution of both the world oil price in US dollar and the real oil price expressed in national currency for Nigeria over the period 1985:M01 to 2011:M12. In the series, the upward trend and volatility in oil prices can be observed.

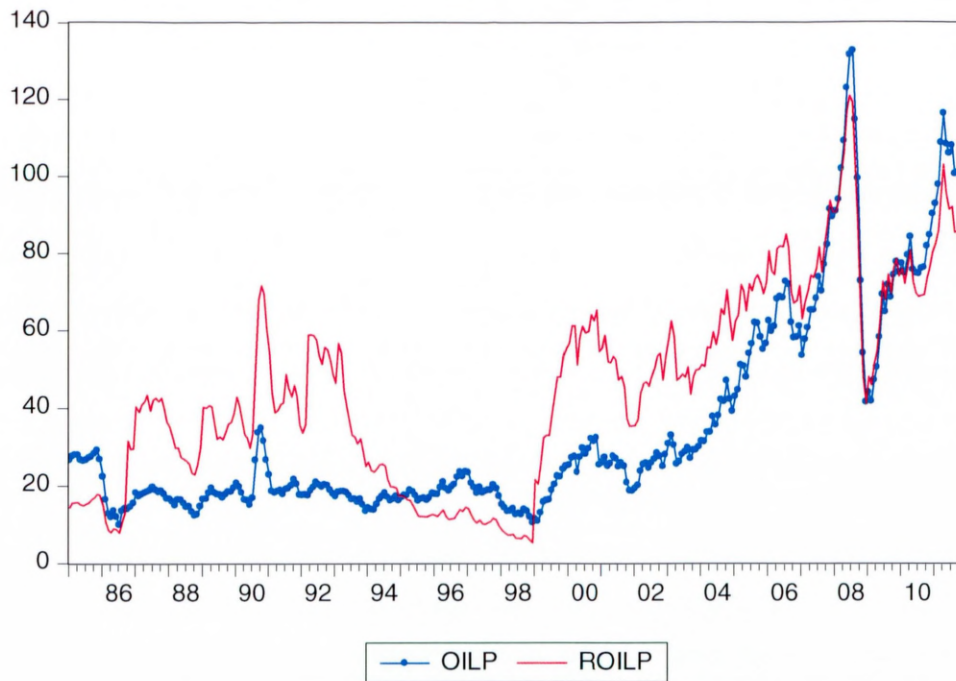


Figure 5-1: World oil prices and Real oil price changes

Following Mork (1989), the asymmetric oil price specification is chosen distinguishing between increases and decreases. Mork (1989) believed that oil price increases have a more significant effect on macroeconomic variables than oil price declines. In order to distinguish the shocks into positive and negative parts, the log levels of real oil prices is defined as $\ln oil_t$ while the monthly change of oil price (i.e first difference) is defined as Δoil_t . The proxy that considers oil price increases and oil price decreases can then be defined as:

$$POC = \max(0, \Delta oil_t), \Delta oil_t^+ : \text{oil price increases} \quad 5.1$$

$$NOC = \min(0, \Delta oil_t), \Delta oil_t^- : \text{oil price decreases} \quad 5.2$$

Figures 5.2 and 5.3 plot the asymmetric oil price shock proxies pioneered by Mork (1989) in national currency of Nigeria. Following Mork, oil price changes

are separated into positive and negative changes in a belief that the impact of oil price changes is asymmetric and therefore oil price increases have a more significant effect on macroeconomic variables than oil price decreases.

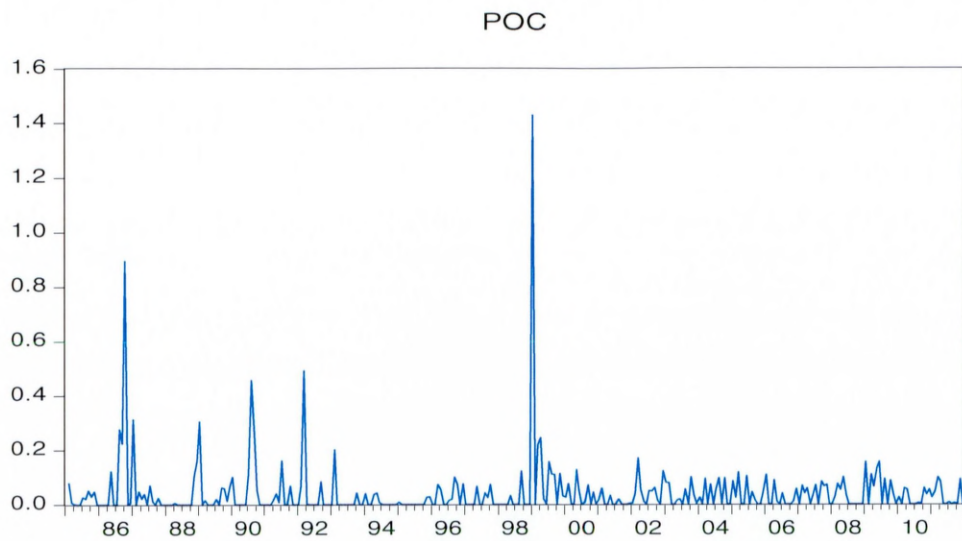


Figure 5-2: Positive oil price changes

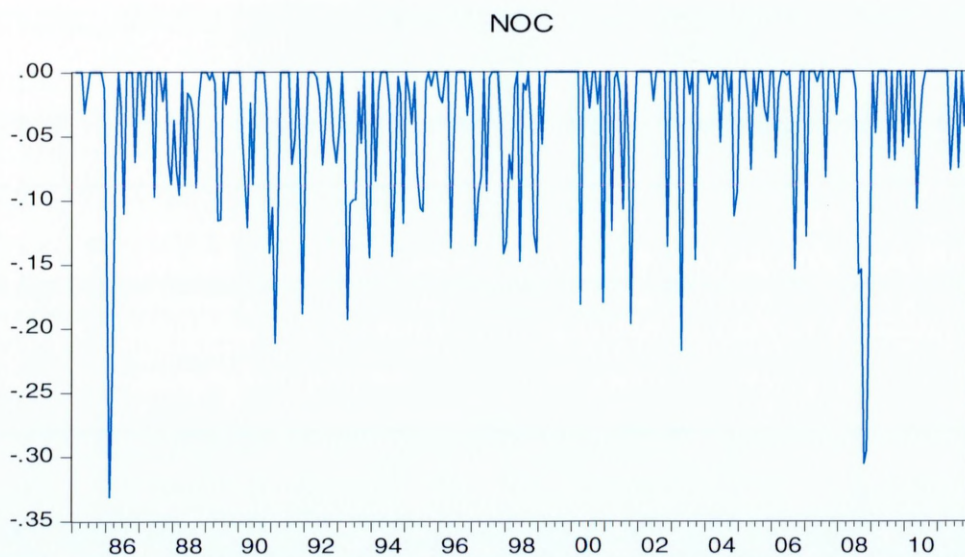


Figure 5-3: Negative oil price changes

Lee, Nee and Ratti (1995) proposed a different transformation of the oil price variable believing that oil price increases in period of high volatility was less likely to cause a decrease in economic activity. They called this specification the scaled specification (SOPI). The scaled specification employs oil price volatilities by conducting a transformation that standardizes the estimated residuals of the autoregressive model by its time varying variability. They proposed the following GARCH (1, 1) representation of oil prices:

$$O_t = \beta_0 + \beta_1 o_{t-1} + \beta_2 o_{t-2} + \beta_3 o_{t-3} + \beta_4 o_{t-4} + e_t (e_t / I_{t-1}) \approx N(0, h_t) \quad 5.3$$

$$h_t = \gamma_0 + \gamma_1 e_{t-1}^2 + \gamma_2 h_{t-1} \quad 5.4$$

$$SOPI = \max \left(0, \frac{\hat{e}_t}{\sqrt{\hat{h}_t}} \right) \qquad SOPD = \min \left(0, \frac{\hat{e}_t}{\sqrt{\hat{h}_t}} \right)$$

Where SOPI: scaled oil price increases and SOPD: scaled oil price decreases. This approach focuses on volatility believing that oil price changes in a volatile environment are more likely to be reversed and therefore the impact of an oil shock was more likely to be destabilizing in an environment where oil price has been stable. Figure 5.4 graphs the evolution of the Scaled oil price increase in national currency for Nigeria over the period 2000:01 to 2010:12.

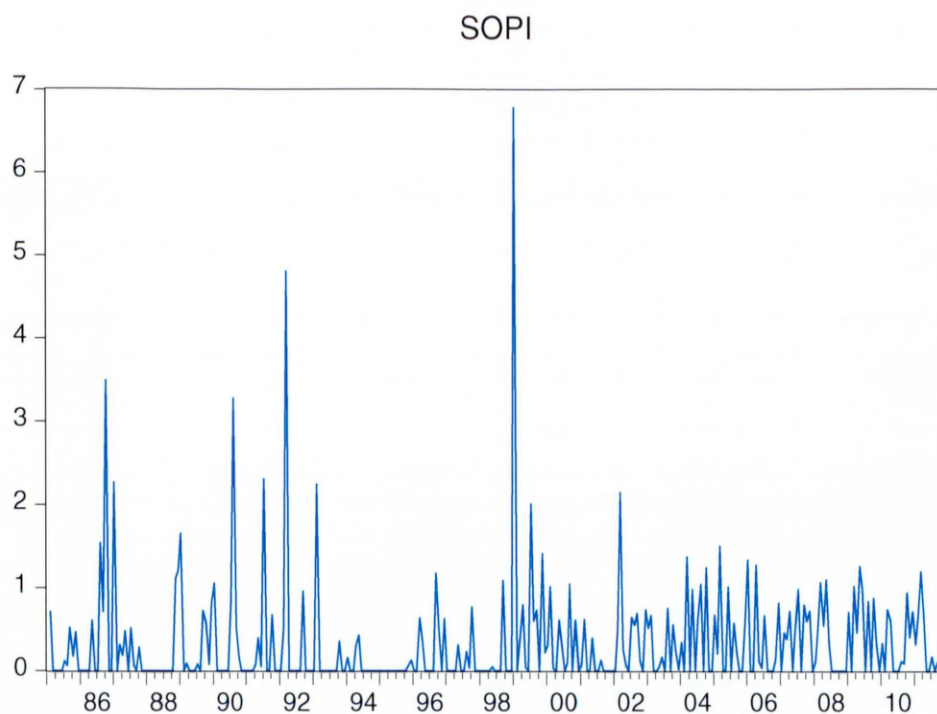


Figure 5-4: Scaled oil price increase

Hamilton (1996) proposed a different nonlinear specification he calls net oil price increase. Hamilton believed that it was more appropriate to compare oil prices with what they have been over the previous year than just the previous quarter in order to find out how unsettling the increase is likely to be to the spending decisions of firms and consumers. He proposed the net oil price increase (NOPI), defined as the percentage change over the previous year's maximum if the oil price of the current quarter exceeds the value of the preceding four quarters maximum. Symbolically the equation below describes how one can construct a net oil price increase if positive and zero otherwise.

$$NOPI_t = \max\{0, \ln(oil_t) - \ln(\max(Oil_{t-1}, \dots, oil_{t-12}))\} \quad 5.5$$

If oil prices are lower than what they have been over the previous period, no oil shock is said to have occurred. Figure 5.5 below show the evolution of net oil price increase expressed in Nigeria's national currency.

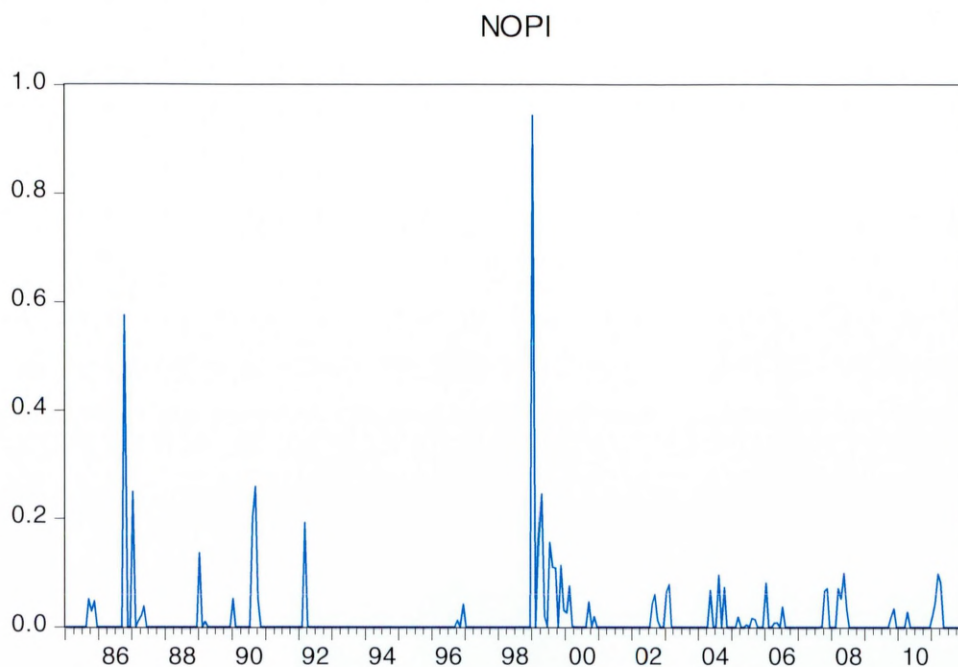


Figure 5-5: Net oil price increase

5.3.2 The Econometric Framework

The main focus of the analysis is to examine if and how oil price influence stock returns in Nigeria using a multivariate vector autoregression (VAR) and quantile regression model. The estimated VAR will demonstrate the estimated impulse response functions and variance decompositions of the VAR system. The precise interpretation of the VAR is brought to light through the estimated impulse response and variance decomposition of the VAR. While the quantile regressions

will demonstrate if the interrelationship between oil price and stock returns is different throughout the distribution of stock returns.

5.3.2.1 Unit root test

As a pre-test for the econometric analysis, the order of integration of the variables is ascertained using the Zivot and Andrew's unit root test. A well-documented weakness of conventional unit root tests is their failure to reject a unit root if a series has a structural break. Given the estimation period covers a turbulent period and thus the potential for structural break, it is important to check the data for structural breaks. Consequently, to determine the stochastic properties of the series considered in the model, the Zivot and Andrews (1992) unit root test is employed given it allows for the possible existence of a one-off structural change under the alternative hypothesis.

Zivot and Andrews (1992) based on Perron (1989) procedure proposed a test which accounts for an unknown breakpoint in the intercept, trend and both intercept and trend function and where the break point is estimated rather than fixed. The null that a series contains a unit root with a drift that excludes any structural break is tested against the alternative that a series is a trend stationary process with a onetime break occurring in the trend function and that the exact time of the break point is unknown. The three models can be written:

Model A:

$$\Delta y_t = \mu + \beta_t + \theta DU_t + \gamma DT_t + \alpha y_{t-1} + \sum_{j=1}^k c_j \Delta y_{t-j} + e_t \quad 5.6$$

Model B:

$$\Delta y_t = \mu + \beta_t + \gamma DT_t + \alpha y_{t-1} + \sum_{j=1}^k c_j \Delta y_{t-j} + e_t \quad 5.7$$

Model C:

$$\Delta y_t = \mu + \beta_t + \theta DU_t + \gamma DT_t + \alpha y_{t-1} + \sum_{j=1}^k c_j \Delta y_{t-j} + e_t \quad 5.8$$

Model A accommodates a onetime break in the intercept only, model B accommodates a one-time break in the trend only and model C, which is the least restrictive accommodates for a break in the intercept and trend. Where DU is an indicator dummy for a mean shift at each possible trend break and DT is an indicator for a mean shift in the trend. The Zivot and Andrews procedure investigates the null hypothesis $H_0: \alpha=0$, the series y_t has a unit root and excludes any structural breakpoint against alternative $H_1: \alpha > 1$ the series is a trend stationary process with one break that occurs at an unknown point in time.

5.3.2.2 VAR methodology

To assess the complexities of the dynamic connections between oil price shocks and stock market behaviour in Nigeria, an unrestricted vector autoregression (VAR) model with five variables (real stock returns, real oil price, interest rates, inflation and industrial production) is estimated. Consider a VAR of order P:

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + Bx_t + \varepsilon_t \quad 5.9$$

Where y_t is a k-vector of non-stationary I(1) endogenous variables, A_1 is a vector of deterministic variables, and x_t is a vector of innovations. The VAR may be rewritten as,

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + \varepsilon_t \quad 5.10$$

The linear specification of the VAR in (5.9) is first estimated to test the potential relationship that exists in the system. Where $Y_t = [\text{lroilp}, \text{lipi}, \text{inf}, \text{rsr}, \text{lint}]_t$. The VAR model is estimated with different lags after detecting the optimal lag structure by using the Schwarz criteria (SIC), Akaike information criteria (AIC) and Hannan-Quinn test. In addition, Granger Causality test is also carried out to see how much the change in the oil price variable or the information shocks carried by other macroeconomic variables will impact other variables in the vector or the rest of the system.

The impulse response function curves are simulated by analytic method. The orthogonalized innovations in each of the variables and the dynamic responses are identified using the generalized impulse method suggested by Pesaran and Shin, (1998). The estimated impulse response functions provide dynamic simulations showing the response of an endogenous variable over a number of subsequent periods to a given shock, while variance decompositions shows the proportion of movements in the dependent variables that are due to their own shocks and the proportion contributions of the forecast error variance of the given variable. The advantage of this method is that it does not depend on the variables orders in the VAR model. Confidence bounds of 95% are provided to judge the statistical significance of the impulse response function. The VAR model in equation 5 above is estimated for both a linear specification and the three main non linear specifications. The sample period runs for a total of $T = 324$ monthly observation from January 1985M01 to December 2011M12.

Following Hamilton(1994), the problem of non stationarity in the estimated VAR is ignored where a variable follows an I(1) process by estimating the VAR in levels, relying on standard t- and F- distribution for testing any hypothesis. As observed by Hamilton(1994) in Farzanegan(2009), even if the true model is a VAR in differences, certain functions of the parameters and hypothesis tests based on a VAR in levels have the same asymptotic distribution as would estimates based on differenced data.

5.3.2.3 Quantile regression

The Quantile regression method models the quantiles of the dependent variable given a set of conditioning variables. It is an increasingly popular method introduced by Koenker and Basset (1978) as an alternative to the ordinary least square method. The method provides estimates of the linear relationship between regressors and a specified quantile of the dependent variable. While the great majority of regression models are concerned with analyzing the conditional mean of a dependent variable, there is increasing interest in methods of modeling other aspects of the conditional distribution. Quantile regression permits a more complete description of the conditional distribution than conditional mean analysis alone. It describes how the median, or perhaps the 10th or 95th percentile of the response variable, are affected by regressor variables. Fitting the conditional median of the response variable known as the least absolute deviations (LAD) estimator is a special case of quantile regression. Moreover, since the quantile regression approach does not require strong distributional assumptions, it offers a distributionally robust method of modeling these relationships.

Focusing on the relationship between changes in real oil price and stock returns and controlling for other macroeconomic factors to keep the results robust. The linkage between real oil price and real stock returns can be described as:

$$RSR_t = c + \beta_1 D(LROILP)_t + \beta_2 D(LIPI)_t + \beta_3 D(LINT)_t + \beta_4 D(INF)_t + \varepsilon_t \quad 5.11$$

Where RSR is the real stock return, D denotes first difference, LROILP is the real oil price, LINT is the interest rate, LIPI is the industrial production index, β_i ($i=1,2,3,4$) is the estimated coefficient and ε_t is the error term.

Given that the literature considers oil prices to have asymmetric effects especially in the post 1986 period. In the next equation the asymmetric measures of oil price shocks proposed by Mork (1989) are incorporated and are symbolically described as:

$$RSR_t = c + \beta_1 POC + \beta_2 NOC_t + \beta_3 D(LIPI)_t + \beta_4 D(LINT)_t + \beta_4 D(INF)_t + \varepsilon_t \quad 5.12$$

In the next equation the influence of the net oil price increase established by Hamilton (1996) in which real oil prices exceed their maximum value over the previous year is measured. The estimated model for testing the asymmetric effect is as follows:

$$RSR_t = c + \beta_1 NOPI_t + \beta_2 D(LIPI)_t + \beta_3 D(LINT)_t + \beta_4 D(INF)_t + \varepsilon_t \quad 5.13$$

Next the influence of the scaled oil price increases established by Lee, Nee and Ratti (2001), is measured. Lee, Nee and Ratti (2001), believed that oil price changes in a volatile environment are more likely to be reversed and therefore the impact of an oil shock was more likely to be destabilizing in an environment

where oil price has been stable. The estimated model for testing the asymmetric effect is described as follows:

$$RSR_t = c + \beta_1 SOPI_t + \beta_2 D(LIPD)_t + \beta_3 D(LINT)_t + \beta_4 D(INF)_t + \varepsilon_t \quad 5.14$$

Following Lee and Zeng (2011), 9 quantiles ($\Theta = 0.1, 0.2, \dots, 0.9$) are established dividing them in to three parts: Low, Medium, and High. Following Lee and Zeng (2011) where at least two adjacent quantiles are statistically significant, then the part is said to be statistically significant.

Aside inflation and stock prices, differences are taken on the levels of the variables leading to absolute changes in the variables³¹.

5.4 Empirical results

This section presents the result of the impact of oil shocks on stock returns. The section is divided into three parts; first, the result of the time series properties of the data is discussed. Second, the main results of the VAR discussing the responses to oil price shocks are presented and then finally the result of the quantile regression is presented.

5.4.1 Time series properties of the data

Figure 5.6 below shows the Nigerian All-Share Index and world oil price. Both have increased over the last couple of years not always in the same direction, sometimes rising and falling together and the relationship between them does appear to be strong.

³¹ As observed by Brooks(2007), the choice between taking difference of the log or level form of the variable is an empirical one.

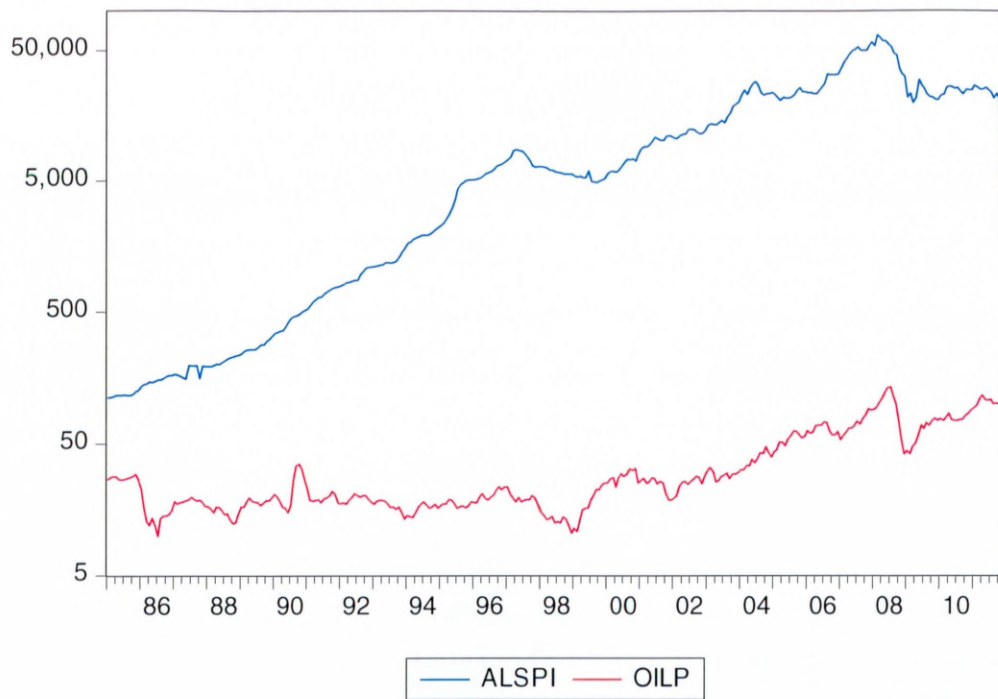


Figure 5-6: Monthly averages of the world oil price and the Nigerian all share Price index (logarithmic scaling)

The following scatter plot in figure 5.7 relates to the monthly behaviour of the world crude oil prices with the real stock return of the Nigerian stock market since the beginning 1985. If a clear negative relationship exists as market commentators often suggest, then there will be aligned along a somewhat downward sloping line indicating poorer stock performance when oil prices go up (Pescatori and Mowry, 2008). On the other hand, for an oil exporting economy if a clear positive relationship exists the scatter plot then will align along an upward sloping line indicating stronger performance as oil price rise. However no such relationship is evident in the time period in Nigeria. Furthermore, the correlation between the monthly averages of oil price and real stock returns is negative and weak, -0.03 for the 10 years.

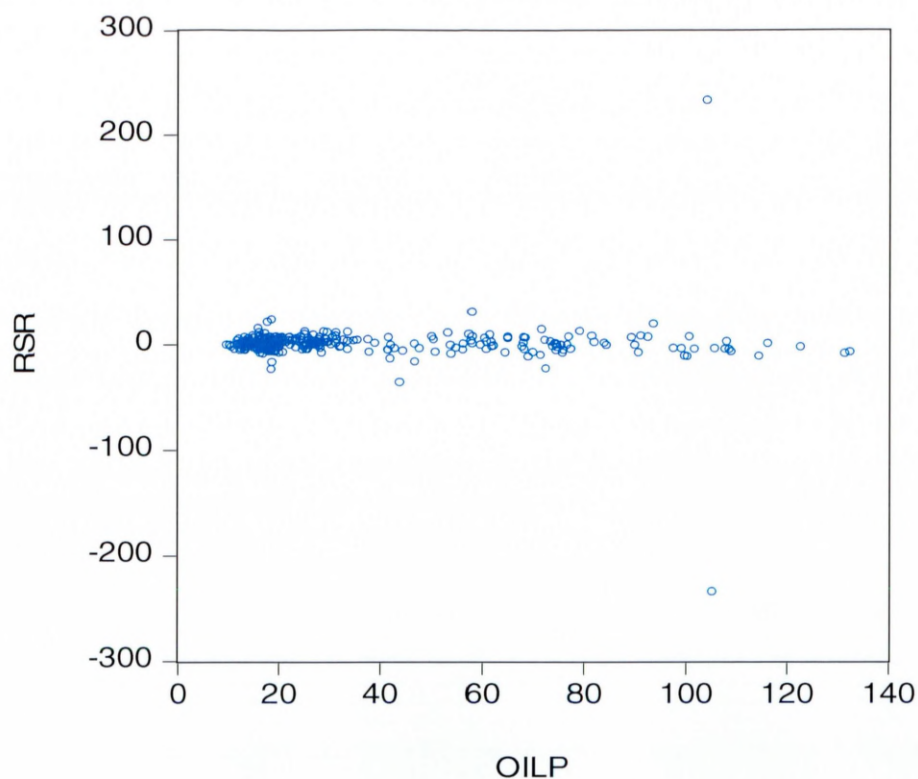


Figure 5-7: Simple Scatter plot of the monthly behaviour world oil price and ALSPI performance

Table 5-1: Zivot Andrews unit root test

Variables	T-statistics	Break date	Variables	T-statistics	Break date
<i>Levels</i>			<i>First difference</i>		
lroilp(model B)	-3.15	1996M06	roilp(model B)	-15.65*	1993M07
rsr(model C)	-7.14*	2006M06	rsr(model C)	-11.46	2006M05
lipi(model C)	-3.24	1992M05	ipi(model C)	-9.05*	1999M11
lint(model C)	-3.98	1993M10	lint(model B)	-9.19	1997M08
inf(model C)	-8.81*	1995M07	inf(model C)	-10.91*	1989M05

Note: * and ** denote significant at the 1% and 5% level. The asymptotic critical values for Zivot-Andrew model B are: -4.93(1%), -4.42(5%) and -4.11(10%); model C are: -5.57(1%), -5.08(5%) and -4.82(10%).

Table 5.1 reports the results of the Zivot and Andrews's unit root test for Nigeria taking into account endogenous structural breaks. Except for real oil price, an intercept and trend is included in the regression. An inspection of table 5.1 indicates that for all the variables in levels, only real oil price interest rate and industrial product index do not reject the null hypothesis that each series contains a unit root. However the first difference rejects the null hypothesis at the 1% level. Real stock returns, inflation and interest rate are all best described as stationary in levels. There is therefore evidence to conclude that real oil price, interest rate and industrial production index are I(1) processes.

Since some of the series contain a unit root, I therefore conduct a cointegration test to see whether these variables have a common stochastic trend. The result of the cointegration test is summarized in Table 5.2 below. To test for cointegration, the Johansen maximum likelihood approach is used employing both the maximum eigen value and trace statistic. The determination of the appropriate lag structure in the system is based on a number of information criteria³². The long run relationship between real oil price, interest rate and industrial production is examined since they contain a unit root. An inspection of Table 5.2 reveals that, both the trace test and Eigen value statistics indicates there is no long run relationship between the three macroeconomic variables under study. The null hypothesis of no cointegration is rejected at the 1% level of

³² Lag order 10 was selected for the model based on Akaike information criteria (AIC), Final predictor error (FPE) and the sequential modified LR test statistic (LR).

significance. Having verified that the variables are not cointegrated a VAR model employing all variables in levels can be applied.

Table 5-2: Johansen cointegration test

LROILP LIPI LINT

Null Hypothesis	Alternative Hypothesis	Test statistic	p-value
<i>Trace test</i>			
$r=0$	$r \leq 1$	24.09	0.19
$r=1$	$r \leq 2$	5.84	0.71
<i>Max.eigenvalue test</i>			
$r=0$	$r \leq 1$	18.24	0.12
$r=1$	$r \leq 2$	5.64	0.66

The Granger causality /block exogeneity test using chi-square (wald) statistics is used to examine if the oil price measures (linear and non linear) have a direct impact on real stock returns and other included macroeconomy variables. A variable is said to Granger cause another variable if the inclusion of past values of the former helps in prediction of the latter (Green, 2006).

Table 5-3: Granger causality/Block exogeneity

Dependent Variable	Excluded variables				
	lroilp	poc	noc	nopi	sopi
RSR	4.12[0.84]	1.96[0.98]	8.12[0.43]	3.64[0.88]	3.39 [0.90]
LIPI	4.18 [0.83]	5.57[0.69]	6.23[0.62]	6.32[0.61]	5.43[0.70]
LINT	15.34 [0.05]	15.63 [0.04]	15.85[0.04]	15.22[0.05]	15.64[0.04]
INF	6.35[0.60]	6.29 [0.61]	5.31[0.72]	6.49[0.59]	6.88[0.54]

Probabilities in []

Oil price is said to Granger-cause the dependent variable if values of oil price can provide statistically significant information about future values of the dependent variable. Results of the Granger causality test are presented in Table 5.3. Focusing on the significance of the impact of oil prices on real stock returns, it can be seen that the null hypothesis that log of oil prices; positive oil price changes; net oil price increases and scaled oil price increase do not granger cause real stock returns in Nigeria cannot be rejected implying that oil price shocks do not granger cause stock returns regardless of the benchmark used.

5.4.2 VAR approach

Here as mentioned earlier, a VAR is estimated to assess the estimated impulse response functions and variance decompositions of the VAR system. First, the impact of the oil price shocks on stock market behaviour is assumed to be linear (The linear log difference of nominal oil price was used by Hamilton, 1983). Then the three nonlinear specifications popularly used in the literature are estimated. The first stage of the analysis is to decide on the order of the VAR by examining the lag length criteria. The estimates of the VAR itself are of little interest and the analysis proceeds to examine the output in terms of the impulse responses and variance decompositions. The generalised impulse responses were calculated using the generalised method and is not sensitive to ordering of the variables.

Figure 5.8 shows the response of real stock returns, inflation rates, interest rates and industrial production resulting from a one standard deviation innovation to the linear benchmark of oil shocks (log of real oil price) for the period 1985:01 to

2011:12. While Figures 5.9 through 5.12 show the impulse response functions for a one standard deviation innovation to the three asymmetric oil price changes.

Symmetric impact of oil prices

Impulse response functions

The orthogonalized impulse responses of real stock returns from a one standard deviation shock to oil price measured by the log of real oil price for the period 1985:M01 to 2011:M12 are shown in Figure 5.8. Each orthogonalized impulse appears with 95% confidence bounds to judge the statistical significance of the impulse response function. An inspection of Figure 5.8 shows no statistical significant response of real stock returns to shocks in the linear benchmark oil shock measure. For other macroeconomic variables, the impulse response of industrial production suggests that the series reacts to a symmetric shock in real oil price by appreciating. This appreciation is statistically significant from the 10th to the 30th month. The linear oil price shock had a positive impact on short term interest rate, the effect was not however statistically significant.

For inflation rate however, an oil shock first results in a negative response up to certain periods, then positive up to certain ranging period and then positive for the remaining periods although not statistically significant. The generalised impulse responses are qualitatively dissimilar to those obtained by Adebisi et al (2009) with some important differences. Adebisi et al³³ (2009) employing a multivariate VAR over the period 1985 to 2008 observed a “significant negative

³³ Adebisi et al (2009) model was estimated with quarterly data over the period 1985:1 to 2008:4 classifying oil shocks in to three sub samples(1985-99; 2000-04;2005-08)

effect” (sic) of oil price shocks on real stock returns in Nigeria. Conversely, Asaolu and Ilo ³⁴(2012) using a multivariate cointegration (VECM) find that oil price have a negative and significant impact on stock prices over the period 1984 to 2007. The finding of this study is not consistent with these two previous studies as the “significant negative effect” of oil price shocks on real stock returns in Nigeria is not observed.

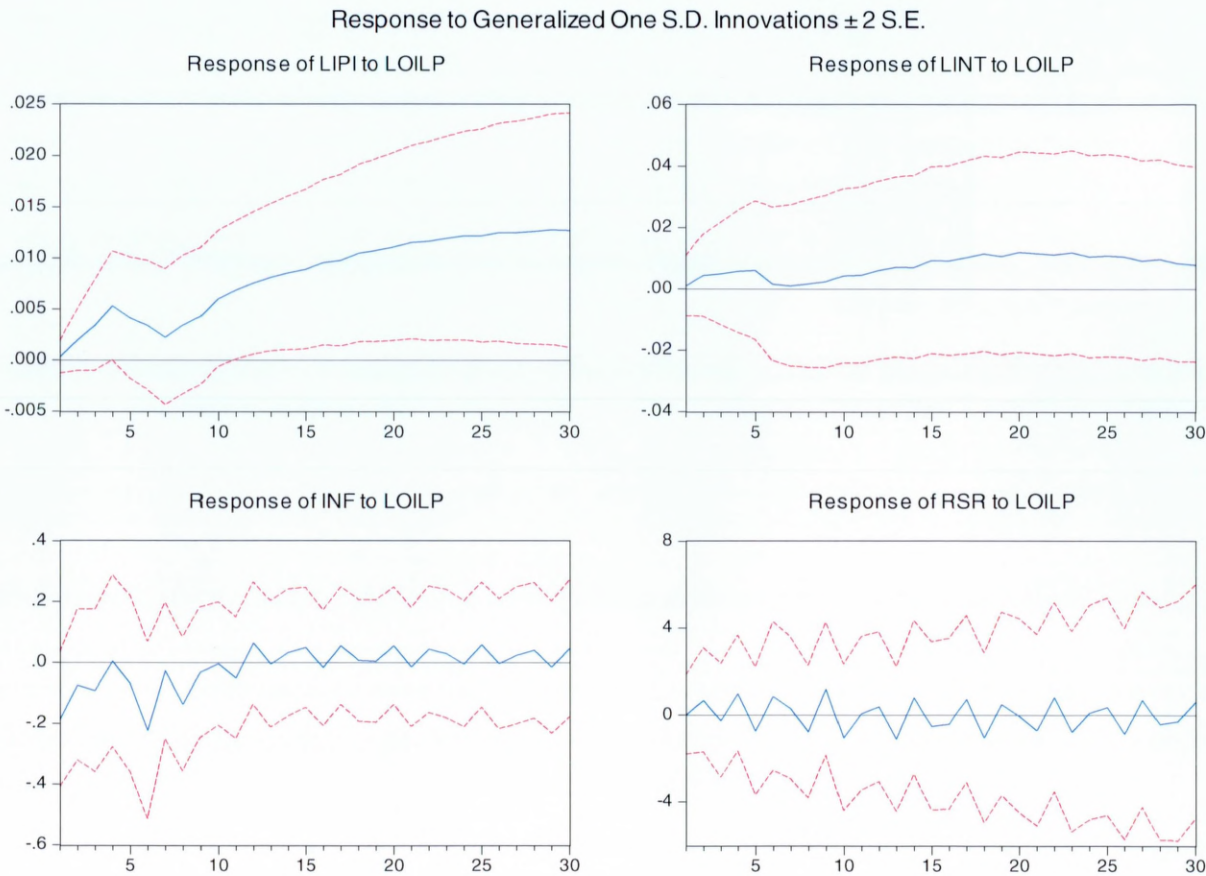


Figure 5-8: Impulse response for Iroilp

³⁴ Asaolu and Ilo (2012) model was estimated using annual data from 1985 to 2007. Secondly different from previous studies, they employ the dollar price of oil

Employing a 30 month forecasting horizon used, the forecasting error variance decomposition is also examined to determine the proportion of the movement in the time series that are due to shocks in their own series as opposed to shocks in other variables. Table 5.5 demonstrates the variance decompositions of the VAR. The estimated decompositions suggest that for real stock returns, other than stock return itself, interest rate is the major source of shock. The contribution of oil price to real stock return variability ranges between 0.00 to 0.56% over the 30 month forecast horizon. It is seen that in the first period, oil shocks contributed 0% to the variation in stock returns and this increased to 0.51% in the 15th period and further increased to 0.56% in the 30th month period. While interest rate accounts for 1.45%, 2.73% and 3.29% of variances in real stock return in the 1st, 15th and 30th month respectively. Other variables, inflation and industrial production combined account for less than 1.5% of the shock to real stock returns. This underscores the unimportance of oil prices ahead of the other macro-economic variables on real stock returns. Consistent to the findings of Adebisi et al (2009), interest rate was found to contribute more to variability in real stock returns than that of oil price.

Different from previous studies on the Nigerian economy, each stochastic process explains the preponderance of its own past values; real stock return explains over 94% of its forecast error variance, whereas industrial production explains 60% of its forecast variance. Interest rate explains over 81% of its forecast variance, whereas inflation explains nearly 55% of its forecast error variance. Oil price affects Nigeria's industrial production but not the reverse. It is also noted that real stock returns make significant contribution variability in

Nigeria's inflation rate. This is consistent with the notion by Chen, Roll, and Ross (1986), Haung, Masulis, and Stoll (1996), Cong, Wei, Jiao, and Fan (2008), and Apergis and Miller (2009) among others who argue that oil prices are not likely to affect the stock markets as they are no longer a significant source of economic fluctuation, as was suggested by Hamilton (1983).

As a net oil exporter we expect the response to a positive innovation to the oil price to have contemporaneous positive effect on real stock returns in Nigeria. Several reasons have also been put forward by a number of researchers, including Bjørnland (2009) and Lee and Chang (2011) as to why movements in oil prices should affect stock markets. They argue that oil price increases have a positive impact on stock markets in oil-exporting countries, through income and wealth effects. Since the price of an asset is determined by its expected discounted cash flows, any factor that can influence the expected discounted cash flows should have a substantial effect on asset prices. An increase in the price of oil should therefore be accompanied by a fall in stock prices because an oil price increase leads to increased cost, restraining profits and to a great extent cause a decrease in share value (Filis, 2011).

Variance decomposition

Table 5-4: Estimated Variance decomposition

Dependent variable	Period	Standard error	RSR	LIPI	LINT	INF	Lroilp
RSR	1	1.97	96.04	0.68	1.45	1.81	6.71E-05
	15	2.82	95.57	0.27	2.73	0.90	0.51
	30	3.12	94.93	0.26	3.29	0.93	0.56
LIPI	1	0.13	0.00	99.95	0.00	0.93	0.04
	15	0.55	6.89	78.90	1.89	5.19	7.11
	30	0.64	7.39	59.20	5.84	8.39	19.09
LINT	1	0.01	0.00	0.01	99.96	0.00	0.01
	15	0.08	2.95	1.35	87.72	7.56	0.39
	30	0.11	4.36	4.66	81.91	7.47	1.58
INF	1	0.08	0.00	0.31	0.00	98.78	0.90
	15	0.31	26.93	0.42	4.75	66.18	1.69
	30	0.35	38.26	0.58	5.31	54.26	1.56

5.4.3 Asymmetric impact of oil price shocks

The above analysis assumed that the relationship between oil price shocks and stock prices in Nigeria is symmetric and thus linear. On the basis of the previous literature, the impact of non-linear transformations of the real oil price on the Nigerian stock market is also considered. In the following section, focusing on the impact on real stock returns, the dynamic effects of oil price shocks are considered in terms of impulse response functions using the previous transformations of the oil price (i.e. POC, NOC, SOPI, NOPI) in order to account for the asymmetry and non linearities

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

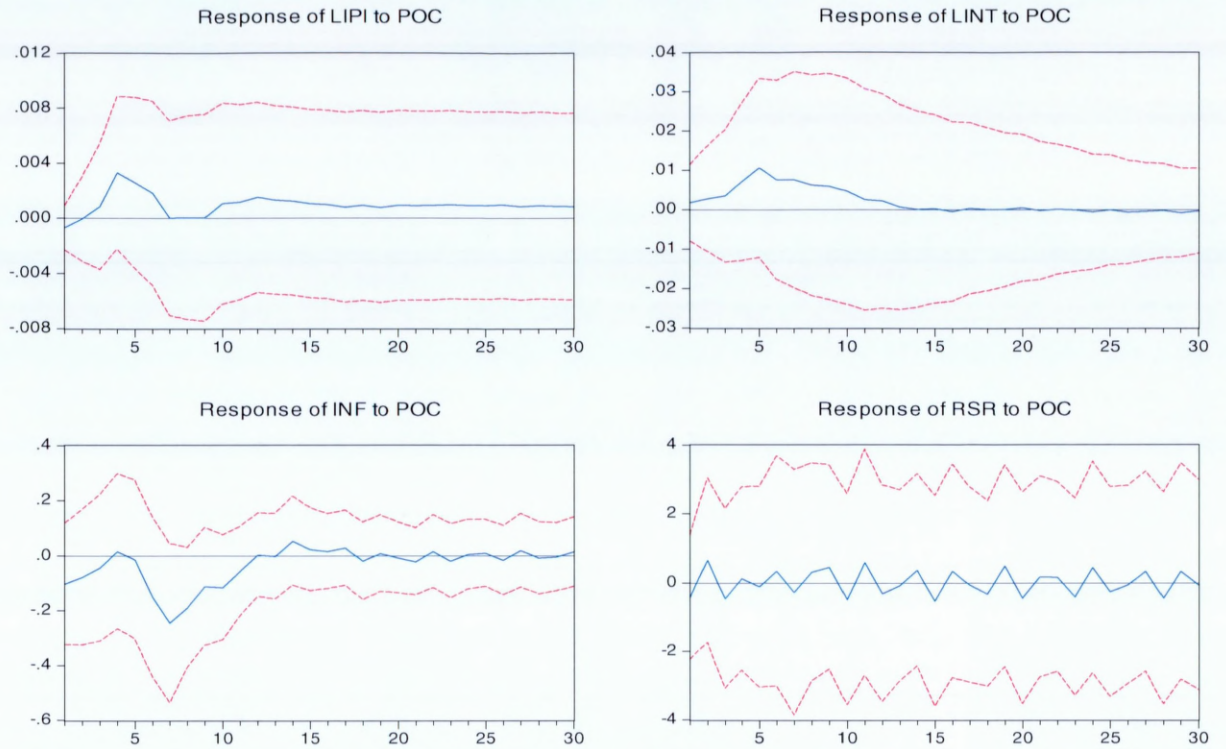


Figure 5-9: Impulse response for poc

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

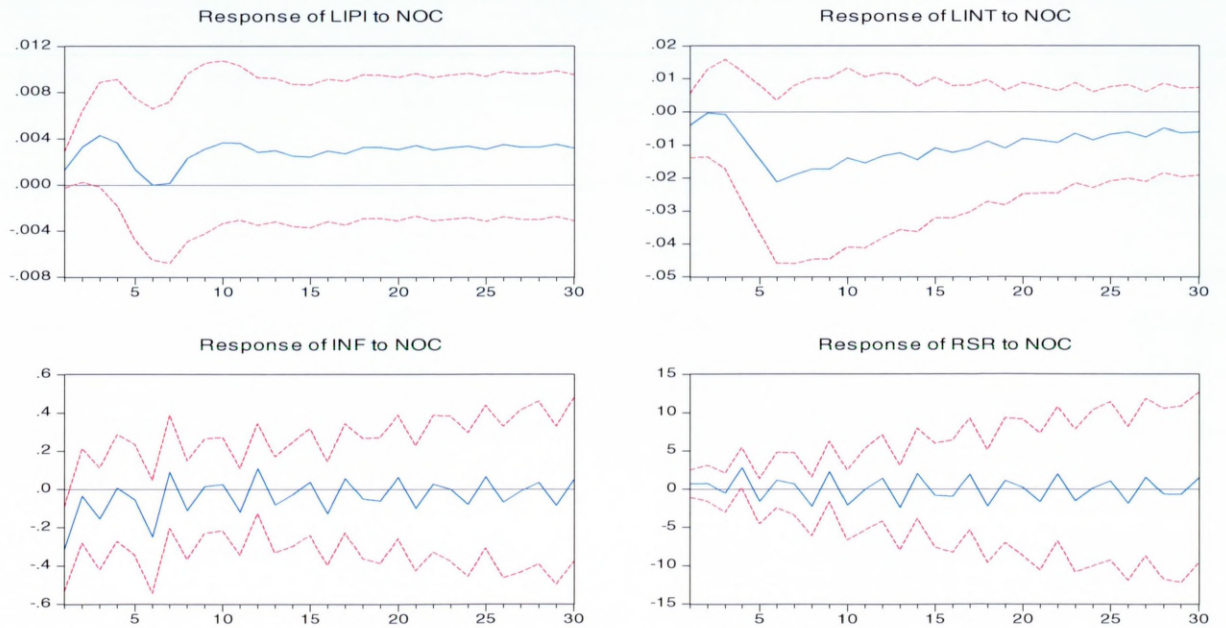


Figure 5-10: Impulse response for noc

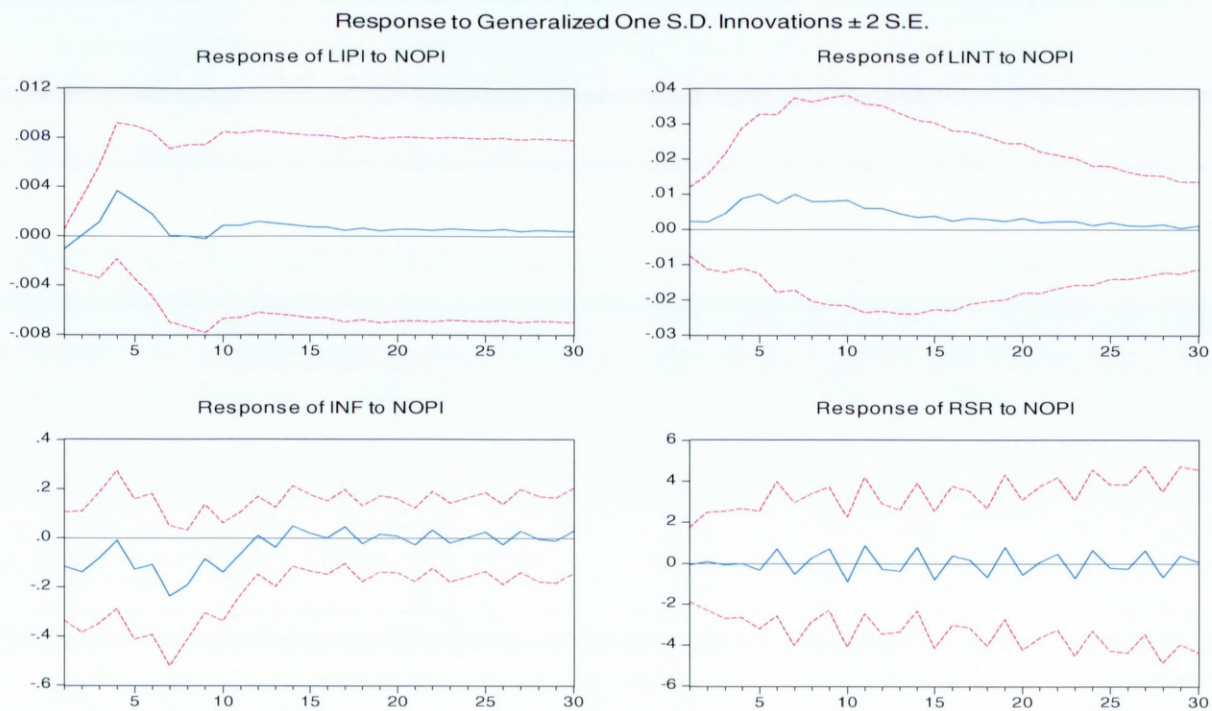


Figure 5-11: Impulse response for Nopi

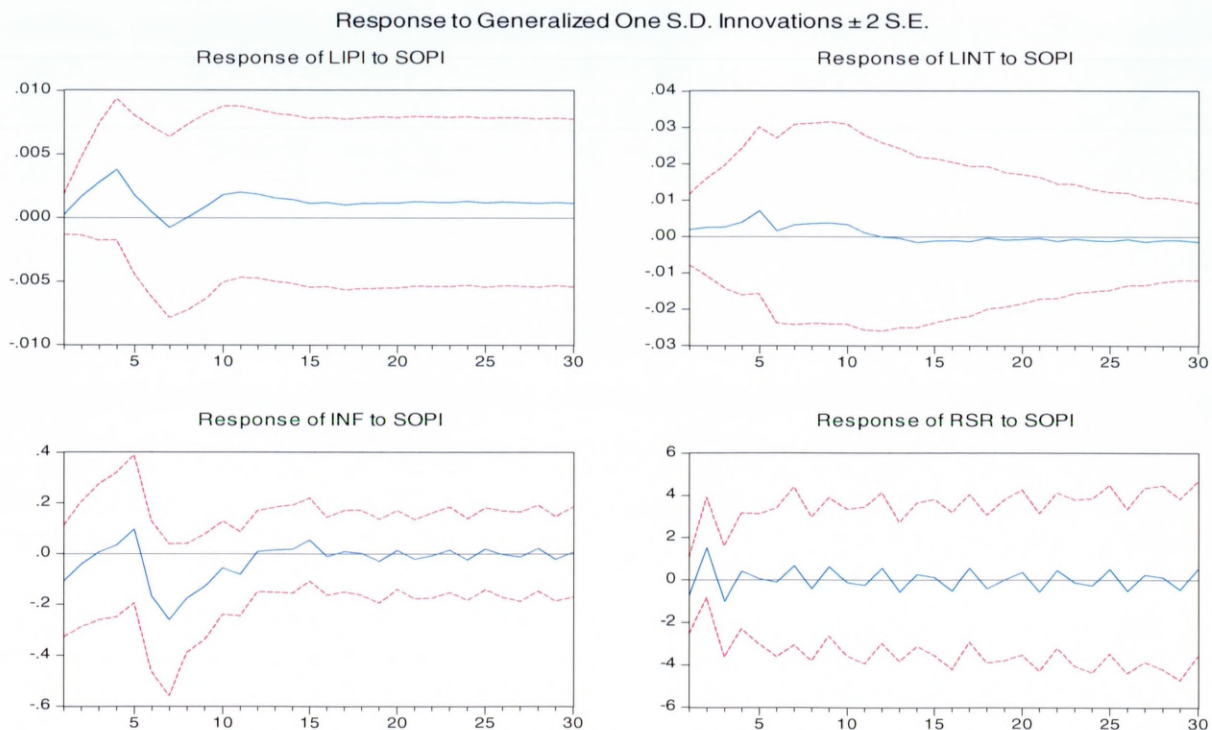


Figure 5-12: Impulse response for sopi

Figures 5.9 through 5.12 display the impulse response of each variable to a unitary shock to positive oil price changes (poc); negative oil price changes (noc); Net oil price increase (Nopi) and scaled oil price increase (Sopi) . While the linear model supposes that the impact of oil price increases and decreases are symmetric, non-linear asymmetric specifications allow for differential effects of oil shocks of the same magnitude and opposite sign (Kumar, 2009).

Again, the generalised impulse responses are qualitatively dissimilar to those obtained by Adebisi et al (2009) with many important differences. The impact of the asymmetric effect of oil price shocks on real stock returns takes us further from Adebisi et al (2009) result. Figure 5.9 demonstrates the response of macroeconomic variables to a one standard deviation shock in POC for the period 1985M01 to 2011M12. Looking at the response, it can be observed that real stock returns responded differently both positively and negatively throughout the period. This is qualitatively similar to what was obtained for the linear oil shock measure. Furthermore, common between the two measures, was their responses are all not statistically significant.

An inspection of figure 5.9 shows no significant response of oil price shock on real stock return. Industrial production and interest rate responds positively – although not statistically significant- to a positive oil price shock, the response of industrial production to real oil price is delayed for up to the third period and then gradually followed by a growing response peaking in the fifth period before declining gradually, interest rate also peaked at about the fifth period before declining and becoming negative from the 15th period throughout the remaining periods. The response of inflation rate, interest rate, industrial production and

real stock return to a positive oil shock is however not statistically significant. The positive stimulus effect of positive oil price shocks on real stock returns is not observed nor its inflationary effects. The long run increasing trend confirms the stimulus effect of positive oil price shock on Nigeria industrial production and interest rate. As expected, industrial production responds positively to positive shocks albeit not statistically significantly reaching its peak in the fifth month after the initial shock.

Figure 5.10 demonstrates the responses of real stock returns and other macroeconomic variables to negative changes in real oil prices. The response of real stock returns to a decreasing real oil price is varied and not significantly different from zero. The result is qualitatively similar to the previous results. The response of interest rate to negative oil price changes (NOC) is negative throughout the 30 month horizon.

Figure 5.11 contains the response of real stock return and other macroeconomic variables to a shock in the non-linear asymmetric benchmark measure of oil shock (NOPI). It can be seen that the response of real stock returns to a shock in NOPI shows different reactions ranging from negative to positive throughout the 30 periods after the shock to oil prices.

Figure 5.12 contains the response of real stock return and other macroeconomic variables to a shock in the non-linear asymmetric benchmark measure of oil shock (SOPI). The response of real stock returns to a shock in SOPI is, as seen previously, varying from positive to negative throughout the period. For the other macroeconomic variables, an oil price shock first results in a negative response

of inflation rate, with the response becoming positive from the second until the fifth period. It is interesting to note that stock return and other included macroeconomic variables respond in almost the same way to all the symmetric and asymmetric measures of an oil price shock. What can be deduced from the above discussion is that oil price shocks do not have a major impact on real stock returns as evidenced by the qualitatively similar and not statistically significant impulse response functions. These results are surprising as it would have been expected that an increase in oil price shocks will have a positive stimulus effect of stock returns. An explanation of this mild effect could be that oil price has never been an important factor affecting stock market behaviour in Nigeria.

Table 5-5: Estimated variance decomposition with poc in var

Dependent variable	Period	Standard error	RSR	LIPI	LINT	INF	POC
RSR	1	1.96	96.08	0.62	1.38	1.84	0.06
	15	2.82	95.98	0.21	2.77	0.86	0.15
	30	3.12	95.45	0.19	3.35	0.82	0.16
LIPI	1	0.11	0.00	99.75	0.00	0.00	0.24
	15	0.12	5.88	88.17	0.77	4.75	0.41
	30	0.13	8.13	81.91	3.64	5.99	0.30
LINT	1	0.01	0.00	0.00	99.95	0.00	0.04
	15	0.08	2.53	0.70	89.44	2.53	0.40
	30	0.11	3.53	2.30	86.15	7.67	6.29
INF	1	0.01	0.00	0.35	0.08	99.36	0.27
	15	0.01	27.29	0.51	4.65	65.38	2.15
	30	0.01	38.67	0.51	5.33	53.56	1.79

Table 5-6: Estimated variance decomposition with noc in var

Dependent variable	Period	Standard error	RSR	LIPI	LINT	INF	NOC
RSR	1	1.97	96.28	0.51	1.19	1.80	0.20
	15	2.80	93.62	0.30	2.41	1.09	2.55
	30	3.06	92.64	0.32	2.89	1.21	3.02
LIPI	1	0.87	0.00	99.12	0.00	0.00	0.87
	15	0.06	6.02	87.72	0.47	4.25	1.52
	30	0.06	8.18	81.51	3.19	5.23	1.86
LINT	1	0.01	0.00	0.01	99.75	0.00	0.22
	15	0.08	3.71	0.52	86.24	6.80	2.70
	30	0.12	4.66	2.33	82.37	7.62	3.00
INF	1	0.08	0.00	0.17	0.02	97.34	2.45
	15	0.31	25.20	0.33	4.90	66.47	3.07
	30	0.35	35.00	0.42	5.37	55.91	3.28

Table 5-7: Estimated variance decomposition with NOPI in var

Dependent variable	Period	Standard error	RSR	LIPI	LINT	INF	NOPI
RSR	1	1.96	96.19	0.58	1.39	1.81	0.00
	15	2.81	95.85	0.21	2.73	0.89	0.29
	30	3.08	95.31	0.19	3.24	0.87	0.36
LIPI	1	0.07	0.00	99.44	0.00	0.00	0.55
	15	0.08	6.15	87.90	0.72	4.79	0.42
	30	0.08	8.51	81.64	3.61	5.97	0.25
LINT	1	0.01	0.00	0.05	99.93	0.00	0.06
	15	0.08	2.74	0.78	88.56	7.26	0.65
	30	0.11	3.69	2.53	85.24	7.94	0.57
INF	1	0.08	0.00	0.35	0.00	99.29	0.34
	15	0.32	26.71	0.50	4.65	65.66	2.46
	30	0.35	37.14	0.51	5.29	54.89	2.14

Table 5-8: Estimated Variance decomposition with sopi in var

Dependent variable	Period	Standard error	RSR	LIPI	LINT	INF	SOPI
RSR	1	1.95	95.96	0.65	1.36	1.80	0.20
	15	2.83	95.79	0.24	2.74	0.85	0.35
	30	3.20	95.23	0.23	3.38	0.83	0.31
LIPI	1	0.68	0.00	99.96	0.00	0.00	0.00
	15	0.80	5.58	88.45	0.77	4.57	0.13
	30	0.91	0.04	82.24	3.65	5.85	1.40
LINT	1	0.01	0.00	7.59E-05	99.95	0.00	0.47
	15	0.08	2.65	0.69	89.54	6.95	0.13
	30	0.11	3.69	2.32	86.12	7.74	0.12
INF	1	0.08	0.00	0.21	0.00	99.47	0.30
	15	0.32	27.87	0.42	4.47	64.94	2.27
	30	0.35	41.46	0.42	5.09	51.18	1.82

To determine the proportion of the movement in time series that are due to shocks to individual series as opposed to shocks in other variables, the forecasting error variance decomposition is evaluated. Tables 5.5 through 5.8 present the results of the forecast error variance decompositions on the role of asymmetric oil price changes in explaining the future variability in real stock returns and other macroeconomic variables with a 30-month forecasting horizon used. Focusing on its impact on real stock returns, the estimated decompositions suggest that positive oil price changes explain relatively little of future variation in real stock returns in Nigeria. It can be seen that oil price shocks (POC) as measured by the non-linear bench mark contributed 0.06% to variation in real stock returns in the first period and this only marginally increased to 0.16% in the 30th period. Similarly, negative oil price shocks presented in Table 5.6, account for about 0.20% and 3.02% of the variation after the 1th and 30th periods, respectively.

Still with respect to real stock return, Net oil price increases (Nopi) do not account for a significant portion of the variation in real stock returns in Nigeria. It can be seen that only 0.36% of the variation in stock returns is accounted by NOPI in the 30th period. The variance decomposition of SOPI is also similar to NOPI such that NOPI do not account for a significant proportion of variation in stock return with NOPI accounting for between 0.20 – 1.82% over the forecast period.

An inspection of the forecast variance decomposition tables reveals that each time real stock return explains the preponderance of its own past values irrespective of the non linear model used; real stock return explain 95.45% of its forecast error variance in the POC model, whereas real stock return explains 92.64% of its forecast error variance in the NOC model. It is interesting that real stock return explains 95.31% and 95.23% in the forecast error variance of NOPI and SOPI model.

In summary, the estimates of the oil price specifications are similar. The future variations of real stock returns in Nigeria do not seem to be governed by the price of oil. From the impulse response functions, only the response of industrial production is significant for the linear model. For the forecast error variance decomposition, there was no difference in terms of result between the linear and three non linear models as oil price does not appear to be the main source of the shock. The findings of this study are consistent with recent findings of a number of closely related studies such as Adeniyi(2010) , Iwayemi and Fawowe(2010) and Akpan(2009). Similar to these studies, in this study it is observed that asymmetric oil price changes do not account for significant proportions of most

macroeconomic aggregates in Nigeria. The findings of this study contrast with those of Aliyu (2009) who found increase in oil prices benefits Nigeria's real GDP in both linear and non linear models. The empirical results support the findings of Chukwu, Effiong and Sam (2010) who found that oil price shocks were not a major determinant of macroeconomic activity from their linear model.

Unlike Imarhiagbe (2010) who found a long run relationship between oil price and stock prices in oil exporting economies of Russia and Saudi Arabia, this study does not find such a relation. This study contrasts the findings of Ramos and Veigna (2011) who observed that oil price had a positive influence on the stock market of oil exporting countries. There is no evidence that Nigeria benefits from asymmetric oil price decreases. As an oil exporting nation, heavily reliant on oil revenue, it is expected that an oil price decrease should affect Nigeria's real macroeconomic variables.

5.4.4 Quantile regression approach

In this sub section a traditional (OLS) ordinary least square and a quantile regression estimation technique is employed to analyse the influence of oil price shocks(equation 5.11) on real stock returns in Nigeria ; similarly the asymmetric effect of oil price shocks(equation 5.12) on real stock returns, the effect of net oil price increase on real stock returns(equation 5.13) and the influence of scaled oil price increase (equation 5.14) in Nigeria. The second column in Table 5.9a and 5.9b reports the results for the OLS regression while columns 3 through 11 reports the results for the quantile regression method.

The analysis is carried out over two distinct periods, first over the period 1985:01 to 2011:12 and secondly given that the financial press often posit a short term effect of oil price on the stock market, the analysis is further carried out over the period 2000:01 to 2011:12.

Table 5-9a: Quantile Regression method (1985:01 to 2011:12)

Oil Shocks	OLS	Quantile								
		Low			Median			High		
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
d(loilp)	-4.55	-0.13	0.11	-0.82	1.36	0.84	0.71	0.55	-0.49	-3.04
POC	-8.62	-0.35	-0.79	-1.11	-2.17	-1.13	-2.59	-4.44	-0.78	-3.05
NOC	7.27	10.28	11.79	10.00	8.04	8.84	7.93	3.44	1.29	2.72
SOPI	-2.35	-1.17	-0.11	-0.19	0.32	0.09	0.01	0.41	-0.10	-0.98 ^a
NOPI	-2.80	-0.20	-0.60	-1.26	-2.34	1.52	-3.62	-6.57	-6.50	-5.16 ^a

Note: The superscript a, denote significance at the 1%, level.

Table 5-9b: Quantile Regression method (2000:01 to 2011:12)

Oil Shocks	OLS	Quantile								
		Low			Median			High		
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
d(loilp)	-15.06	1.16	7.69	12.34	12.40	12.48	15.88	7.94	3.85	7.19
POC	-141 ^b	-118.8 ^a	-55.06 ^c	-22.43	-020.5	-32.6	-20.59	-15.26	-11.0	30.03
NOC	62.26	94.08 ^a	58.72	21.85	27.87 ^c	35.88 ^b	39.99 ^a	31.43 ^c	40.65 ^b	0.89
SOPI	-11.46	-4.47	-0.52	0.09	0.64	0.10	0.01	-0.85	-0.56	-0.05
NOPI	-11.4 ^b	22.52	16.68	-4.79	-18.6	-24.31	-31.68	-27.98	-47.65 ^c	-58.2 ^a

Note: The superscripts a,b, and c denote significance at the 1%, 5%, and 10% levels, respectively.

An inspection of Table 5.9a and 5.9 b indicates varying results. From Table 5.9a, it can be observed that over the period 1985M01 to 2011M12, there are no significant effects of oil price shock on real stock returns (equation 5.11) in both the traditional OLS and quantile regression. Mork's (1989) asymmetric effect of either positive or negative oil price shocks on real stock returns is further analysed in equation 5.12. As shown in the second row of Table 5.9a, the OLS estimation indicates that the effect of positive oil price shocks has a negative influence on real stock returns. The negative effect is however not statistically significantly different from zero. Despite being an oil exporting economy, positive oil price changes have a negative effect on real stock returns. Differently, the effect of negative oil price changes in Nigeria have a positive influence on real stock returns, that is to say decreasing oil prices indicating good news stimulate investors to be optimistic on future real stock returns.

The influence of the asymmetric effect of net oil price increase established by Hamilton (1996) is next measured in equation 5.13. The result shows a negative albeit not statistically significant effect on real stock returns in both the OLS and quantile regression technique. Lee et al (2001) established the scaled oil price increase believing that oil price increases in period of high volatility were less likely to cause a decrease in economic activity. An inspection of Table 5.4 shows no noticeable significant influences of the negative effect of scaled oil price on stock returns. From the above results therefore, it can be concluded that over the period 1985 to 2011, oil price shocks were not an important factor in determining stock returns in Nigeria.

Estimating the relationship over 2000:01 to 2011:12, the results are qualitatively dissimilar, as an inspection of Table 5.9b indicates varying results. For equation 5.11, there are no significant effects of oil price shock on real stock returns. Mork's (1989) asymmetric effect of either positive or negative oil price shocks on real stock returns is further analysed in equation 5.12. As shown in the second row of Table 5.9b, the OLS estimation indicates that the effect of positive oil price shocks has a negative influence on real stock returns. The negative effect is relatively large and statistically significant. Despite being an oil exporting economy, positive oil price changes have a significant negative effect on real stock returns. Differently, the effect of negative oil price changes in Nigeria has a positive although not statistically significant influence on real stock returns, that is decreasing oil prices indicating good news stimulate investors to be optimistic on future real stock returns.

The influence of the asymmetric effect of net oil price increase established by Hamilton (1996) is next measured in equation 5.13. The result shows a positive and statistically significant effect on real stock returns in the OLS. Furthermore, an inspection of Table 5.9b shows no noticeable significant influences of the negative effect of scaled oil price on stock returns over the period 2000 to 2010. Lee et al (2001) established the scaled oil price increase.

Estimating a quantile regression over the period, it can be seen that the response of either positive or negative effects of oil price shocks is related to the quantiles (i.e what performance the stock market has) as the significant negative effects of positive oil price changes are observed in the low part. Extreme low performance does not cause any noticeable influence on the linkage between negative oil price

changes and the stock markets as the significant positive effects are observed in the medium and high part. Equally, over the period 2000 to 2010, the significant negative effects of Net oil price increase is observed in the high part.

To summarize, the result of this study is not consistent with the theoretical literature on the impact of an oil price on stock market returns. From our results, the OLS and QR method show no significant evidence oil price changes on the Nigerian stock market over the period 1985 to 2011. Differently, over the period 2000 to 2011, the OLS estimates show significant evidence of the negative effect of positive oil price changes. While negative oil shocks have no significant impact on stock returns, results from the quantile regression technique indicate positive oil price changes have a significant negative effect on real stock returns despite being an oil exporting economy. The influence of the net oil price increase established by Hamilton is also statistically significant in the high part. From the result, it can be discerned that scaled oil price increase has no noticeable influence on the stock market either in the low, median or high part. The impact of oil price shocks is not related to the performance of stock returns.

5.5 Conclusions

In this section of the chapter, an empirical analysis is conducted in attempt to shed light into the dynamic relationship between oil price shocks and stock market behaviour in Nigeria. Some macroeconomy variables such as industrial production, inflation and interest rate are added. First, a multivariate VAR analysis is conducted with linear and non linear specification of oil price shocks.

The dynamic effects of oil price fluctuations is analysed in terms of impulse response and variance decomposition for a 30 month horizon. Second, an OLS and quantile regression analysis is conducted with linear and non linear specification of oil price shocks, in order to explore the relationship conditional on quantiles in the distributions of real stock returns.

The empirical evidence of the impact of oil prices on oil exporting economies is not unequivocal. There is therefore need for further empirical analysis to further untangle this relationship. The principal conclusion that can be drawn from the impulse response graphs and QR method is that only the response of industrial production is significant for the linear model (loilp). Secondly, as regards the impact of oil price on stock returns, there is no difference in terms of results between the different linear and non linear model. There is no evidence of asymmetric relation between oil price and stock returns. These results are surprising as it would have been expected that an increase in oil price shocks will have a positive stimulus effect of stock returns. Bjornland(2009) notes that higher oil prices could affect an oil exporting economy in two ways. First through positive income and wealth effects occasioned by the transfer of wealth from oil importing to oil exporting countries depending on how an economy utilises the additional income, and second through negative trade effects as a result of the oil induced recession in oil importing economies. An explanation of this mild effect could be that Nigeria's stock market is still largely immune from activities of the international oil market. As a policy recommendation Market practitioners and policy makers should take note of the positive effects of

negative of oil price shocks in building prediction models for energy and financial markets to avoid an imprecise prediction.

In conclusion, empirical findings show that:

- From the estimated impulse response functions, the responses to shocks in oil price are very small and statistically insignificant. The impact of a unitary shock to log in real oil prices (LROILP); positive oil price changes (POC); Negative oil price changes (NOC); Net oil price increase (NOPI) and Scaled oil price increase (SOPI) on real stock returns in Nigeria, demonstrate significant response.
- Furthermore, looking at the forecasting error variance decomposition, there is again little that can be seen from the variance decomposition tables. It can be observed that none of the oil price shocks has a pronounced effect on real stock. The findings of the impulse response and variance decomposition show that oil price changes have no significant role in determining real stock returns in Nigeria.
- Results from the traditional OLS and quantile regression model suggest no significant evidence of the importance of oil price for stock returns in Nigeria over the full sample period. However in recent times, over the period January 2000 to December 2011, the significant negative effect of positive oil price change (POC) and Hamilton's Net oil price increase (NOPI) can be observed. Furthermore the significant positive effect of negative oil price changes is observed. This suggests that over the period

2000 to 2011, oil price had a negative effect on real stock returns in Nigeria.

- Furthermore over the period 2000 to 2010, the asymmetric effect of oil price shocks on real stock returns is established in Nigeria.
- The effect of quantile regression indeed exists in the linkage between real stock returns and real oil prices. The study finds that the influence of either positive or negative oil price shocks is statistically significant in the high and medium part thus it can be discerned, the response of either positive or negative effects of oil price shocks is related to the quantiles (i.e what performance the stock market has).
- This study documented quite a few new facts about the influence of oil price fluctuations on the Nigerian stock markets. Over the period 1985:01 to 2011:12, results from the VAR, OLS and quantile regression show that Nigerian stock markets are not sensitive to world oil prices consistent with works by Cong et al (2008), while in recent times, over the period 2000:01 to 2011:12, results from the QR reveal the significant negative effects of oil price increase and the significant positive effect of negative oil price changes.

5.6 PART II: MODELLING THE DYNAMIC CORRELATION BETWEEN STOCK MARKET AND CRUDE OIL PRICES IN NIGERIA

In the previous part of this chapter, the impact of oil price shocks on stock market behaviour in Nigeria was examined. This present part extends the previous analysis by investigating the dynamic correlation relationship between international crude oil prices and the Nigerian stock market. The motivation originates from the simple observation of the importance of oil prices to the Nigerian economy³⁵. As observed by Choi and Hammoudeh (2010), investors, traders, portfolio managers, oil exporting economies, monetary authorities and other policy makers are always keen to understand the dynamic correlations between oil prices and stock markets. Furthermore policy makers and monetary authorities may be interested in understanding the duration of oil or stock volatilities in order to assess its impact on the economy as well as to determine the appropriate monetary responses (Choi and Hammoudeh, 2010).

In theory, an oil price increase affects the economy of an oil importing economy by increasing the cost of running a business consequently diminishing profits and cash flow margins which are the key drivers of stock prices (Ramos and Veiga, 2011). For an oil exporting economy, an oil price increase is expected to have a

³⁵ It would be interesting and useful to understand its dynamic correlation with the financial markets and determine whether and when correlations between two increase or decrease, and whether and when it gets stronger or weaker over time. By paying attention to both volatility within oil prices and the Nigerian stock exchange and the changing nature of the relationship between them, this should lead to more comprehensive understanding on what the relationship has been over recent period where oil price has become increasingly volatile.

positive effect as a result of increase in income with the stock market responding positively in the same direction (Bjørnland, 2009, Jiménez-Rodríguez and Sanchez, 2004).

Nigeria is a oil-rich nation with, as of January 2011, an estimated 37.2 billion barrels of proven oil reserves - approximately 32 percent of Africa's total - producing about 2.46 million barrels per day. Coming to the stock market, Nigeria has the largest stock market in sub Saharan Africa. Although small by international standard, during its peak in 2007, the Nigerian stock market had a total market capitalisation of about N15 trillion (\$125 billion) and about 283 listed companies, making the Exchange one of the most active during this period.

The present study differs from previous studies examining the dynamic correlation between oil price and the financial markets. Previous studies have focused on mainly oil importing and exporting industrialised economies, while this focus is appropriate given the small nature and lack of internationalisation of stock markets of middle income and developing economies, it leaves the question how do stock markets of low income oil exporting developing economies correlate to oil price changes. To answer this question, the present paper exclusively investigates the dynamic correlation between oil price and stock markets in Nigeria. By employing a dynamic conditional correlation (DCC), the contemporaneous time varying correlation between the Nigerian stock market and oil prices is estimated.

The DCC has its origins from multivariate GARCH modelling (M-GARCH) and have been found very useful in studying volatility spillovers in equity markets

(Sadorsky, 2012). The DCC simplifies and accounts for volatility and adequately tackles the two issues of time varying relationship and volatility. The DCC is useful to answer whether volatility in a market leads to volatility in other markets and to find out whether correlations among markets change over time. As noted by Filis et al (2011), “there are however only a few studies on the dynamic correlation between Stock markets and oil prices”. To my knowledge, this is the first study to examine the dynamic correlation between the Nigerian stock market and oil prices using a DCC-I-GARCH(1,1) model. Thus the present chapter will significantly add to the existing and growing literature on the Nigerian economy.

As a preview of the empirical results, the dynamic correlation findings reveal several notable positive and negative correlations between the Nigerian stock market and oil prices over the period. While the Nigerian stock market does not always move in the same direction with oil price, correlations between the two increase and decrease over time. The balance of the chapter is set as follows: following this introduction section 5.7 introduces the data and the proposed model of the dynamic conditional correlation model. Section 5.8 presents the empirical evidence and finally ends, in Section 5.9, with summary and conclusions.

5.7 Data and methodology

This section presents the data and methodological issues concerning the dynamic conditional correlation, detailing the intuition, motivation and estimation procedures employed.

5.7.1 Data

The data used for this study include monthly data for the Nigerian All Share stock market index denoted (Y_{1t}) and oil prices (denoted Y_{2t}). The sample period for the data set covers January, 2000 to December, 2010. The All Share Index is the only index maintained by the Nigerian stock market and includes all shares. The data for which is available from the Central Bank of Nigeria website. Regarding oil price, the average price of crude petroleum is employed and was obtained from the IMF International Financial Statistics data base. The data range is influenced by availability.

Figure 5.13 plots the raw data of world average oil prices over time while Figure 5.14 plots the raw data of the Nigerian stock market All Share Index over time. Primarily it can be observed that oil prices and the All share price index tend to move and swing at the same direction with oil prices during the entire sample period. The dramatic rise and subsequent sharp crash in crude oil prices during the 2008 price shock is reflected on the Nigerian all Share Price index. The main events that took place in the period 2000 to 2010 are presented in Table 5.10

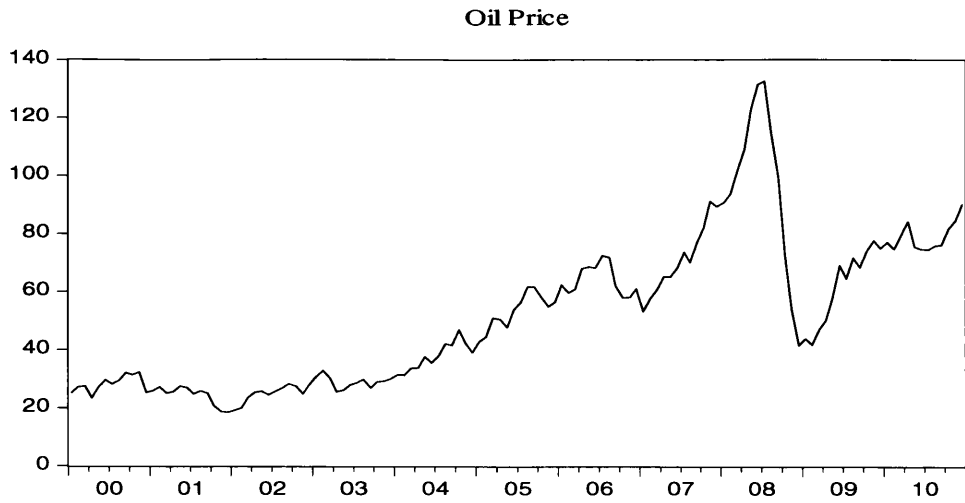


Figure 5-13: showing original series of oil price (oilp) during the period January 2000 to December 2010.

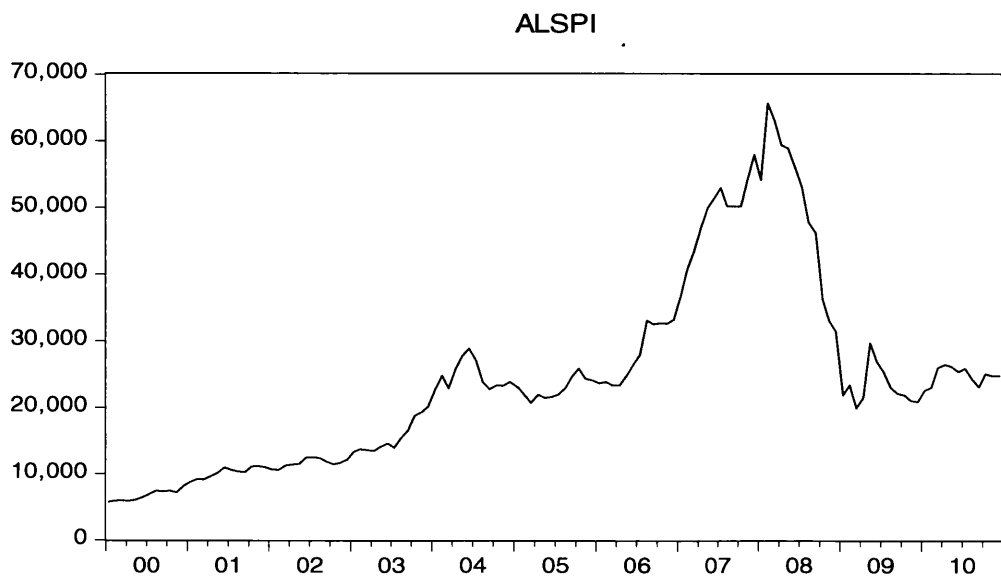


Figure 5-14: Original series of the Nigerian stock market index(ALSPI) during the period Jan 2000 to Dec 2010.

Table 5.10: The main events that took place in the period 2000 -2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
January		OPEC decides to cut quotas by 1.5mbpd	OPEC production cut goes into effect	OPEC decides to raise production by about 6.5%	OPEC decides to cut quotas at various meetings	Royal Dutch/Shell resumes 1114,000 bbl/d after it had declared force majeure in December over a dispute in south eastern Nigeria			Rising demand; low spare capacity	OPEC decreases target 4.2 million	
February							Militant attacks in Nigeria shut down morethan 600,000 bbl/d of oil production	OPEC implements a 500,000 barrel per day cut		Oil Price rise supported by rising demand in Asia and OPEC cut	
March	OPEC oil ministers agree on an increase in oil production of 1.45 million b/pd	OPEC decides to cut production by 1mbpd to prevent a price collapse		War in Iraq and outbreak of violence between soldiers and Niger delta militants in Nigeria	OPEC decides to cut quotas putting downward pressure on oil prices			Shell shuts in 187,000 barrels per day of crude production in Nigeria			

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
April			Venezuelan Pdvsa workers stay at home					Elections in Nigeria and threat of possible unrest pushes world oil prices			
May								Estimated shutin for Nigeria of about 750,000 barrels per day as a result of series of supply disruptions			
June	OPEC oil ministers agree on an increase in oil production										
July					OPEC agrees to raise production to moderate high prices		Nigeria had at least 718,000 of its over 2 million bbl/d capacity of crude output shut in owing to attacks on oil infrastructure by militants		oil price continues to soar, spare capacity was low and extremely strong speculation		

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
August						Hurricane Katrina, Dennis and Rita strike					
September		9/11 attacks			Hurricane Ivan strikes in the Gulf of Mexico				Hurricane Gustav strikes		
October						A two day strike by workers at Nigerian Brass river crude export terminal					
November	OPEC puts away any production increases on hold			OPEC decides to cut quotas at various meetings due to lower prices							
December	Oil prices fell sharply during the month down 1/3 from Oct highs	OPEC decides to cut production by 1.5mbpd for a period of six months	PdVSA workers Strike in Venezuela; Iraq war worries		300 unarmed Nigerian villagers shut 100,000 bbl/d production for a week	Royal Dutch/Shell declares force majeure two crude oil pipeline bombing in Nigeria	615,000 bbl/d of Nigerian crude oil production stays shut in		OPEC decides to cut quota, oil price crash in the face of recession		

Source: <http://www.eia.gov/cabs/aomc/0009.html> http://www.wtrg.com/oil_graphs/oilprice0711.gif

For each data series, continuously compounded monthly returns are calculated as $\ln(y_t/y_{t-1})$ where y_t is the monthly all share price index and oil price. The time series graphs of the returns of the two series are depicted in Figures 5.15 and 5.16. An understanding of their movement and comovement is however incomplete without understanding the dynamics of their variances as well as their means(see Lebo and Box- Steffensmeier,2008). An analysis and distinction of the relationship and comovement will therefore be based on the analysis of the estimated DCC-IGARCH.

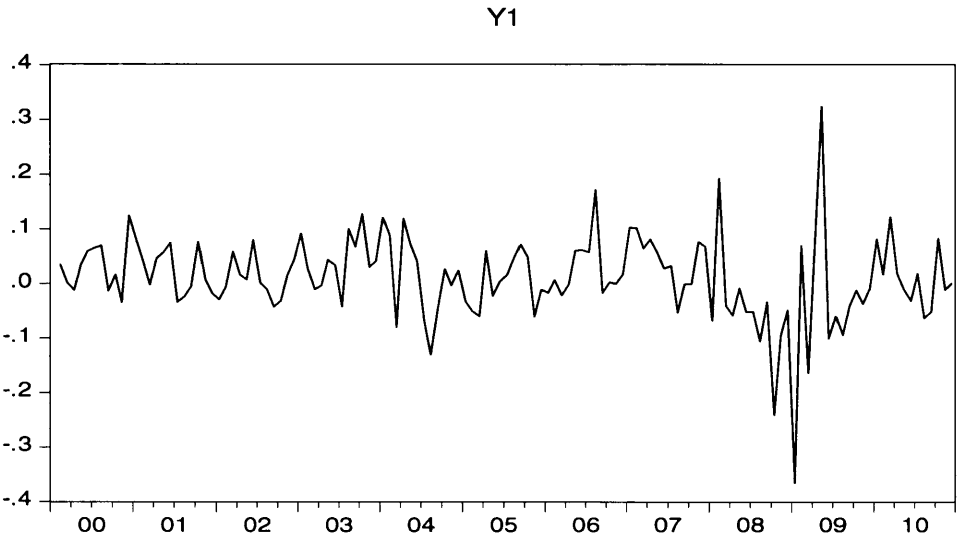
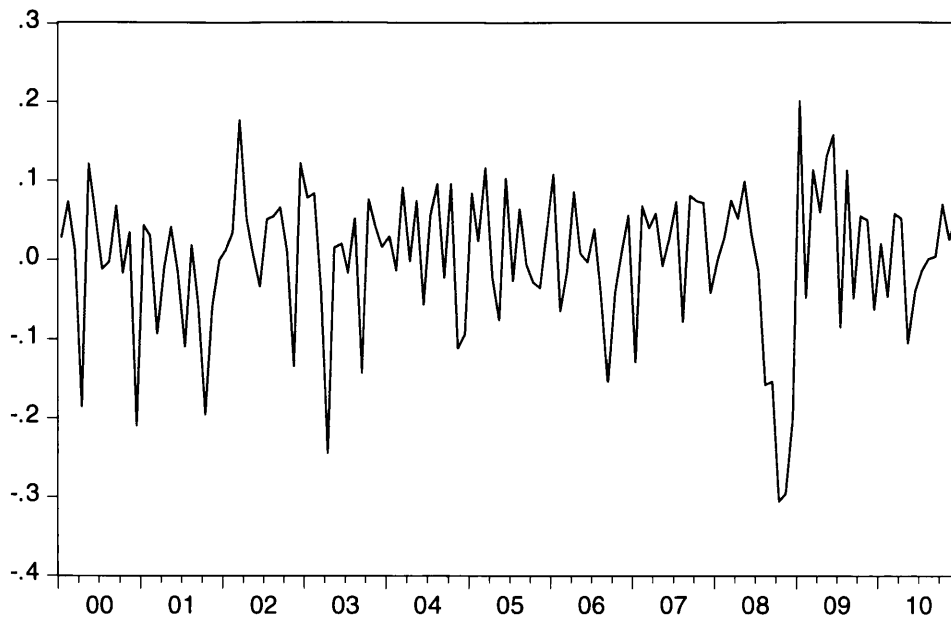


Figure 5-15: showing return series of oil price (oilp) during the period January 2000 to December 2010.

Y2



**Figure 5-16: Return series of the Nigerian stock market index(ALSPI) during the period
Jan 2000 to Dec 2010.**

Table 5.11 shows descriptive statistics for each return series. For each series the mean and median values are close to zero. The standard deviation of each series is also larger than their mean values. Oil price return is slightly more volatile than stock returns. Both series show significant skewness and leptokurtosis. The larger amount of kurtosis in excess of 3 implies that extreme movements with greater frequency in practice than would have been predicted by a normally distributed return. The correlation of stock returns and oil prices in Nigeria are illustrated in Table 5.12. The correlation result shows a positive correlation between the returns.

Table 5-9: Summary statistics for stock market return and oil price return

	Y1	Y2
Mean	0.011145	0.00972
Median	0.006885	0.028104
Maximum	0.323516	0.173823
Minimum	-0.365883	-0.311841
Std. Dev.	0.076962	0.090139
Skewness	-0.568705	-1.158285
Kurtosis	8.667447	4.748443
Jarque-Bera	182.3829	45.97854
Probability	0.00	0.00

Table 5-10: Constant correlation estimates

	Y1	Y2
Y1	1	0.138418
Y2	0.138418	1

The Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test is used to check the stationarity of the return series of the Nigerian All share price index (y_{1t}) and oil price (y_{2t}). The results of the ADF and PP test (Table 5.13) show that all variables are stationary at levels and integrated to order zero denoted $I(0)$.

Table 5-11: Augmented Dickey Fuller test and Phillip Perron

Variables	ADF		PP	
	(i)	(ii)	(i)	(ii)
y_{1t}	-9.77*	-10.03*	-9.75*	-10.07*
y_{2t}	-9.75	-9.71	-63.78	-63.54

Note : * indicates statistically significant at 1%

5.7.2 Methodology

A bivariate DCC-IGARCH model is estimated to investigate the relationship between oil price and stock markets in Nigeria. The DCC was first suggested by Engle (2002), the method benefits from a number of advantages over simple contemporaneous correlation analysis for modelling correlations. The DCC is parsimonious compared to other multi-variate GARCH models. The DCC is a time varying parameter model which can inform how effects are different across time. The DCC achieves this by calculating a current correlation between variables of interest as a function of past realisations of both the correlations between them and the volatility within the variables (Lebo and Box-Steffensmeier, 2008).

Engle (2002) starts from the same decomposition of the variance –covariance matrix proposed by Bollerslev (1990) for the Constant conditional correlation (CCC) model but he removes the hypothesis of constant correlations through time. Engle extends the CCC model by allowing the conditional correlation to be time varying. A DCC is most useful when there is a long time series, when there

is variation in volatility and when the basic model structure is not of interest (Lebo and Box-Steffensmeier, 2008). The number of estimated parameters is lower than traditional MGARCH and therefore results interpretation is simpler (Urga, 2011).

Filis et al (2011) provide guidance on how the model is implemented:

Consider the following model where the $(n \times 1)$ vector of $\{y_t\}$ refers to the multivariate stochastic process to be estimated. Where $n=2$ and $y_t = (y_{1,t}, y_{2,t})$ and where $y_{1,t}$ denotes the stock index log returns and $y_{2,t}$ denotes the log returns of the oil price. The innovation process of the conditional mean $\varepsilon_t \equiv y_t - \mu_t$ has an $(n \times n)$ conditional covariance matrix $V_{t-1}(y_t) \equiv H_t$:

$$\begin{aligned}
 y_t &= \mu_t + \varepsilon \\
 \varepsilon_t &= H_t^{1/2} z_t \\
 z_t &\approx f(z_t; 0, I, \nu) \\
 H_t &= \sigma(H_{t-1}, \dots, H_{t-2}, \dots, \varepsilon_{t-1}, \varepsilon_{t-2}, \dots)
 \end{aligned}
 \tag{5.15}$$

Where $E_{t-1}(y_t) \equiv \mu_t$ denotes the mean of y_t conditional the available information at time $t-1$. I_{t-1} , Z_t is an $(n \times 1)$ vector process such that $E(Z_t)=0$ and $E(Z_t Z_t')=1$. $f(z_t; 0, I, \nu)$ denotes the multivariate standardized Student-t density function:

$$f(z_t; 0, I, \nu) = \frac{\Gamma((\nu + n)/2)}{\Gamma(\nu/2)(\pi(\nu - 2))^{n/2}} \left(1 + \frac{z_t' z_t}{\nu - 2} \right)^{-\frac{\nu + n}{2}}
 \tag{5.16}$$

Where $\Gamma(\cdot)$ is the gamma function and v is the degree of freedoms to be estimated, for $v > 2$. The multivariate student-t distribution was first proposed in the estimation of multivariate ARCH models by Harvey, Ruiz, and Sentana (1992) and Fiorentini, Sentana, and Calzolari (2003). Where $\sigma(\cdot)$ is a positive measurable function of the lagged conditional covariance matrices (moreover, it requires the estimation of less number of parameters than other multivariate GARCH models). It assumes that the covariance can be decomposed such as:

$$H_t = \sum_t^{1/2} C \sum_t^{1/2}, \quad 5.17$$

Where $\sum_t^{1/2}$ is the diagonal matrix with the conditional standard deviations along the diagonal, i.e.:

$$\sum_t^{1/2} = \text{diag}(\sigma_{1,t}, \sigma_{2,t}, \dots, \sigma_{n,t}), \quad 5.18$$

And C_t is the matrix of conditional correlations. The model is estimated in two steps with the conditional variance-covariance matrix and conditional correlation matrix are estimated separately. In the first step, a GARCH model for the variance is estimated, the conditional variances, $\sigma_{i,t}^2$, for the $i=1, \dots, n$ assets, are estimated as Integrated GARCH (IGARCH) model. The Integrated GARCH (IGARCH) model is a special case of the GARCH (1, 1) model which arises by the presence of a unit root in the autoregressive dynamic for squared residuals. This happens when $\alpha + \beta = 1$. The IGARCH (1,1) formulation is:

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + (1 - \alpha) h_{t-1} \quad 5.19$$

This IGARCH model is also known as the Exponentially Weighted Moving Average model and the standard riskmetrics model where the variance is interpreted as a weighted average of all past squared returns with the weights declining exponentially. One limitation of the model as noted by Nelson(1990) is that even though the model is strictly stationary the variance in the stationary distribution does not exist (not covariance stationary).

In the second step, given results obtained in the first step, using the residuals resulting for the first stage that is, the correlation matrix(conditional correlation) is estimated. The time varying correlation matrix has the form:

$$C_t = Q_t^{*-1/2} Q_t Q_t^{*-1/2} \quad 5.20$$

The correlation matrix $Q_t = (q_{i,j,t})$, is computed using

$$Q_t = (1 - a - b) \bar{Q} + a(z_{t-1} z'_{t-1}) + b Q_{t-1}, \quad 5.21$$

Where z_t are the residuals standardized by their conditional standard deviation, i.e. $z_t = (z_{1,t}, z_{2,t}, \dots, z_{n,t})' = (\varepsilon_{1,t} \sigma_{1,t}^{-1}, \varepsilon_{2,t} \sigma_{2,t}^{-1}, \dots, \varepsilon_{n,t} \sigma_{n,t}^{-1})'$, \bar{Q} is the unconditional covariance of the standardized residuals and $Q_t^{*-1/2}$ is a diagonal matrix composed of the square roots of the inverse of the diagonal element Q_t , i.e. $Q_t^{*-1/2} = \text{diag}(q_{1,1,t}^{-1/2}, q_{2,2,t}^{-1/2}, \dots, q_{n,n,t}^{-1/2})$ see Xekalaki and Degiannakis(2010) and Filis et al(2011) for more technical information and detailed presentation about the estimation model.

If the DCC estimates $\alpha + \beta = 0$ then the constant correlation model is sufficient. The parameter α gives the lingering effect of standardized residuals in the previous period while β tells us the memory of the correlations.

To provide adequacy of the DCC-IGARCH(1,1) model a number of specification test of the model is carried out. First to verify the necessity of introducing a dynamic for conditional correlations and thus move from conditional correlation model to a dynamic model, the significance of coefficients α and β for the Engle model is tested with the Tse proposed test with the following hypothesis.

$$H_0 : h_{ij,t} = p_{ij} \sqrt{h_{ii,t} h_{jj,t}} \quad vs \quad H_1 : h_{ij,t} = p_{ij,t} \sqrt{h_{ii,t} h_{jj,t}} \quad 5.22$$

This is a LM type test which under H_0 is distributed like a

$$\chi^2(N(N-1)/2) \quad 5.23$$

Engle and Sheppard alternatively propose a different test with the following hypothesis:

$$\begin{aligned} H_0 : R_t &= \bar{R} \quad \forall_t \\ H_1 : vech(R_t) &= vech(\bar{R}) + \beta_1 vech(R_{t-1}) + \dots + \beta_q vech(R_{t-q}) \end{aligned} \quad 5.24$$

Second, the Hoskin's Portmanteau test is used to verify the absence of serial autocorrelations in the standardized or squared residuals of the DCC model.

Urga(2011) presents the test as:

$$HM(m) = T^2 \sum_{j=1}^m (T-j)^{-1r} [C_{yt}^{-1}(0) C_{yt}(j) C_{yt1}^{-1}(0) C'_{yt}] \quad 5.25$$

Where y_t is the variable to be tested for presence of serial autocorrelation; $C_{yt}(j)$ is the sample covariance matrix and the null H_0 : absence of serial autocorrelation with the test asymptotically distributed as:

$$\chi^2_{N^2M} \quad 5.26$$

The Li and McLeod test is another specification test used to verify the absence of serial autocorrelations in the residuals. The test is presented by Urga(2011) as:

$$Q_m^* = Q_m + \frac{k^2 m(m+1)}{2n} \quad 5.27$$

Where m is number of lags

$$K=N. \quad 5.28$$

The test statistics is asymptotically distributed as

$$\chi^2_{(k^2(m-(p+q)))} \quad 5.29$$

5.8 Empirical analysis

This section presents the empirical results obtained from estimating a DCC-I-GARCH obtained from equation 5.19. Table 5.12 shows the estimation results for the DCC-I-GARCH (1, 1) model. A number of results stand out, first Table 5.12 shows that some of the parameters of the DCC model estimated are significantly different from zero.

Table 5-12: DCC IGARCH(1,1) model estimation results

	Coefficient	Stand. err.	t-value	t-prob
Y1				
Cst(M)	0.020775	0.0047178	4.403	0.0000*
Cst(V)	0.000376	0.00018081	2.082	0.0393**
ARCH(Alpha1)	0.364957	0.080010	4.561	0.0000*
GARCH(Beta1)	0.635043			
Y2				
Cst(M)	0.002081	0.0072537	0.2869	0.7747
Cst(V)	0.000431	0.00034520	1.248	0.2142
ARCH(Alpha1)	0.219946	0.088814	2.476	0.0146**
GARCH(Beta1)	0.780054			
STEP2				
rho_21	0.040044	0.10617	0.3772	0.7067
alpha	0.070709	0.091941	0.7691	0.4433
beta	0.204012	0.18198	1.121	0.2644
df	7.704325	2.5517	3.019	0.0031*
DIAGNOSTICS				
TSE LM test for constant correlation			5.49(0.01)*	
Engle and Sheppard test (5)			7.45(0.28)	
Hoskings Portmanteau Statistics(5)			15.19(0.76)	
Li-McLeod(5)			15.32(0.75)	

*** p< 0.01, ** P<.05, * p < .001

Second, there was a high degree of persistence in the conditional volatilities and correlation; this was what led me to the integrated GARCH. Third, the coefficients of all the parameters are positive. Fourth, the estimation value of the DCC coefficient equals 0.04, this result indicates that oil price positively affects the Nigerian stock market. Empirical results also show that there do not exist any asymmetrical effect of oil price on stock market.

Using the Tse's (2000) test to check the null hypothesis of constant correlations, the result of the test rejects the null of constant correlations pointing to the unsuitability of assuming constant correlations. The Hoskin's Portmanteau test also confirms the absence of serial autocorrelations as the null of the absence of serial correlation in the residuals cannot be rejected.

In theory, an oil price increase affects the economy of an oil importing economy by increasing the cost of running a business consequently diminishing profits and cash flow margins which are the key drivers of stock prices. Therefore an increase in oil prices results in a decrease in stock prices (Ramos and Vega, 2011). Given the important role of oil in an economy, Maghyreh(2004) observes that it is bound to be correlated with the stock market. Oil price shocks could also affect the financial market of oil importing economies due to the uncertainty they create (Filis et al, 2011). For an oil exporting economy, an oil price increase is expected to have a positive effect as a result of increase in income with the stock market responding positively in the same direction (Bjornland, 2009; Jimenez- Rodriguez and Sanchez, 2005).

The analysis and distinction of the relationship and comovement will be based on the analysis of the estimated DCC-IGARCH. Figure 5.17 below presents the graph resulting from the time varying correlation coefficients resulting from equation 5.19 between the Nigerian stock market and oil price which can be seen to vary a lot through time. Correlation is negative about 10% of the time. Lowest just at the beginning of the year 2001 while a peak in correlation coefficient is observed in late 2008 following the high demand for oil.

During the period 2000, the Nigerian stock market exhibited a considerable positive correlation with oil price. This same period was characterised by changes in OPEC oil production. At the start of 2001, Nigeria exhibited a high negative correlation with oil prices. This is the period dominated by changes in OPEC production levels in order to prevent a price collapse. In addition, this is the period when correlation between oil price and the Nigerian stock market was at its lowest.

Continuing along the time line, for a short period following the 2001 decline, the Nigerian stock market exhibited a positive correlation with oil prices. Further along the time line the September 2001 attack which took place in the last quarter of 2001 produced significant negative correlation between oil prices and stock prices. Thereafter the Nigerian stock market exhibited a moderate positive correlation with oil prices after the period. It can be observed that for a period of 2 year following the attack in 2001, the Nigerian stock market exhibited a positive correlation with oil price (except briefly in late 2003 where the correlation became negative). During this period there were cuts in OPECs oil production quota, war in Iraq and especially violence between soldiers and Niger Delta militants in oil producing areas of Nigeria.

Further along the time line negative correlations can also be observed in early 2004, mid 2004, mid 2005, early 2006, mid 2006 and early 2007. These episodes could as well be attributed to a number of events in Nigeria which also influenced the international oil market. For example there is significant negative correlation between oil prices and the Nigerian stock market at the start of 2005. This is the period dominated by the dispute in south eastern Nigeria which forced

Royal Dutch Shell to declare force majeure. However the two day strike by workers at Nigeria's Brass river crude export terminal did not produce any significant negative correlation between oil prices and the stock market.

The continued militant attack on Nigeria's oil infrastructure in 2006 which led to a shutdown of more than 600,000 barrels per day of oil production of Nigeria's over 2 million barrels per day capacity produced moderate negative correlation during this period. In early 2007, a number of combined factors led to a significant negative correlation between oil prices and the Nigeria stock market. These factors include the start of the planned OPEC 500,000 per day production cuts; the Shell shut-in of 187,000 barrels per day of Nigerian crude production after discovering a major oil spill and the threat of violence and unrest during April 2007 elections in Nigeria .

For a period of almost three years since the decline in early 2007, the Nigerian stock market exhibited a positive correlation with oil prices. However during this period, there was rising demand for oil, spare capacity was low and oil price continued to soar. This led to the dramatic increase in the price of crude petroleum reaching an all-time high in July of 2008 before a dramatic fall following the Global financial crisis with oil price falling as low as \$39 by December of 2009. During this period, the Nigerian stock market was exhibiting a positive correlation with oil prices and a significant negative correlation when oil prices began to fall causing the stock market to swing in the same direction.

The main findings that can be extracted from the analysis is that there are two periods of noteworthy positive or negative correlation between oil prices and

stock market. Secondly these are all interactive effects which are of value for forecasting and policy.

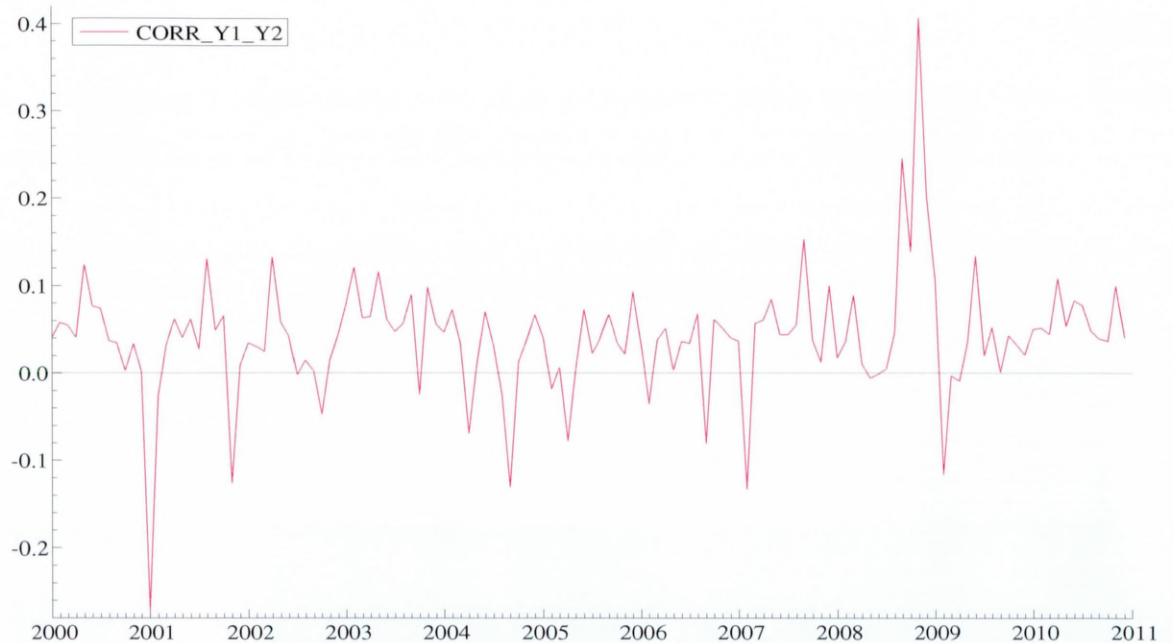


Figure 5-17: Time varying correlation between the Nigerian stock markets all share index and crude oil price

5.9 Conclusion

Given the importance of oil prices to the Nigerian economy and given its recent increased volatility. It is important to have a better understanding of the volatility dynamics of the Nigerian stock market and oil prices. This chapter uses a DCC I-GARCH to investigate the time varying correlation between the Nigerian Stock market and oil prices. Using a multivariate setting, the DCC allows for the study of the evolution of the relationship over time. As observed by Lebo and Box-Steffensmeier (2008) the DCC is most useful in understanding how correlations

change over time and when they will be weak or strong .It accounts for volatility allowing correlation to vary over time and be positive or negative.

Policy makers, investors as well as monetary authorities can all systematically learn something from these correlations of oil price and the Nigerian stock market. The present study differs from Filis et al (2011) and other studies by examining the dynamic correlation of oil exporting developing economy. Previous studies have focused on oil importing and exporting industrialised economies. While this focus is appropriate given, the small nature and lack of internationalisation of stock markets of middle income and developing economies, it leaves the obvious question how do stock markets of low income developing economies respond to oil price changes. To answer this question, the present chapter exclusively investigates the dynamic correlation between oil price and stock markets in Nigeria. The findings of this study are generalisable to similar economies.

Empirical results show that:

The DCC-IGARCH (1,1) was appropriate and there is absence of serial correlation in the residuals. The DCC shed light on the dynamic correlations between oil price shocks and stock market behaviour in Nigeria

- From the estimated DCC, the conditional correlation of the estimated DCC between oil price and stock market is extracted. The analysis and distinction of the relationship and comovement is based on the analysis of the estimated DCC-IGARCH.

- The dynamic correlation findings show substantial variation over time. Looking at Figure 5.16, it can be seen that the peak of correlation is achieved in 2008 indicating the height of the oil price shock of 2008. The oil price shock during this period of world crisis had significant impact on the relationship between oil and the Nigerian stock market.
- The results suggest that during the period 2000, and a for a short period following the 2001 decline the Nigerian stock market exhibited a considerable positive correlation with oil price.
- There was a significant negative correlations between the oil price and the Nigerian stock market during the September 2001 attack,; equally in early 2004; at the start of 2005; in mid 2005; early and mid 2006 and early 2007. All these episodes could be linked to a number of events in Nigeria and the world which influenced the international oil market.

CHAPTER 6

SUMMARY AND CONCLUSION

This chapter consists of a summary and the conclusions that can be drawn from the main findings. It also evaluates the contribution of this thesis as well as providing suggestions for future research.

6.1 Summary of the study

Since the first oil shock of 1983, a large body of work has examined the impact of oil prices on macroeconomic variables. Hamilton's (1983) pioneering study has led to a wide range of research in this area using different data sets and estimation procedures. Most studies have however been concerned with oil-importing developed economies, and in particular that of the US. Currently there is notable research exploring this relationship in the Nigerian economy, but a limited number of studies exist that have explored the oil price exchange rate nexus as well as the oil price stock market nexus in this country. Thus the purpose of the study is to contribute to understanding this relationship in Nigeria.

In summary, based on the results, it can be discerned that oil price volatility explains variations in the exchange rate but not the stock market. Oil price shocks have important implications for exchange rate management in Nigeria, but they do not have serious implications for stock market behaviour. The relevance of oil price changes for exchange rate management is clearly supported by the current findings. The findings of the study have important implications for

understanding the role of oil prices on exchange rate and stock market behaviour in Nigeria. This in turn can provide insight for policy makers.

6.2 Reconsideration of the Research Objectives

Returning to the objectives posed at the beginning of this study, it is now possible to state that the objectives are met given the findings of this study. This study set out to determine the impact of oil price shocks on the exchange rate and stock market in Nigeria. To this end, the study examines four objectives as outlined in Chapter 1. Each of the four objectives has been met as follows:

The first objective is to investigate the dynamic relationship between oil price shocks and the real exchange rate in Nigeria. Employing the Johansen procedure and a SVAR framework based on annual data from 1980 to 2010, this study investigates whether real oil price has an impact on real exchange rate in Nigeria. This study contributes to knowledge and departs from earlier works in the following ways: first, following Habib and Mandlova-Kalamova (2007), the productivity differential measure against Nigeria's thirty main trading partners is constructed, thus controlling for the Balassa Samuelson effect by including productivity differentials as an explanatory variable of the real exchange rate model. There is evidence of the long-run relationship between oil prices, real exchange rates and productivity differentials over the study period. After normalising by the co-efficient of the real exchange rate the long-run co-efficient of the co-integrating vector indicate a positive relationship. However, the productivity differential exerts a negative influence on the real exchange rate and

therefore in Nigeria the Balassa Samuelson effects do not seem to play an important role in driving the real exchange rate. Employing a SVAR analysis with short-run restrictions, the results indicate that oil price shocks have a positive albeit not statistically significant influence on productivity and the real exchange rate. These findings show that the objective was achieved.

The second objective is to explore the influence of recent oil price changes on nominal exchange rate in Nigeria during periods of extreme volatility. Employing GARCH class models on daily data from 2/01/2007 through to 31/12/2010, the study complements the work of Ghosh (2010) and Narayan et al (2008) but, unlike these studies concentrates on the Nigerian experience. Although Adeniyi (2011) has carried out similar work, the significant point of this study departs from his research and advances knowledge of the subject by considering a larger time frame, as well as employing the GARCH/EGARCH-in-mean. The results indicate that an increase in oil price return during the period of extreme volatility led to a depreciation of the Nigerian currency vis-a-vis the US dollar, and contrary to theoretical expectations of a positive relationship given the status of Nigeria as an oil-exporting economy. The findings therefore show that the objective was met.

The third objective is to analyse the extent to which oil price shocks have an impact on stock market behaviour. The study extends Adebisi et al (2009) by employing higher frequency data set and a variety of econometric techniques. First, a multivariate VAR analysis is conducted with linear and non-linear specification of oil price shocks and the dynamic effect of oil price fluctuations is

analyzed in terms of impulse response and variance decomposition for a 30 month horizon. Second, an OLS and quantile regression analysis is conducted with linear and non-linear specification of oil price shocks; this method allows the exploration of the relationship conditional on quantiles in the distributions of real stock returns. The empirical findings from the quantile regression model suggest that, despite being an oil-exporting economy, the result of the OLS and QR methods show no significant evidence of the effect of oil price changes over the period 1985 to 2011. From the QR method result, over the period 2000 to 2011, the study finds that the influence of either positive or negative oil price shocks is statistically significant and thus it can be concluded that in recent times the response of either positive or negative effects of oil price shocks is related to the quantiles (i.e. the performance of the stock market). From the estimated VAR and resulting impulse response and variance decomposition, it is observed that the future variations of real stock returns in Nigeria do not seem to be governed by the price of oil. The findings show that the objective was also achieved.

The fourth objective is to examine the dynamic correlation relationship between oil price and the stock market in Nigeria. To my knowledge, this has so far not been done in the case of Nigeria. From the estimated DCC, the conditional correlation of the estimated DCC between oil prices and the stock market was extracted; the analysis and distinction of the relationship and co-movement is based on the analysis of the estimated DCC-IGARCH. The dynamic correlation findings show substantial variation over time. Correlation is negative about 10% of the time, with the lowest at the beginning of 2001, while a peak in the

correlation co-efficient is observed in late 2008 following the high demand for oil. The findings show that the objective was also met.

6.3 Contribution of the study to knowledge

The study makes several contributions to the current literature which is far from reaching a consensus. The existing literature has several attempts exploring the impact of oil prices on the Nigerian real economy but with limited studies looking at its impact on exchange rate and the stock market. Therefore on the theoretical side, the present study have made a modest contribution to knowledge as being one of only a handful of studies exploring this relationship in Nigeria. The study of the effect of oil price shocks on exchange rate and stock market behaviour in the Nigerian economy is thus a contribution to knowledge as the study is expected to add to the current literature.

On the practical contributions, the study identifies that an oil price shock is an important factor in explaining variation in exchange rates, while showing little sensitivity to the stock market. The positive effect of oil prices on exchange rate movement that study the identifies will assist in our understanding of the consequences of an oil price shocks. Real exchange rate appreciation is a manifestation of the Dutch disease syndrome³⁶ and policy makers need therefore to focus attention on the potential of this occurring due to foreign exchange inflows arising from oil revenue. At the same time, the present study confirms

³⁶ Dutch disease is a concept that explains the negative consequences arising from among others large increases in a country's income following arise in the price of its natural resource

that nominal oil price changes causes significantly negative responses on nominal exchange rate during periods of extreme volatility. This is thus a warning sign of potential crisis in exchange rate management during periods of extreme volatility.

Previous research on the effect of oil price on the Nigerian stock market had postulated a clear negative relationship. This study has been instrumental for the first time to provide evidence negating this view. Employing higher frequency data and wider variety of estimation technique, the study finds that contrary to existing literature on the Nigerian economy oil price is not an important factor explaining variations in the Nigerian stock market. This research will thus serve as a base for future studies.

Another major contribution of this study is in its application of rigorous econometric techniques, approaching the data through different angles with empirical results providing a richer understanding of the underlying relationship in Nigeria. In this way, the study demonstrates the importance of this relationship, contributing to the study of the consequences of oil shocks and separately observing the effects on exchange rate and stock market behaviour. In addition, by employing updated data, a wider variety of econometric techniques and by employing empirical techniques largely absent in the existing literature on the Nigerian economy, it can be argued that superior estimates have been produced. The study has no doubt gone some way towards enhancing our understanding of the impact of oil price shocks on exchange rate and the stock market in Nigeria. This information can be used to develop targeted interventions in the foreign exchange market and stock market. In practice, these findings

suggest several courses of action for exchange rate and stock market management.

6.4 Limitations of the study and proposals for further research

The relationship between oil price shocks, exchange rate dynamics and stock market behaviour is an interesting and fruitful area for future research. The applied methodology and conclusions of this study should serve as a benchmark for comparison with results of future research on the effects of oil price shocks on exchange rate and stock markets in the Nigerian economy, and the results of the study should be applicable to other oil exporting economies. While the findings of this study may aid in understanding the nature of relationship between the three, it should however be noted that a weakness of this study is that it does not allow for any regime switching behaviour, given that economic time series and their relations contain non-linearities, and thus the behaviour of economic variables could depend on different states of the world or regimes. Although the focus of this study was primarily on the linear association between oil prices, exchange rates and stock markets, future research should re-examine these issues using non-linear methods. These issues remain on the agenda for future research

Another possible extension would be in adding additional variables to the estimations. It may also be rewarding to examine the impact on oil price shock and stock market behaviour using a Dynamic Stochastic General Equilibrium approach (DSGE); although empirical models are easier to use with better

forecasting properties, a view held by Burlage and Spannig (2006). Another natural extension would be to look at this problem using a Computational General Equilibrium model. Employing such techniques could provide another perspective, moreover future research may also benefit by perhaps revisiting these investigations as new updated data sets or higher frequency data become more readily available.

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