The relationship between changes in Oil price and the Currency volatility in Nigeria and South Africa between 2009 and 2019

By

Loretta Omosefe Avielele

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ABSTRACT

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This research work seeks to investigate the relationship between changes in oil price and currency volatility in Nigeria and South Africa. The impact analysis and the causality analysis of the changes in oil price and currency volatility were employed for a robust understanding of the theme of the research. Using the Ordinary Least Squares (OLS), the result showed that there is a negative relationship between oil price and the Nigerian Naira and for the South African model, there is a rather positive relationship between South African Rand and oil price changes. Employing the ARDL, the short-run and long-run estimates for the Nigerian model shows that there is a direct or positive relationship between oil price changes and economic growth in Nigeria and while the relationship between currency volatility and economic growth is negative. Furthermore, the short run and long run estimates for the South African imply that there is a positive or direct relationship between currency volatility and economic growth in South Africa. The study recommends that when designing investment portfolios, investors (both foreign and local) pay critical attention to currency volatilities. Additionally, capital flight and currency management policies integrating expected oil price shocks are recommended. Currency hedging strategies for companies with dollarized obligations are recommended for both economies because currency volatilities have a profound impact on the economy. This research will be useful to firms, governments of both Nigeria and South Africa, and other various stakeholders particularly in understanding the dynamics of oil price and currency volatility nexus in a bid to make quality decisions.

Keywords: Oil price, Currency volatility, Purchasing power parity, Cointegration, Granger causality test.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Changes in the crude oil price is a prevailing problem which is being felt by each country in the world. The oil price's impact is particularly influential in determining the economies of Oil exporting emerging countries as these economies are not financially stable and are susceptible to the various effects of external shocks (Siok, Xue, and Yen, 2015). The economies of Nigeria and South Africa in recent times have been referred to as emerging economies and in fact, they constitute two of the biggest economies in Africa. Time and again, the two countries have demonstrated what could be referred to as the giant of Africa as far as economic growth is concerned in recent times. [1]Among several similarities between South Africa and Nigeria is the fact that they are both producers of crude oil. While South Africa ranks 42nd in the world, Nigeria ranks 15th in the world. Worthy of note also is that Nigeria holds 37 million barrels of proven oil reserves as of 2016 ranking 10th in the world and accounting for about 2.2% of the world's total oil reserves of 1.6 Billion barrels. On the other hand, South Africa holds 15,000,000 barrels of proven oil reserves as of 2016, ranking 84th in the world and accounting for about 0.0% of the world's total oil reserves of 1.6 Billion barrels[2]. Currently, the proven oil reserves for South Africa and Nigeria stands at 15 million barrels and 36.9 million barrels

The global oil trend has been of special interest to government bodies as well as various stakeholders. The collapse of crude oil prices in the second half of 2014 shocked all stakeholders. The price of Brent crude oil as a benchmark fell more than 50 percent from $115 per barrel (bbl.) in June to less than $50/bbl. by early January in 2015 and indicates no sign of reaching the bottom just yet. Four years before June 2014, oil prices had remained consistently above the $100/bbl. mark. As recorded, the last drop to this extent was during the financial crisis of 2008/2009: in July 2008 prices were approaching $150/bbl., but had plummeted to below $50/bbl. by the end of the year. This dramatic price collapse was in reaction to the severe recession in many countries. However, the drop proved to be temporary and oil prices were back up above $100/bbl. by early 2011[3].

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[1] Nigeria's GDP and that of South Africa according to the World Bank 2019 are valued at $397 billion and $366 billion respectively- making them the biggest players on the continent.

[2] https://www.worldometers.info/Accessed on 01/06/2020

[3] https://www2.deloitte.com/ng/en/pages/energy-and-resources/ Accessed on 01/06/2020

The production of North America shale oil has drastically increased lately, commonly called the North Dakota oil boom[4]. This lies behind the significant increase in oil production in Canada and the United States. Russia, Iraq, and Libya's production have also increased since mid-June 2014. Contrary to the previous price falls, notably 2008/2009, when the oil cartel, OPEC reduced production to maintain prices, OPEC increased production. Also, another factor that has contributed to the fall of oil prices is an expected decrease in demand for oil due to lower expectations for global GDP growth. According to Arezki and Blanchard (2014), 65-80 percent of the fall in oil prices until December 2014 can be explained by increased supply.
Most studies have found a positive correlation between oil prices and the US dollar exchange rate, implying that oil price increase will increase the value of the exchange rate, thus depleting the value of local currencies (Quing *et al.,* 2019). So far, various shreds of evidence, particularly over the era of the post-Breton wood, have indicated the vital role of oil price fluctuations in the determination of the path of the exchange rate (ogundipe et al, 2014; Adeniyi *et al.,* 2004). The reason for this is because to a large extent, oil prices are quoted in US dollars and thus the US dollar exchange rate is the primary channel through which fluctuations in oil prices are transmitted to the real economy and financial markets (Reboredo, 2012).

As Krugman (1983) rightly put, the exchange rate of oil-producing countries in terms of the USD, appreciates in response to rising oil prices and depreciates with the response to falling oil prices in oil-exporting countries, while the opposite is expected to be the case in oil-importing countries. Nigeria and South Africa both maintain an open economy that is overly predisposed to the oil price volatility[5], having implications on their exchange rates in terms of dollars, inflation rate, money supply, budget, and international trade to mention a few. The importance of oil prices cannot be overlooked, as it represents a huge part of the trade balance

[4] 'The North Dakota oil boom refers to the period of rapidly expanding oil extraction from the Bakken formation in the state of North Dakota that lasted from the discovery of Parshall Oil Field in 2006, and peaked in 2012'.

[5] 'For its oil imports, South Africa depended for the most part on OPEC nations in 2010, especially Iran (29%), Saudi Arabia (23%), Nigeria (19%) and Angola (18%) (EIA, 2011). Dependence on Iranian imports of crude oil was impeded to an extent in 2012 under pressure from sanctions levied by the United States and the European Union on the Iranian oil industry.. So far in 2018, South Africa has imported crude oil worth R54.4 billion, while total imports into South Africa totalled R474 billion. As a result, crude oil accounts for approximately 11.3% of total imports from South Africa, and crude oil comes to South Africa. The Nigerian economy on the other hand, is heavily dependent on the oil sector, which, accounts for over 95 percent of export earnings and about 40 percent of government revenues, according to the International Monetary Fund'.

of an energy-dependent country[6]. In connection to this, Oriavwote and Eriemo (2012) believe that the exchange rate is one important variable in the growth process of any economy since its level and stability have a direct effect on the tradable sector and investment. In light of this, oil price negative or positive shocks have a direct impact on the exchange rate, which in turn affects the overall growth process.

The aforementioned underscored the impact of oil prices on currency volatility and its varying implications for the economy. Given this, it becomes pertinent to assess the impact of the nexus between oil prices and currency volatility in the economies of Nigeria and South Africa.

1.2 Statement of the problem

It is important to categorically state that volatility in oil prices and the currency is referred to as the rate at which price change over a given period. This is expressed as a percentage and calculated as the annualized standard deviation of the percentage change in the daily price. The larger the size of the change, or the more quickly it changes over time, the higher the volatility (Englama *et al.,* 2010).

Suffice to say that changes in oil prices have varying implications for different countries basically, from the perspective of trade; while oil-producing countries gain from high oil prices, oil-importing countries usually have unfavorable terms-of-trade in their external sector that bears further consequences for economies in the long run (Englama *et al.,* 2010).

Ozcelebi (2018) argued that exchange-rate volatility has a detrimental impact on investor risk-taking activity in exchange-rate markets and can funnel the portfolios of investors into money markets. Consequently, because of the growing uncertainty of the exchange rate, investors switch away from currency markets to money markets, and while economic growth can be promoted within the context of the credit channels. However, according to Krugman 1983; Jin, 2008 and Mensah *et al.,* 2016, there has been an agreement on the economic grounds that

[6] For instance, 'Crude oil exports generate over 90%, of Nigeria's foreign exchange earnings. Oil accounts for about 70% of Qatar's government revenues, and also has an impact on production of condensate and associated natural gas. Oil revenue accounts for about 90% of Kuwait's government income, which comprises nearly half the country's GDP. Oil export revenues account for about 95% of Libya's hard currency earnings' (EIA, 2019)

exchange rate volatility may be the key source of macroeconomic instability due to the contagion effects among financial markets and economies

On the other hand, two reasons have been observed to understand why macroeconomic variables are affected by oil shocks. One, oil price increase leads to lower aggregate demand given that income is redistributed between net oil import and export countries. Oil price spikes can have a grave effect on economic activities because household income is spent more on energy consumption, and firms cut the amount of crude oil it purchases which then leads to underutilization of the factors of production like labor and capital. Two, the supply-side effects are connected to the fact that crude oil is regarded as the basic input to the production process. A rise in oil prices will lead to a fall or drop in the supply of oil because a rise in the cost of crude oil production will lead to a decline in potential output (Trung and Vinh, 2011). This is also referred to as the two-way transmission mechanism.

Many authors have been able to come up with the relationship between oil price and currency volatility, Basher *et al.,* (2012) while investigating the dynamic relationship between real oil prices, exchange rate index of major currencies, emerging market stock prices, interest rates, global real economic activity, and oil supply found that positive shocks to oil prices tend to weaken emerging market stock prices and US dollar exchange rates in the short run. A positive oil production shock lowers oil prices while a positive shock to real economic activity increases oil prices and thus concluded that increases in emerging market stock prices often led to a rise in oil prices.

In terms of causality, Hamisu, *et al.,* (2015) investigated the correlation between the South African rand (ZAR) and oil prices for 43 years. They found long-run causality between oil price and exchange rate(ZAR per USD). In a similar vein, Kin and Courage (2014) investigated the effects that oil prices on ZAR and found out that the ZAR exchange rate was significantly affected by changes in oil prices in the international oil market. For the Nigerian scenario, ogundipe *et al.,* (2014) concluded that the exchange rate is susceptible to changes in oil prices.

While, the link between exchange rate and oil prices has been established by various authors for different economies, particularly in the oil-exporting countries, it is not justifiable to generalize the cases of oil-importing countries, given the dynamics in situations and environments. A more unique situation necessitating clarification is when an economy is an

importer and as well exporter of crude oil which is the case in Nigeria and South Africa[7]. The problem remains that there is no clear-cut establishment of the relationship that exists between oil price and currency volatility if the studied economy or economies is/are both oil-exporting and oil-importing.

1.3 Research Questions

In light of the inherent problems, this study will seek to answer the following research questions;

1. What are the significant direct and indirect impacts of oil prices and currency volatility on economic growth especially via the credit channel in Nigeria and South Africa?
2. What is the causal relationship between oil price, currency volatility, and economic growth in Nigeria and South Africa? and
3. What role does the 2008-09 global financial crisis play in the nexus between oil price and currency volatility in Nigeria and South Africa?

1.4 Objectives of the study

The broad objective of the study is to examine the relationship between oil price and currency volatility in the Nigerian and South African contexts. However, the specific objectives of the study include:

1. To carry out detailed trend analysis on oil price, currency volatility and some other macroeconomic indicators, including real gross domestic product, foreign direct investment, domestic investment, and financial deepening;
2. To investigate the existence of a long-run relationship between oil price, currency volatility and economic growth, having controlled for some other important macroeconomic indicators, including FDI and inflation

[7] 'Even though Nigeria has a sizeable nameplate refining capacity of 445,000 b/d that exceeds domestic demand, however, the country continues to import petroleum. This is because Nigerian refineries typically operate below full capacity due to operational failures, fires and sabotage. To combat this the Nigerian government is planning a series of new refineries. One of the largest of these planned refineries is the Dangote Refinery and Polypropylene Plant situated in the Lekki Free Trade Zone. Once completed in early 2020, the refinery will produce 153,000 b/d of gasoline, 104,000 b/d of diesel, 73,000 b/d of jet fuel, 4,109 b/d of LPG and 12,300 b/d of fuel oil.

South Africa on the other hand with such a large reliance on imports for oil and natural gas, South Africa has a well-developed midstream sector consisting of import and storage terminals. With South Africa consuming the second-largest amount of petroleum in Africa (behind Egypt), the country has a well-developed downstream sector. Petroleum products are largely derived from South Africa's domestic refineries. As of January 2017, South Africa has a crude oil distillation capacity of 493,000 b/d. Yet, due to ever increasing domestic demand South Africa still needs to expand its downstream capacity further'.

3. To determine the direction of causality between oil price, currency volatility, and economic growth in Nigeria and South Africa

1.5 Significance of The Study

This research work seeks to investigate empirically, providing the link or relationship between oil price and currency volatility and their impacts on the economies of Nigeria and South Africa. This empirical investigation will in turn be the basis for policy recommendations in this work. This research will be useful to firms, governments of both Nigeria and South Africa, and other various stakeholders particularly in understanding the dynamics of oil price and currency volatility nexus in a bid to make quality decisions.

The study will essentially be relevant for the government, particularly the Ministry of Finance and the central banks of both Nigeria and South Africa, to make policy decisions whose ulti mate goals are to influence the level of economic activity and manage the volatility of the exc hange rate. This may also help promote improved dissemination of monetary policy and stabl e prices, all of which could be influenced by oil prices and subsequent currency fluctuations, which could in turn boost economic growth in the region. It will also suggest areas for further research so that the frontier of knowledge in energy finance is ultimately and continually expanded.

1.6 Scope and Methodology of The Study

The study attempts to collect monthly data on the variables to be used covering the period between 2009 and 2019, based on the available data, from various sources, such as Central Bank of Nigeria (CBN) Statistical Bulletin, South African Reserve Bank, World Bank's World Development Indicator (WDI) Database, and US Energy Information Administration (EIA) website, among others. The framework for analysis is the Autoregressive Distributed Lag (ARDL) model which is basically for the investigation of the long-run relationship of variables, will be estimated with the aid of Eviews 10[8].

1.7 Structure of The Study

This thesis is organized into five chapters. Following the abstract and the introductory part, the rest of the study is organized as follows; Chapter two presents the review of relevant literature comprising concepts, theories, methodologies, and empirical findings of previous studies. Chapter three describes the methodology used to carry out the analysis and test for the study objectives. Chapter four covers the result of pre-estimation tests, the result of estimated short-

[8] EViews is a statistical package for Windows, used mainly for time-series oriented econometric analysis.

run and long-run models, and the result of post estimation/diagnostic tests, and Chapter five shows the summary of the findings and conclusions drawn from the former.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Chapter one discussed exhaustively the background to the study, the problem statement, the research questions, and objectives. The significance of the study was also outrightly spelled out. However, building on the existing work in the first chapter of this study, this chapter discusses the conceptual issues around changes in oil price and currency volatility in Nigeria and South Africa. It elucidates on the findings of other studies which sums up the empirical literature review. This chapter besides, unveils some significant and relevant theories of the subject matter. Accordingly, section 2.1 will be the review of conceptual literature, section 2.2, the empirical literature review, and section 2.3, the theoretical framework.

2.1 Conceptual review

2.1.1 Overview of Nigeria's Economy

Nigeria's economy is a middle-income, mixed economy and emerging market, with growing sectors of retail, banking, education, media, telecommunications, and culture. In terms of nominal GDP, it is ranked as the 27th largest economy in the world and the 24th largest in terms of purchasing power parity. Nigeria has the largest economy in Africa; its re-emerging manufacturing sector became the largest on the continent in 2013, and the West African subcontinent produces a large proportion of goods and services.

The primary sector accounted for more than 50% of the gross domestic product (GDP) with agriculture continuing to play an important role. The oil and gas industry remains a significant engine of the economy, accounting for more than 95% of export earnings and around 85% of government revenues between 2011 and 2012. In 2011 and 2012, respectively, the sector added 14.8% and 13.8% to GDP. It also reported a rise in inventory in 2012 from 36,042 billion barrels in 2011, from 37,119 billion barrels. By comparison, Nigeria's industrial sector (including engineering, mines, and utilities) accounts for a tiny share of economic operation (6 percent) while the textile sector contributed just 4 percent of GDP in 2011. This, following government policy initiatives over the past 50 years, and more recently, in particular, has sought to promote the cycle of industrialization.

Agriculture became the Nigerian economy's backbone in 1960 and for most of that decade, supplying food and jobs for the people, raw materials for the burgeoning manufacturing sector,

and producing the bulk of government revenue and foreign exchange earnings (Chete *et al.*, 2012). Following the discovery of oil on 15 January 1956, its exploitation and production in industrial amounts, agricultural fortunes slowly declined, although crude oil substituted it as the primary source of profit and export earnings. This is following an economic growth push in Nigeria with the first National Development Plan for the era 1962-68 dated back to the early 1960s. The first development plan had the objectives of mobilizing and sharing capital on a cost/benefit basis across contending ventures as a concerted effort to grow the industry and in this regard adopted import-substituting industrialization (ISI). The duration of this plan ushered the commissioning of energy projects such as the Kanji dam and thermal plants in Ughelli, which provided the emerging industrial sector with a critical infrastructural backbone (Chete *et al.*, 2012).

Another significant industrial infrastructure built during this time frame was considered necessary to promote industrial take-offs in Nigeria; it included an oil refinery, a development bank, and a mint and defense company. Although the ISI strategy's main objective was to encourage the start-up and growth of industries as well as boost indigenous participation by modifying ownership structure and industry management, it was accompanied by a high degree of technical dependency on foreign expertise to the point where the country's domestic resource endowments were largely overlooked (Chete *et al.*, 2012).

Consequently, the reliance on the ISI strategy as the core of industrial growth efforts during the First Plan era seems to have ignored many of the reasons required to handle the developing industrial sector and, in particular, the management of the transferred or acquired technologies. The Second National Development Plan (1970-74) sought to overcome the shortcomings of the ISI strategy and emphasized 'upgrading local manufacturing of intermediate and capital products for export to other industries. This was the first organized attempt to establish an urban framework connected with the forestry, shipping, manufacturing, and quarrying. Nigeria 's recently gained position as a major petroleum exporting nation aligned with the Second Programme. As the economy has benefited greatly from huge foreign direct investment, the government has supported vast and expensive industrial projects in sectors such as steel production, cement, salt, sugar, fertilizer, pulp, and paper, and many more. According to the plan, the development of industrial projects during this time was driven by the need to enhance the population 's economic capability; to reduce public upheaval by generating more employment; to make the basic goods and service accessible and to lay the foundations for a self-sustaining economy. Nevertheless, the simplistic nature of the technological capability of Nigeria has prevented the economy from moving beyond the different stages of these

undertakings, and in fact, almost all of these undertakings have either been closed down or are operating at very reduced efficiency today (Chete *et al.,* 2012).

The 1970-74 Plan era also witnessed a drastic change in strategy from private-sector to public-sector-led industrialization. Industrial policy was carried out in the public sector and also carried out much of the construction ventures while the government actively engaged in successful activities. It was obvious at this period that Nigerian businessmen did not have the resources or the techno-managerial ability to set up and run these enterprises and thus the government had to take the lead. Overall, a thorough examination of the essence of the industrial growth problem of the 1970s shows that the weakness was not so much that of financing, but the scarcity of human resources, particularly the techno-management capacities and expertise needed to undertake, execute and handle industrial ventures. This was all the more obvious since the planning of the project, feasibility reports, development sketches and designs for fabrication, erection, and commissioning relied heavily on international technological skills and services. The 1972 Act on Indigenization of Enterprises Operating in Nigeria culminated in a policy of indigenization that was later revised, abolished and substituted by the Nigerian Enterprise Promotion Act of 1977. The policy goals were:

• Transition of ownership and control to Nigerians in respect of those companies previously owned (in whole or part) and operated by foreigners;

• Promoting widespread company ownership among Nigerian citizens;

• Creating opportunities for indigenous businesses in Nigeria;

• Encourage global businessmen and investors to switch from the unsophisticated realms of the economy to domains where large investments are required.

At the peak of the oil boom, the Third National Development Plan (1975-80) was introduced. Despite the country's shortage of administrative ability, the program envisaged an expenditure outlay of NGN 42 billion (up from the second plan's 3.2 billion NGN). The focus remained on investment in the industry by the public sector, especially by heavy industries. With easy access to foreign exchange, private companies opted for small, low-tech consumer industries that relied heavily on imported machinery and raw materials. It was clear that the nation had signed industrial partnership arrangements with very little regard about the country's product procurement capability. Although each of these projects by its definition included the acquisition of key sector-specific skills, the arrangements reached by the Nigerian planners were for turnkey technology transplantation. Assistant to the fact that the oil sector of the nation had been vibrant and thriving during the same time, and that the borders of the economy had been opened to all kinds of imports. This had a crippling impact on actual development in

business. Indeed, the Third National Development Plan era struggled in a substantially positive way to advance the path of industrial growth in Nigeria (Chete *et al.*, 2012).

The Fourth National Development Plan (1981-85) coincided with the advent of a global economic recession that caused falling foreign exchange earnings, the balance of payment disparities, and unemployment in the Nigerian economy. The massively import-based manufacturing industry has been affected badly as a consequence. The plummeting world oil markets and declining foreign exchange profits left foreign-exchange companies in need of importing new products and components. In reality, this global recession has revealed profound vulnerabilities in the industrial system and the planning of Nigeria. At the end of the fourth growth decade in Nigeria, it became clear that current policies aimed at industrialization could not address either the issue of economic underdevelopment or the social challenges generated by widespread inflation unemployment and life and property insecurity. As a consequence, demand was caused not only by technological and economic imperatives but also by social concerns to pursue alternate planning paradigms.

The Structural Adjustment Program (SAP) was introduced in 1986 as an innovative mechanism to fix the shortcomings and inefficiency of previous planning attempts for growth. SAP's objectives included fostering innovation, boosting non-oil exports and creating a base for private-sector growth; fostering the productivity of Nigeria's industrial sector; privatizing and selling state-owned enterprises to improve industrial output; improving and utilizing domestic technology through facilitating rapid production and exploitation of local raw materials. In 1986, a national science and technology (S&T) strategy was adopted and introduced. The objectives of this strategy were to raise the public interest of S&T and its vital position of national growth and well-being; guide S&T activities alongside established national goals; encourage the conversion of S&T findings into real products and services; and build, improve, and empower production in the S&T sector. The S&T strategy marked the beginning of S&T activities being regarded as a tool for productive industrial growth in Nigeria. In 1987, the Raw Materials Research and Development Council was created by Decree No. 39 to promote the attainment of the S&T policy's 'self-reliance' aspiration. It has also developed the Standards Organisation of Nigeria (SON) to ensure standardization and satisfactory quality assurance in industrial production. The S&T strategy stressed the transition of international technologies to local companies by licensing and registration of inventions, trademarks, provisions for technical support, research and production, training and operations. There is little evidence that the S&T policy was successful. Among other authors, Bamiro (1994) and Oyeyinka (1997)

described some of the possible explanations for the ineffectiveness of the S&T policy to include the fact that:

• S&T institutions operated independently, with little or no interrelationships, resulting in administrative overhead and wastage;

• The narrow S&T research base that has focused on R&D;

• Isolation of the manufacturing sector from research and development activities, and therefore no marketing of ideas;

• The S&T sector was underfunded.

The macroeconomic environment is a dynamic superstructure that incorporates many interrelated industries and activities working together to promote the country's economic growth and development. Hence the main economic sectors as suggested by the Nigerian Federal Government (2002) are identified.

2.1.2 Overview of South Africa's Economy

According to IMF (2019), South Africa's economy is the second-largest in Africa, just after Nigeria. As a regional manufacturing hub in Africa, it is the most industrialized and diversified economy on the continent. South Africa is one of only eight countries in Africa regarded as upper-middle-income economies. By the end of over twelve years of foreign sanctions since 1996, South Africa's GDP virtually tripled to peak at $400 billion in 2011 but experienced some decline to roughly $385 billion in 2019. In the same period, foreign reserves increased from $3 billion to nearly $ 50 billion, creating a thriving economy with a growing and significant number of middle-class people in the space of two decades after the end of apartheid. South African state-owned enterprises play an crucial part in the economy of the country with the government having a stake of around 700 SOEs engaged in a wide variety of key industries. In 2016, the top five industry problems in the world were dysfunctional government administration, stringent labor regulations, a lack of qualified employees, political uncertainty and corruption, while the large banking sector in the world was considered a positive economic function.[9] South Africa is one of the G20[10]and is the only in Africa belonging to the international organisation.

[9] "Economies". Global Competitiveness Report 2015-2016.

[10] The G20 (or Group of Twenty) is an international forum for the governments and central bank governors from 19 countries and the European Union (EU). Founded in 1999 with the aim to discuss policy pertaining to the promotion of international financial stability. The reason for South Africa's inclusion is because it is more integrated into the international economy and has better financial institutions as at the time of consideration. This makes it easier since the G20 is so financially oriented.

Historically, mining and agriculture have contributed the most to the gross national output in South Africa. With government involvement during and after the Second World War, manufacturing was the largest contributor to the total gross domestic product, and overall economic growth rivaled Japan's economic growth in the 1960s, averaging 5.9 percent per annum in real terms (compared to the 1950s average annual growth of 4 percent). But growth across both the manufacturing and agricultural sectors steadily declined during the 1970s, and the services sector. The fastest-growing economic sector, however, were particularly the insurance, financial facilities, and transport services. Gold prices were allowed to float (relative to the rand) in the early 1970s and high prices for gold and other export goods spurred a brief economic recovery by the end of the decade. Mining remained crucial to the economic future of the nation because minerals, particularly gold, influenced exports and profoundly affected the growth of other major sectors of the economy that relied on gold exports to bring in much-needed foreign currency. Thus, while the significance of gold in Gross domestic product declined, it continued to influence the balance of payments in the country. When gold prices (and export revenues) dropped, manufacturing industries were often unable to obtain imports, such as machinery and other inputs needed to maintain production; consequently, other exports also declined

South Africa's economic growth decreased in the late 1970s and early 1980s due not just to declining gold revenues but also to rising oil import prices and expanded global competition in other traditional export commodities. This period's first crisis hit in 1976, despite unexpected spikes in oil prices. Rapid export growth based on higher gold prices facilitated recovery from recession but a series of droughts hit the country in the 1980s, seriously affecting agricultural production. Further swings in gold prices resulted in a series of booms and bust, limiting annual average GDP growth in the 1980s to just 1.5%.

In the 1980s, slow economic growth resulted in an overall decrease in living standards, with population growth well outstripping economic growth. Over the decade, per capita GDP fell by more than 10 percent, and in 1990 real wealth was no different for the average person than it had been in 1970. Economic stagnation in the early 1990s persisted. According to the Central Statistical Service of the government, GDP declined in 1991 and 1992 and reported only slight positive growth in 1993. In 1993, private consumption accounted for 57 % of GDP, a marginal rise (0.4 %) over 1992. However, high consumer indebtedness and fears about crime and job security limited private consumption. In 1994, rehabilitation improved. GDP accumulated to R432.8 billion (US$ 121.9 billion) in that year, reflecting actual growth of 2.6% over 1993. On average, GDP per capita was around US$3,010, putting South Africa in the upper-middle-

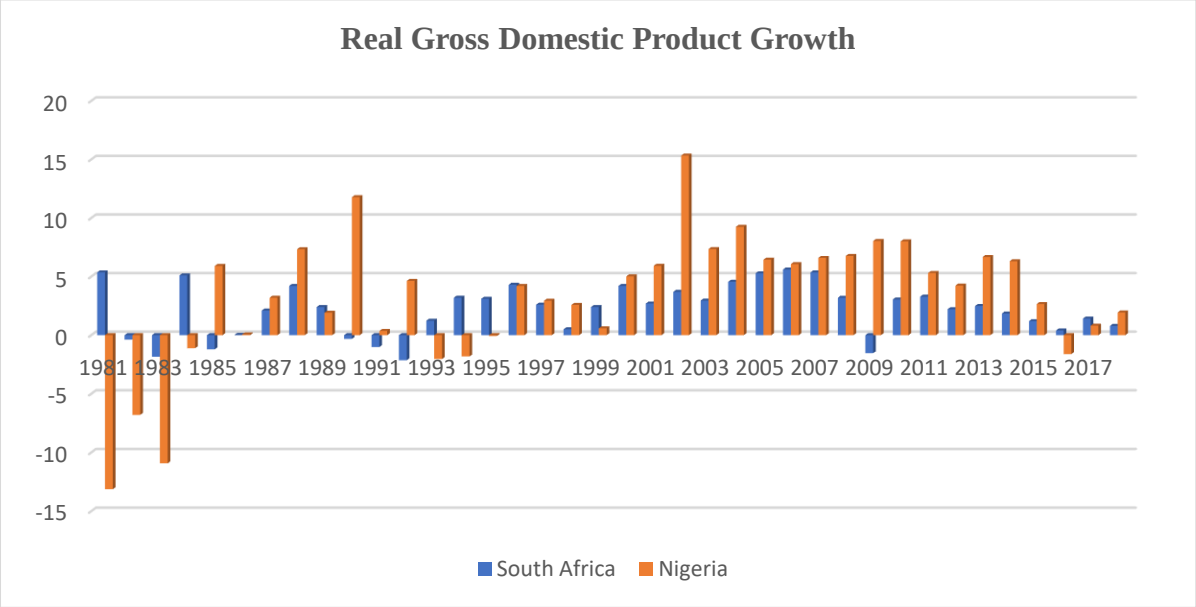
income developed countries of the World Bank. The recovery began in 1995, with officials expecting GDP growth in 1996 approaching 4%.

The advanced industrial sector of South Africa has made it the world 's twenty-fifth largest economy, a superpower among many of the African countries in the 1990s. In 1994, per capita GDP was topped only by Seychelles, and Gabon, compared to the rest of Africa. Despite just about 7% of the population and 4% of Africa's total land area, South Africa produced more than one-third of Africa's products and service and almost 40% of its manufacturing production[11].

[11] http://countrystudies.us/south-africa/ Accessed on 05/06/2020

2.1.3 Comparative Analysis of Macroeconomic variables for Nigeria and South Africa

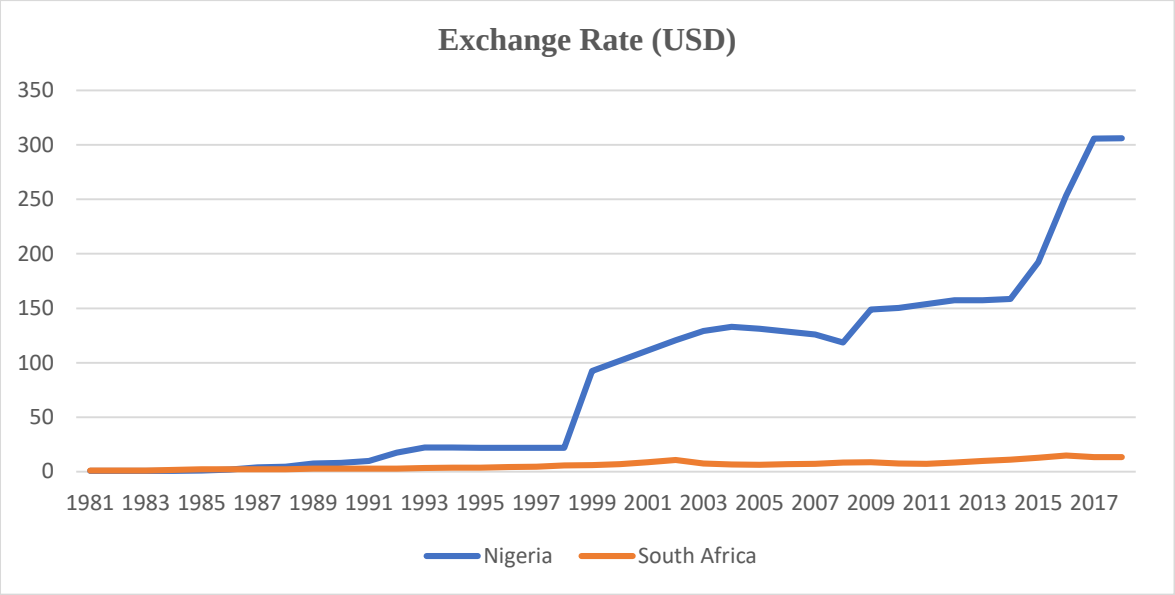
Figure 2.1: Trend of Economic Growth in Nigeria and South Africa (1981 – 2018)



Source: Computation based on data obtained from World Development Indicators

Figure 2.1 above showed the trend of economic growth for the period 1981 – 2018. The figure shows a steady increasing trend from 1981 until around 2001 for South Africa. From the start of the period under review, the economic growth in Nigeria declined to about 13% of the previous year's RGDP. The growth rate of Nigeria's economy, however, averaged 3.18% throughout the period under review. For the South African case, there was a decline in 2002 and according to Mboweni (2003), the decline in the rate of economic growth was due to a fall in the volume of exports, whereas domestic demand continued to increase strongly. The global economic meltdown of 2008/2009 took different turns on both economies, while the economic growth of South Africa decreased by -1.54%, that of Nigeria increased by 8.04%.

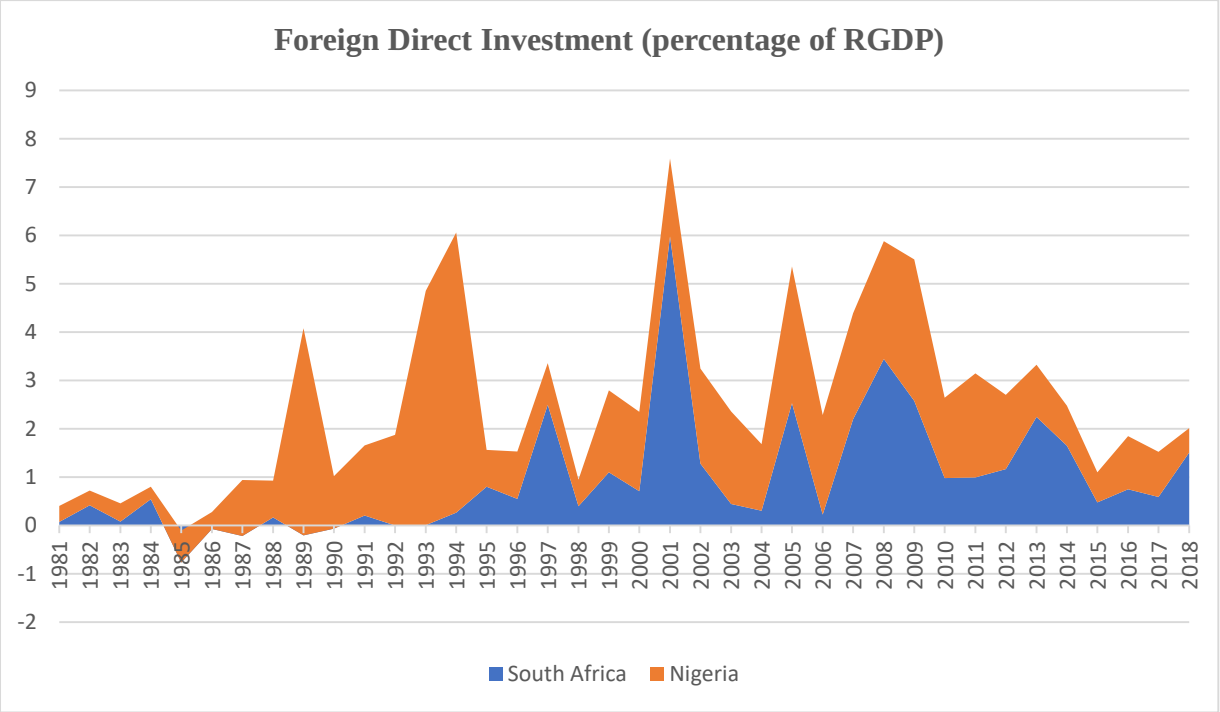
Figure 2.2: Exchange Rate trend in Nigeria and South Africa (1981 – 2018)



Source: Computation based on data obtained from World Development Indicators

Figure 2.2 above depicts the changes in exchange rates of the Nigerian Naira and South African Rand in terms of the US Dollar from 1981-2018. The exchange rates in both economies were evidently on par with the USD most of the 1980s. As showed in the figure above, the South African Rand exchanged for less than R20 per dollar from 1981-2018, with an average exchange rate of R6.04 per USD. The Nigerian currency, however, took a different turn in 1992 jumping from a single-digit zone to exchange for ₦17 per USD. The Naira-Dollar exchange rate further deteriorated as the Naira exchanged for a whopping ₦306.08 per USD in 2018.

Figure 2.3: Foreign Direct Investment Trend in Nigeria and South Africa (1981 – 2018)

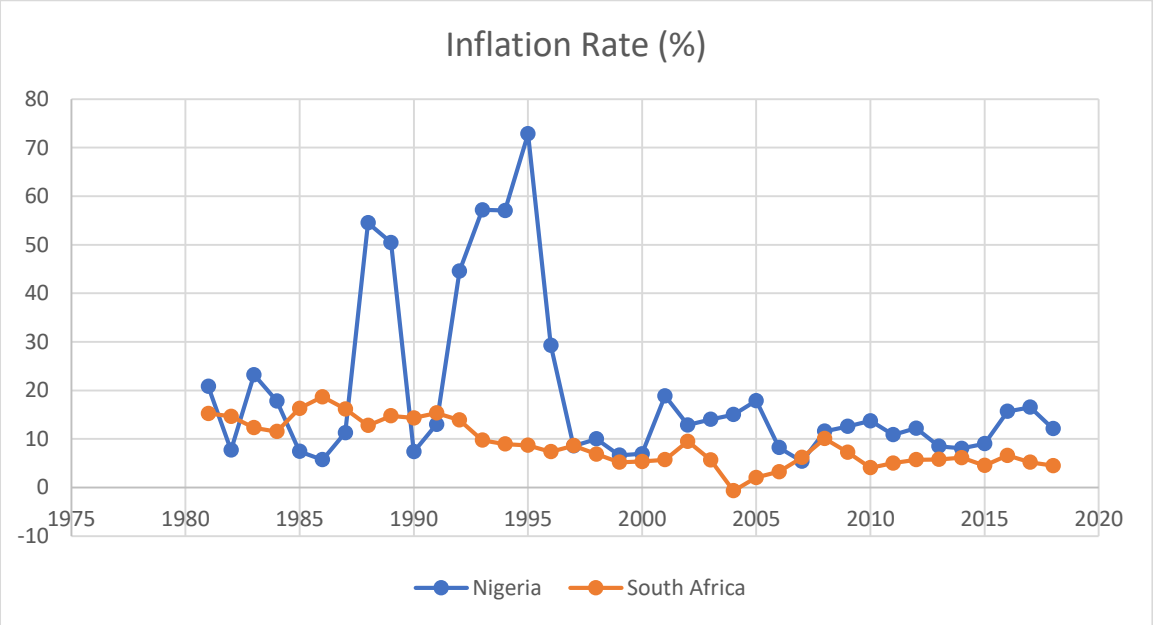


Source: Computation based on data obtained from World Development Indicators

Figure 2.3 depicts the trend analysis of foreign direct investment (FDI) in Nigeria and South Africa. It is noteworthy that FDI is a category of cross-border investment made by a resident in one economy (the direct investor) to establish a lasting interest in an enterprise (the direct investment enterprise) that is resident in an economy other than that of the direct investor (OECD, 2008). In simpler terms, the FDI is also referred to as the capital inflow. The FDI attracted by both economies from 1981 to 1988 were infinitesimal. The figures from 1981-1988 represent less than 1% of the GDP of both economies. South Africa had been able to boost its FDI beginning from 1994. But FDI inflows remained extremely unstable over the next twenty years as the economy tried to respond to the global financial crisis and disruptions in local exchange rates. FDI volatility is due to the vulnerability to commodity price changes as South Africa's FDI is mainly correlated with the export sector although the importance of the manufacturing and financial sector has recently increased significantly. It should be noted that between 2001 (US$ 7.3 billion) and 2002 (US$ 1.5 billion) FDI inflows decreased by 20 percent. It was primarily attributed to the South African Rand's decline against the US$ by 37 percent as this caused increased investment risk and resulted in capital flight. FDI inflows into South Africa began to rise again after 2006 (Sunde, 2017). Nigeria, on the other hand, is one of the few countries that have consistently gained as shown in Figure 2.3 from the FDI inflow into Africa. Nigeria 's share of FDI inflows to Africa averaged about 10%, from 24.19% in

1990 to 5.88% in 2001 to 11.65% in 2002. In 2001 and 2002, UNCTAD (2003) revealed that Nigeria was the second-largest recipient of FDI on the continent after Angola. Nevertheless, there was a downturn in the percentage of GDP that FDI accounted for in 2003, empirical evidence indicated that the drop in Nigeria FDI during this time was due to declining profitability, reduced capacity utilization, and other factors; primarily political reversal that seemed to give uncertainty signals to potential investors (Chantal and Patrick, 2005).

Figure 2.4: Inflation Trend in Nigeria and South Africa (1981 – 2018)



Source: Computation based on data obtained from World Development Indicators

Figure 2.4 above showed the downward and upward movement of inflation rates in both South Africa and Nigeria. The figure depicts that the inflation rate in Nigeria has been haphazard, and only becoming relatively stable from the year 2000 and thereafter. The inflation rates in Nigeria averaged 19.35% recording its highest rate in 1995 at 72.84%. The South African economy on the other hand has been relatively stable throughout the period under review. The highest rate ever recorded in South Africa was in 1985 at 16.30%. The lowest inflation rate recorded in South Africa at -0.70% was in 2004 before the financial crisis of 2008/2009.

2.1.4 Oil Shocks and Crises

A dramatic rise in the price of oil is usually regarded as an oil crisis and it is regularly accompanied by a cut in supply. Given that oil serves as the main source of energy for industrial economies, an oil crisis can, however, jeopardize both the economic and political stability of the global economy. The reason for the increase in oil price may be as a result of a unilateral decision by the producers as the case was in 1973 when the Organization of Petroleum

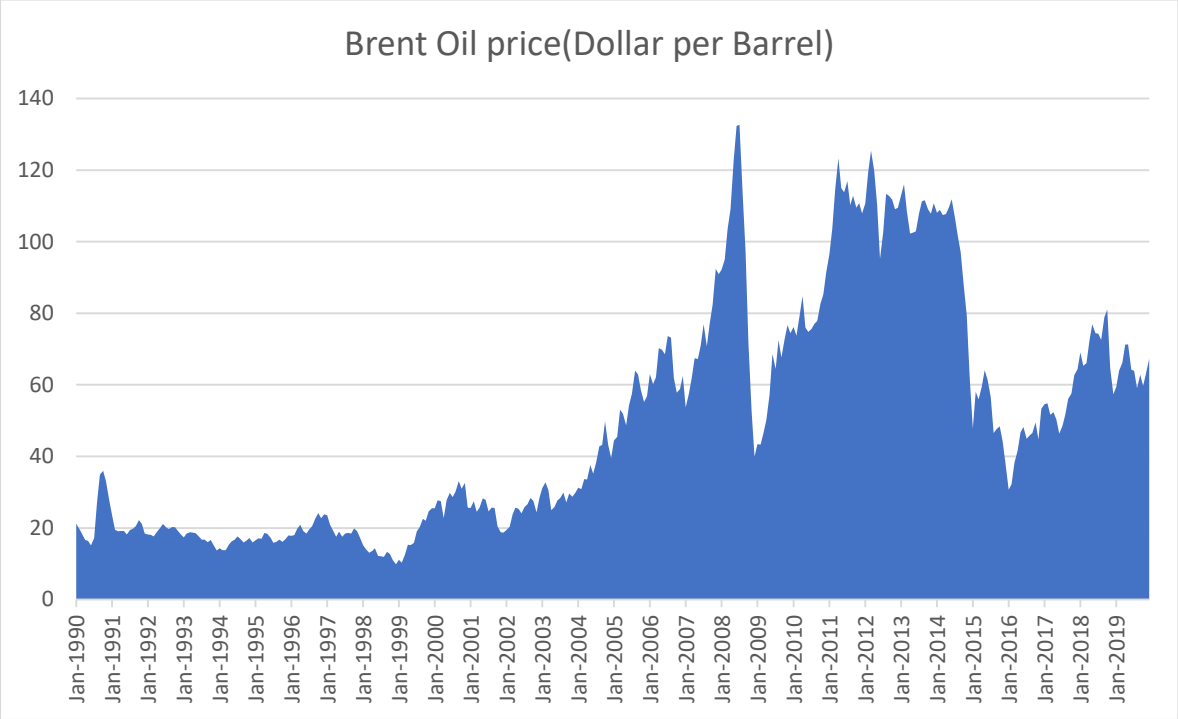
Exporting Countries (OPEC) countries withheld supplies, the political crisis in oil-producing countries, or a sudden increase in world oil demand. When oil demand outstrips supply, price of oil soars and this may negatively influence world economies especially the oil-importing countries. Oil prices have been volatile since 1999 as depicted in figure 2.5 below.

The phenomenon of oil crises can be traced to 1973 when OPEC placed an oil production embargo against the United States and other industrialized nations that threw their weights behind Israel in the Yom Kippur War**.** Consequently, OPEC[12] quadruples the price of oil to virtually $12 a barrel from $3 per barrel. This led to the persistent decline of the US Dollar (denominated currency for oil sales), which in turn, depleted the export earnings of OPEC states.

The Iranian Revolution of 1978-79 and the successive wars in Iraq were responsible for the second oil shock when oil prices rose threefold (World Energy Council). The intensity of the social unrest adversely destroyed the Iranian oil industry, leading to a large loss of output and a corresponding rise in prices. The case worsened following the outbreak of the Iran-Iraq War from 1980–88.

[12] OPEC is an intergovernmental organization established in 1960 by Iran , Iraq, Kuwait, Saudi Arabia and Venezuela to integrate the largest oil producers with a view to influencing the international supply of oil.

Figure 2.5 Oil price (1990-2018)



Source: Computation based on data obtained from World Development Indicators

Another oil price shock occurred in 1990, a period that ushered the new industrial age. It was caused by Iraqi's invasion of Kuwait. The 2000s witnessed a rapid increase in oil prices over a relatively long period resulting in an oil price peak of USD 147 per barrel in mid-2008. Successive price correction brought the price down to USD 46 per barrel in the same year. Immediately after the economic meltdown of 2008-2009, oil prices steadily rose to above USD 100 per barrel indicating a strong recovery. The sustained high oil prices however lasted till mid-2014 when price corrections exerted downward pressure. At the end of 2015, oil prices had declined to levels below USD 40 per barrel, a price last seen during the global financial crisis (World Energy Council). The fall in price has been attributed to the slowdown in China's economic growth but more importantly, the world GDP growth rate has been slowing down. The sustained low oil prices have destabilized many oil-exporting economies even though favoring oil-importing countries.

2.2 Theoretical Review

Traditional growth theories concentrate on primary inputs of factors of production such as Capital, labor and land while neglecting the function and importance of primary energy inputs such as; crude oil (Ndungu, 2013). Over the past few decades, however, economists and social scientists have made efforts to develop certain theories that capture the impact and roles of oil price on economic performance, integrating the connection between energy resources and economic growth. The Linear or Symmetric relationship between oil price transformation and asymmetry or nonlinear transformation is mainly the popular theories that link fluctuations in the price of oil and the growth of the economy. Economic growth is a variable of interest in this work as outlined in the research objectives, hence the theory.

2.2.1. Linear or Symmetric Theory

Linear or symmetric growth theory relationships, whose exponents include: Gisser(1985), Goodwin (1985), Hooker (1986), and Laser (1987). They theorized that the relationship which exists between the prices of oil and the real sector is a linear negative one, especially for countries that import oil. This means that an unanticipated increase in the real price of oil will cause aggregate revenues to drop by the same quantity, also if an unexpected decline in the real price occurs aggregate output will increase by the same quantity. They transition their theory based on the oil market experiences between 1948 and 1972 and their impact on the oil-exporting and importing countries' economies, respectively. Hooker (2002) confirmed that the level of oil prices between 1948 and 1972 and its changes had a significant influence on GDP growth. Laser (1987), also validates the symmetrical relationship between the volatility of the oil price and economic growth. After their empirical study, they submitted that a rise in oil prices necessitates a decrease in GDP, while the effect of a drop in oil prices GDP is unclear, as its effects varied in different countries. By the mid-1980s, admittedly, the projected linear relationship between oil prices and real activity began to lose significance. For example, in the second half of the 1920s, declines in oil prices were found to have a reduced positive effect on economic activity than linear models predicted. The misrepresentation of the linear specification has led to various attempts to redefine the measure. Lee *et al.*, (1995) and Hamilton (1996) and some other researchers thereby introduced non-linear oil price transformations, thus establishing an asymmetric relationship between oil prices and economic growth (Killen and Vigfusson, 2011).

2.2.2 Asymmetric Theory

The basis for the asymmetric reaction of real output to oil price innovations centers on the existence of additional indirect effects of unanticipated fluctuations in the real price of oil on microeconomic performance. Lee et al. (1995) held that GDP 's reaction to an oil price shock depends heavily on the oil market stabilization climate. In a price-stable environment, an oil price shock is likely to have greater effects on GDP than one in a price- volatile environment. Therefore, they suggest a formula that takes into account the fluctuations in oil markets, the result shows an asymmetric impact of positive and negative changes in oil prices. To differentiate between variations in the price of oil and oil price volatility, they posited that volatility has a negative and significant impact on economic growth immediately, while the impact of oil price variations delays until after a year. This suggests that oil volatility rather than the oil price level has a significant influence on economic growth. Hamilton (1996) submits that it is more fitting to juxtapose the current oil price with that of the previous year, rather than the previous quarter. Hence, they recommend a new measure such as the net oil price increase (NOPI), which also restores the negative relationship between GDP and oil-price increases.

2.2.3 Purchasing Power Parity Theory

In 1981, Guster Cassel propounded the principle of purchasing power parity. In an attempt to respond to demand a new exchange rate determination process arising from the failure of the fixed exchange rate system, the purchasing power parity principle is popularised. The theory proposes that the movement of demand and supply forces essentially dictates the exchange rate between two currencies. In general, the principle notes that if each currency pair is set at equal, then the exchange rate difference will represent deviations resulting from the relative currency's purchasing power compared to the base exchange rate (Ibenta, 2012). The price of Toyota Vehicles will be sold on the Nigerian and South African markets at the same level (after exchange rate adjustment). If Toyota Vehicle's price is lower in Nigeria, then buyers will buy Honda Vehicle in South Africa as long as it is cheaper (bearing in mind transport costs). This will lead to a fall in demand in Nigeria and a rise in demand in South Africa. From this explanation, an appreciative exchange rate (domestic currency versus foreign currency) will stimulate economic growth as demand for goods and services would increase production, eventually leading to an increase in gross domestic product. The principle of purchasing power parity has changed over time and has usually been embraced in deciding the exchange rate of two currencies by international financial market operators.

2.3 Empirical Review

A lot of studies have been carried out to investigate the relationship between oil price volatility and currency fluctuation in Nigeria, South Africa, and the rest of the world. A few of the related literature is reviewed in this section.

Okolo and Udabah (2019) investigated the dynamics of the price of crude oil and the volatility of the exchange rates, and the impact of this volatility on living costs in Nigeria. Accordingly, the analysis offers two main innovations: It adjusts the modeling of the structural equation to include the three-stage Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model; it also made use of the methodology to uniquely calculate the significance of simultaneous paths from Bonny Light crude oil price predictors through the Naira exchange rate relative to the US dollar. The study found that the price of crude oil and volatilities in the exchange rate did not substantially move through Nigeria's consumer price index. Furthermore, it demonstrates that information is a significant determinant of potential volatility.

The oil price-exchange rate nexus for Nigeria was investigated by Muhammad and Kouhy (2012) using daily data for the period 2 January 2007–31 December 2010 The generalized autoregressive conditional heteroscedasticity (GARCH) and the exponential GARCH models are used to analyze the effect of the nominal exchange rate on oil price fluctuations. The findings of this analysis indicate that an increase in oil prices findings in depreciation of Nigerian Naira in relation to the US dollar over the study period

Ogundipe and Ogundipe (2013) analyzed the impact of oil prices, foreign reserves and interest rates on the fluctuations of exchange rates in Nigeria using annual data for the period 1970-2011. The econometric measures adopted include root unit checks, co-integration technique with Johansen, and the Vector Error Correction Model (VECM). The long-run relationship between the variables was established using the Johansen Cointegration procedure, while the vector correction mechanism was also used to analyze the adjustment speed of variables between the short-run dynamics and the long-run. It was found that a proportionate increase in the price of oil results in a more than proportionate change in the instability of the exchange rate in Nigeria; this means that the exchange rate is vulnerable to changes in the price of oil.

The impact of oil price volatility, foreign exchange demand, and external reserves on exchange rate volatility in Nigeria were analyzed by Englama et al (2010), using monthly data for the period 1999:1 to 2009:12. The authors used the cointegration technique and the vector error correction model (VECM) for long-run and short-run analyses, respectively, regarding Jin (2008). The findings showed that a permanent 1.0 percent rise in oil prices on the foreign market raises the volatility of the exchange rate in the long run by 0.54 percent, while in the

short run it decreases by 0.02 percent. Furthermore, a permanent 1.0% rise in demand for foreign exchange raises the volatility of the foreign exchange rate by 14.8% in the long run. The study reaffirmed the positive correlation between demand for foreign exchange and oil price fluctuations with exchange rate movements and therefore recommends that demand for foreign exchange is closely monitored and that the exchange rate shift in tandem with the fluctuations in crude oil prices, given that Nigeria remains an oil-dependent economy.

Fowowe (2014) conducted an empirical study of the South African connection between oil prices and exchange rates. They modeled volatility and jumps in exchange rate returns using Chan and Maheu's GARCH autoregressive conditional jump strength model, which predicts the impact of extreme news events (jumps) in returns. Empirical findings indicate that increases in oil prices have resulted in a depreciation of the South African rand relative to the US dollar.

In South Africa, Niyimbanira (2015) empirically investigated the connection between the price of fuel and the exchange rate. Monthly data were used for the implementation of the cointegration approach for the period of January 2001 through December 2013. The results of the Johansen cointegration test showed no cointegrating equation, suggesting that the sequence had not been cointegrated. Results show that fuel price is influenced by its previous prices for at least two months. Both explanatory variable coefficients (0.541228 and -0.368649) show that, due to its previous two-month prices, the fuel price will increase by 20 cents Rand. The results of the impulsive test confirmed the VAR test showed evidence that during the last one sub-period, there was a causal link between the exchange rates and the petrol price. The inference, therefore, is that an increase in the fuel price in South Africa is a response to the fluctuations in the Rand value ceteris paribus.

Oil Price Volatility and Exchange Rate Nexus, Evidence from the Rest of the World

Qiang Ji *et al.,* (2020) examined the impact of various oil shocks on the real exchange rates in net oil importers and exporters. Specifically, the measurement of the relationships are paired with the structural vector autoregressive model. The analysis indicate that fluctuations in oil supply have a greater depreciating effect on oil exporters' exchange rates than importers do. All countries are generally more sensitive to oil-specific demand shocks and this sensitivity can lead to a significant appreciation of real exchange rates, except in Japan and the UK. Moreover, since the global financial crisis of 2007–08, the spillover impact between oil shocks and exchange rates has increased. The survey includes three oil importers (India, Japan, and South Korea) as well as three oil exporters [Canada, Norway, and the UK]. The data covered the period from February 1974 to December 2016, except for the South Korean example, where data is only available from April 1981.

Abed et al (2016) examined exchange rate fluctuations in oil prices in the MENA region, a market with oil importers and exporters alike. For the period 2001-2015, the investigation employed the GJR- GARCH model to draw inferences using regular prices. The findings show that the relationship between oil price shocks and exchange rates is significant. Also, oil exporter exchange rates were observed to reinforce as oil prices increased while oil importers enjoyed the exchange rates as oil prices dropped. This led them to conclude that, when modeling for exchange rate movement and volatility, the oil price is an important variable to consider.

Mantai and Alom (2016) analyzed the short- and long-term impacts of the price of crude oil (CP), the exchange rate (EXR), and inflation (CPI) on Malaysia's economic activity (GDP) under the Vector Error Correction Model (VECM). The findings indicate that CPI in the short run has a positive effect on GDP, and the tests do not find any major impacts of EXR and CPI on GDP. All of these variables nonetheless maintain a long-term relationship with GDP. The causality tests showed the unidirectional causality of Granger, which runs from CP to GDP and not from EXR and CPI to GDP.

Mensah *et al.,* (2016) explored the position of the global crude oil price on Ghana's (new oil-producing) exchange rate (EXR) and gross domestic product (GDP) using the Johansen modeling technique for the period 1980–2013. Following the co-integration of the variables, the vector error correction model was developed which revealed that oil prices could increase GDP growth by 3%, but could have a long-term negative impact on the EXR. The short-term study pointed to the Granger causality of energy consumption from oil prices and GDP. It

further showed causality from oil price and EXR to GDP, indicating that both developed in the global oil price and currency performance would impact economic growth. No clear evidence of the function of oil prices in EXR volatility was found; however, by the appreciation of EXR, the syndrome of 'Dutch disease' was apparent. Also, GDP's overall response to oil price shocks for the forecast period is fractionally positive even though oil price shock tends to slow economic expansion in the first 3 years.

Brahmasrene *et al.,* (2014), assessed the US imported crude oil prices and exchange rates to establish the causal relationship between the two variables between January 1996 to December 2009. The study established that exchange rates Granger-caused the price of crude oil in the short run while crude oil prices Granger-caused exchange rates in the long run. They employed panel co-integration and variance decomposition models to arrive at their conclusion.

Turhan et al (2012) investigated the dynamic link between oil prices and exchange rates of 13 emerging economies all constituent members of Emerging Markets Bond Index (EMBI+). The hypothesis used was based on income theory using Petro-dollar flows between oil exporters and the rest of the world. They postulated that high oil prices would benefit emerging markets more as flows of Petro-dollars to these economies were expected to be higher. Using VAR and Generalized impulse response, the study concluded that a spike in oil price leads to the strengthening of currencies in developing economies against the US Dollar.

Aziz (2009) using a simple model developed by Meese and Rogoff (1988) to examine links between the price of oil and real exchange rate for five oil-importing and three oil-exporting countries observed a strong positive relationship for the oil importers but relatively weak for the exporting countries, the countries in question were Japan, Pakistan, South Africa, Ivory Coast, Switzerland, Canada, Denmark, and Malaysia. Three tests were used in their analysis; Mean Group (MG), Dynamic Fixed Effect (DFE), and Pooled Mean Group (PMG) tests. The results from the three tests were diverse and therefore they centered on the PMG results. The PMG results confirmed support of the positive effects of real oil prices on the real exchange rate.

Jin (2008) conducted a comparative analysis on the effect of oil price shock and exchange rate volatility on economic growth and observed that rising oil prices have a negative impact on China and Japan's economic growth and a positive impact on Russia 's growth. Precisely, a 10-per-cent rise in foreign oil prices was found to be correlated with a 5.16-per-cent increase in Russia's Economic output and a 1.07-per-cent decrease in Japan GDP Growth. On the one hand, real exchange rate appreciation had a positive relationship with Russia's GDP and a negative relationship with Japan's GDP Growth.

Rafiq *et al.,* (2008) used the VAR system and Granger Causality tests to examine the effect of oil prices on major macroeconomic variables of Thailand. For the period 1993-2006, they found a significant impact on variables like unemployment and investment. However, their investigation for the post-Asian Financial Crisis period (1997-1998) showed that the volatility of oil prices has affected the budget deficit. They suggest that this may have been influenced by the transition to the floating exchange rate regime.

Chen and Chen (2007) maintained that oil prices may be responsible for the real exchange rate movements for a panel study of G7 countries. They found a positive link between the two variables.

Akram (2002) used several models in trying to probe the oil price-exchange rate relationship for the Norwegian economy for the period 1998-2000. The model with non-linear oil price effects showed the strongest explanatory abilities during sharp currency devaluations compared to a random walk model and a linear model.

2.4 Conclusion

This chapter commenced with an overview of the economies of both countries highlighting the important macroeconomic variables. The trend analysis of some variables of interest such as exchange rate, inflation rate, foreign direct investment, and economic growth was discussed thoroughly. The trend analysis was done comparatively, as the macroeconomic indicators considered were compared between Nigeria and South Africa. Suitable theories on oil prices and currency were extensively discussed to lend theoretical support for this study. Furthermore, relevant literature from reputable journals was also reviewed.

Several studies related to the theme of this study were carefully reviewed to form a basis for the structure of this research work. However, this study will take a different turn as it incorporates the idea of adopting the Autoregressive Distributed Lag (ARDL) to establish the short-run and long-run relationship between the oil price changes, currency volatility and the domestic economies of both Nigeria and South Africa. This method is seemed fit aside from employing the Ordinary Least Squares, to understand the impact analysis between oil price changes and currency volatility. It is important to state that most of the cross-country examination conducted (Chen and Chen (2007); Jin (2008); Aziz (2009); Abed et al (2016)) did not include the cases of Nigeria and South Africa, which are unarguably the biggest economies in Africa. This study, however, observed the economic climate of Nigeria and South Africa as its case study. Suffice to state that Nigeria and South Africa are both oil-exporting and oil-importing, which makes for a dynamic investigation.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The preceding chapters have laid the building blocks for the study by reviewing the various concepts relevant to the subject matter, the most suitable and appropriate theories and the empirical findings of previous related studies. This particular chapter is, however, devoted to giving a detailed description of the methodology that underlies this study, which in turn gives direction to the subsequent chapters. Following this introductory section, the present chapter further contains three sections. Section 3.2 reveals the research philosophy, design and approach, section 3.3 deliberates specification issues and the suitable models to be estimated as far as the relationship between currency volatility and oil price changes is concerned. Section 3.4 focuses on the method of data estimation; section 3.5 captures the data sources and section 3.6 captures the conclusion of the chapter

3.2 Research Philosophy, Design and Approach

Research philosophy implies the idea of how to collect, evaluate, and interpret data about a phenomenon. Research philosophy deals with the way things are perceived in the world. According to Ryan (2019), Positivism, realism, interpretivism, and pragmatism are given as the types of research philosophy that is obtainable. Positivists assume that truth is stable and can be evaluated and determined from an objective perspective, without conflicting with the hypothesis considered. For this study, the positivism research philosophy seems appropriate.

3.2.1 Research Approach

The two major conventional methods of analysis are the quantitative and qualitative approaches. It is important to state that there is a combination of a quantitative and qualitative approach referred to as a deductive or inductive method (Cresswell, 2009). Usually, the approach selected in a study is determined by the research objectives and questions. For the empirical investigation of oil price changes and currency volatility in Nigeria and South Africa, the quantitative approach was adopted.

3.2.2 Research Design

The nature and objectives of this research work make it appropriate to adopt the longitudinal research design. A longitudinal study is defined as a research design requiring repeated measurements of the same variables over short or long periods (e.g., using longitudinal data).in essence, longitudinal studies employ repeated or continuous. Measures to be taken over extended by individuals. Term spans-sometimes years or decades. They are usually of a quantitative and/or qualitative kind, observational.

3.3 Model Specification

This section of the chapter expands on the hypothesized nature of the relationship between currency volatility and oil price changes. The models in this work are specified in accordance with the set objectives and goals in the first chapter of this research work. With respect to this, various relationships (positive as well and negative) have been observed to be relevant to this study. The model specifications according to these relationships established are given below;

3.3.1 The Oil Price-Currency Volatility Nexus

For the Nigerian case we have;

Following the model adopted in the study of Mohammed (2019) on 'oil price and exchange rate nexus-evidence from Nigeria', the model is specified thus

CU_Vol = f(OLP)----------(1)

The model is represented econometrically as;

$$\boldsymbol{CU\_Vol_t = \alpha_0 + \alpha_1 OLP_t + \varepsilon_t} \quad (\mathbf{2})$$

For the South African case we have;

$$\boldsymbol{CU\_Vol_t = \vartheta_t + \vartheta_1 OLP_t + \mu_t} \quad (\mathbf{3})$$

Where $\boldsymbol{OLP_t}$ is the oil price changes in time (t) for both Nigeria and South Africa

$\boldsymbol{CU\_Vol_t}$ is the currency volatility in time (t) for both Nigeria and South Africa

$\boldsymbol{\alpha_0 \; and \; \alpha_1}$ are the intercept and the parameter for the Nigeria model respectively

$\boldsymbol{\vartheta_0 \; and \; \vartheta_1}$ are the intercept and the parameter for the South African model respectively

$\boldsymbol{\varepsilon_t \; and \; \mu_t}$ are the error terms for Nigeria and South Africa respectively

The equations (1) and (2) above are specified to reveal the impact of oil price changes on currency volatility in Nigeria and South Africa.

3.3.2 The Oil Price, Currency Volatility and Economic Growth Nexus

This model specification is aimed at testing the relationship of the variables used in this study with the economic output (economic growth is measured by the growth of GDP) of both countries.

For Nigeria we have;

$$\boldsymbol{ECG_t = \alpha_0 + \alpha_1 CU\_Vol_t + \alpha_2 OLP_t + \alpha_3 FDI_t + \varepsilon_t} \quad (\mathbf{4})$$

The model for the South African is as follows

$$\boldsymbol{ECG_t = \vartheta_0 + \vartheta_1 CU\_Vol_t + \vartheta_2 OLP_t + \vartheta_3 FDI_t + \mu_t} \quad (\mathbf{5})$$

Where $\boldsymbol{ECG_t}$ is the economic growth or the growth in the GDP of both Nigeria and South Africa.

$\boldsymbol{OLP_t}$ is the oil price changes in time (t) for both Nigeria and South Africa

CU_Vol_t is the currency volatility in time (t) for both Nigeria and South Africa

FDI_t is the foreign direct investment in time (t) for both Nigeria and South Africa

$\alpha_1 \; to \; \alpha_3$ are the parameters for the Nigeria model

$\vartheta_1 \; to \; \vartheta_3$ are the parameters for the South African model

$\alpha_0 \; and \; \vartheta_0$ are the intercepts or constants for the Nigerian and South African model respectively

$\varepsilon_t \; and \; \mu_t$ are the error terms for the Nigerian and South African Model respectively

The equations (4) and (5) above are specified to reveal first, cointegration, and secondly, the short-run and long-run estimates of economic growth, Foreign Direct Investment, oil price changes and currency volatility in Nigeria and South Africa.

3.4 Method of Data Estimation

Before the estimation test, it is imperative to carry out a test revealing the properties of the data involved in this work. The properties of these data are essential in ensuring their suitability for the method of estimation that will be employed. Prominent among the pre-estimation tests is the unit root test.

3.4.1 Augmented Dickey-Fuller Test for Unit Root

This test is employed to check for the presence of a unit root in the variable i.e. whether the variable is stationary or not. The presence of unit root means the variable is not stationary. The stationarity property of the series ensures that the result of the void of spurious regression. When a variable is not stationary, it leads to spurious regression. A spurious regression makes the result uninterpretable which necessitates testing for the presence of unit root before an estimation test. It is also used to determine the order of a variable 's integration, i.e. how many times it needs to be differentiated or not stationary. The null hypothesis is, there is no root unit. This research is conducted using an estimation technique from the Augmented Dickey-Fuller (ADF)

3.4.2 Estimation
ARDL

The ARDL is one of vector autoregression (VAR) variants, and in most cases, the pre-testing of unit roots as can be obtained in many other techniques is not required for co-integration. The ARDL Co-Integration Technique is in this context very preferred for series integrated from different orders I (0), I (1) or combinations of the two, and reliable when the underlying series have a single long-lasting relationship in a small sample size. The F-statistic identifies the long-term relationship of the underlying sequence. The main strength of this strategy is that it recognizes the vectors which co-integrate in multiple vectors. The drawback is that in cases in which the sequence is combined in order (2) this technique is defective. It is worth checking the stationarity of the series to avoid working on a series that is I(2), which ultimately results in the inefficiency of the method (Nkoro and Uko, 2016).

This research work as pointed out in the first chapter of this study focuses on Causality and the long-run relationship between oil price changes and currency volatility. The adoption of a suitable methodology will be tailored towards achieving both the broad and the specific objectives of the study. To comprehensively analyze the quantitative data to be used for this study; the Auto-Regressive Distributed Lag (ARDL) bounds testing approach is adopted essentially to estimate models (4) and (5). The ARDL will be used to determine both the short run and the long-run relationship of the models. The long-run relationship is also referred to as cointegration. Also, the models (2) and (3) will be analyzed using the Ordinary Least Squares (OLS) regression analysis. The OLS will show the impact of the oil price changes on currency volatility.

3.4.3 Granger Causality Test

To investigate the causality between oil price changes and currency volatility, the Granger causality test is adopted. In a simple term, given variable y_t and x_t, y_t granger-cause x_t if x_t can be better predicted using the histories of both y_t and x_t then it can by using the history of x_t alone. This is shown below;

$$y_t = \alpha_1 + \sum_{i=1}^{k} \beta_{i1} y_{t-i} + \sum_{i=1}^{k} \delta_{i1} x_{t-i} + \varepsilon_{it}$$

$$x_t = \alpha_2 + \sum_{i=1}^{k} \beta_{i2} y_{t-1} + \sum_{i=1}^{k} \delta_{i2} x_{t-i} + \varepsilon_{it}$$

There are three possibilities to granger causality, which includes;

Unidirectional Causality, where only one of the groups is statistically significant;

$$y_t \rightarrow x_t; \sum_{i=1}^{k} \beta_{i2} \neq 0, while \sum_{i=1}^{k} \delta_{i1} = 0$$

or

$$x_t \rightarrow y_t; \sum_{i=1}^{k} \delta_{i1} \neq 0, while \sum_{i=1}^{k} \beta_{i2} = 0$$

Bidirectional Causality, where at least two groups are statistically significant;

$$x_t \leftrightarrow y_t, such that \sum_{i=1}^{k} \beta_{i2} \neq 0 and \sum_{i=1}^{k} \delta_{i1} \neq 0$$

Non-causality, where none of the groups is statistically significant;

$$\sum_{i=1}^{k} \beta_{i2} = \sum_{i=1}^{k} \delta_{i1} = 0$$

The null hypothesis for the causality test is that there is Granger non-causality in the model

3.5 Data Sources

The data used for this research work are mainly from secondary sources. For the models (2) and (3), monthly data for oil price (Brent) was sourced from US Energy Information Administration (EIA), and the exchange rate was sourced from World Development Indicators (WDI). For models (3) and (4), annual data on Financial development (FID) for Nigeria and South Africa were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin and South African Reserve Bank (SARB) correspondingly.

3.6 Conclusion

This chapter thoroughly dealt with the methodology adopted for this study. This chapter was able to chapter the research philosophy, design, and approach. The model specification which lent support to the research objectives of this study was similarly discussed. In an attempt to achieve the goals of this study. The OLS and ARDL were adopted as suitable techniques of estimation. The OLS and ARDL techniques of estimation were to be preceded by the Augmented Dickey-Fuller Unit root test in a bid to avoid spurious regression.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.0 Introduction

Chapter three revealed extensively the methodology adopted for this study and serves as the framework for the focus of this current chapter. This chapter will concentrate on the presentation of the empirical results and analysis. In this chapter, an empirical analysis of the models presented in the immediate previous chapter is conducted and the results will be interpreted accordingly. This chapter, thus, consists of the presentation, analysis, and discussion of the results of the study. It effectively seeks to examine the empirical evidence on oil price changes and currency volatility in Nigeria and South Africa.

4.1 Descriptive Analysis

Table 4.1: Summary of Statistics for the variables in the Nigerian Model

	NG_ECG (%)	NG_FDI (% of GDP)	NG_CU (NAIRA/USD)	OIL_P(USD)
Mean	4.627476	1.767096	115.2871	48.65345
Median	5.015935	1.608284	125.8081	38.26000
Maximum	15.32916	5.790847	306.0837	111.6300
Minimum	-2.03512	0.502803	8.038285	12.76000
Std. Dev.	4.031869	1.184241	83.09229	32.86173
Skewness	0.376711	1.916433	0.576691	0.698380
Kurtosis	3.246405	6.885034	2.996246	2.134584
Jarque-Bera	0.759268	35.98943	1.607452	3.262357
Probability	0.684112	0.000000	0.447658	0.195699
Sum	134.1968	51.24577	3343.326	1410.950
Sum Sq. Dev.	455.1672	39.26793	193321.2	30237.02

Author's Computation Using Eviews 10

Table 4.2: Summary of Statistics for the South Africa Model

	SA_ECG (%)	SA_FDI (% of GDP)	SA_CU (ZAR/USD)	OIL_P(USD)
Mean	2.293882	1.236228	7.363552	48.65345
Median	2.600002	0.803047	7.045365	38.26000
Maximum	5.603798	5.983101	14.70961	111.6300
Minimum	-2.13706	-0.06553	2.587321	12.76000
Std. Dev.	2.009398	1.294343	3.375013	32.86173
Skewness	-0.41195	1.912742	0.495660	0.698380
Kurtosis	2.609340	7.316032	2.487221	2.134584
Jarque-Bera	1.004633	40.19214	1.505168	3.262357
Probability	0.605127	0.000000	0.471147	0.195699
Sum	66.52259	35.85060	213.5 430	1410.950
Sum Sq. Dev.	113.0551	46.90907	318.9400	30237.02

Author's Computation Using Eviews 10 (Statistical Package)

Mean is the average value of the series which is obtained by dividing the total value of the series by the number of observations. From the Table 4.1, the mean for Economic growth (ECG), Foreign Direct Investment (FDI), Currency (CU), and Oil price (Oil_P) are 4.627476%, 1.767096%, 115.2871 and 48.65345 respectively.

From the Table 4.2, the mean for Economic growth (ECG), Foreign Direct Investment (FDI), Currency (CU), and Oil price (Oil_P) are 2.293882, 1.236228, 7.363552 and 48.65345 accordingly.

Median is the middle value of the series when the values are arranged in ascending order. From Table 4.1 the median for ECG, FDI, CU, and Oil_P are 5.02, 1.61, 125.80, and 38.26 respectively.

For Table 4.2, the median for ECG, FDI, CU, and Oil_P are 2.600002, 0.803047, 7.045365, and 38.26000 respectively.

Maximum and minimum values are the highest and lowest values of the series in the sample. The maximum and minimum values for ECG, FDI, CU and Oil_P in Table 4.1 are 15.32916 &-2.03512, 5.790847& 0.502803, 306.0837 &8.038285 and 111.6300 & 12.76000 respectively.

In Table 4.2, maximum and minimum values for ECG, FDI, CU and Oil_P are 5.603798 & -2.13706, 5.983101&-0.06553, 14.70961&2.587321 and 111.6300 & 12.76000.

4.2 Inferential Analysis

The inferential analysis is carried out with the aid of the estimation technique such as Ordinary Least squares (OLS) and the Autoregressive distributed Lags (ARDL). While the OLS is adopted to show the impact analysis of oil price on currency volatility, the ARDL is employed here to reveal the short run and the long-run estimate of the models adopted for this study. The OLS and the ARDL estimation are preceded by a pre-estimation test to make sure that the variables are stationary. The pre-estimation test is essentially conducted to avoid getting a spurious regression result.

4.2.1 ADF Unit Root Test

Table 4.3: Augmented Dickey-Fuller (ADF) Test for Unit Root Test (Nigerian Model)

Variables	Level	First Difference	Test Equation	Significance	Optimal Lag length	Order of integration
ECG	*-1.034447 (0.7307)*	*-6.036228 (0.0001)****	*Constant, linear trend*	*1%*	*0*	*I(I)*
CU	*-0.175213 (0.6162)*	*-6.667234 (0.0000)****	*Constant*	*1%*	*0*	*I(1)*
FDI	*-3.888477 (0.0229)***	*-5.073878 (0.0011)****	*Constant and linear trend*	*1%*	*0*	*I(0)*
Oil_P	*-4.131074 (0.0026)****	*-9.942482 (0.0000)****	*Constant*	*1%*	*0*	*I(0)*

Author's Computation Using Eviews 10

Table 4. 4 Augmented Dickey-Fuller (ADF) Test for Unit Root (South African Model)

Variables	Level	First difference	Test equation	Significant level	Optimal Lag length	Order of integration
ECG	-4.263056 (0.1451)***	-8.063534 (0.0001)***	Constant	1%	0	I(1)
CU	-1.684173 (0.2572)***	-5.512115 (0.0000)***	No constant and trend	1%	0	I(1)
FDI	-2.352340 (0.4423)***	-4.891838 (0.0000)***	Constant and trend	1%	1	I(1)
Oil_P	*-4.131074 (0.0026)***	*-9.942482 (0.0000)***	*Constant*	*1%*	*0*	*I(0)*

Author's Computation Using Eviews 10

The ADF, which is conducted against the null hypothesis that the data variables have a unit root or are not stationary requires the test statistic derived from an estimation of the test equation to be greater than the critical values obtained from the Dickey-Fuller or Mackinnon tables when all figures are taken in absolute terms if the null hypothesis is to be rejected.

Table 4.3 shows that ECG and CU are stationary at first difference (that is after the series were differenced once) while FDI and Oil_P are both stationary at level. Therefore, ECG and CU are integrated of order one I (1), while FDI and Oil_P are integrated of order zero I (0). The series were all stationary at 5% significant level.

Table 4.4 reveals that ECG, CU, and FDI are stationary at the first difference (that is after the series were differenced once) whereas Oil_P is stationary at level. Thus, ECG, CU, and FDI are integrated of order one I(1) while Oil_P is integrated of order zero I (0). The result of the experiment for the Nigerian and South African Models implies that there are mixtures of degrees of integration (order zero and order one) which will necessitate the use of the Autoregressive distributed lag, which is also known as bounds cointegration test.

Table 4.5: OLS-Nigerian Model

Dependent Variable: NG_CU				
Method: Least Squares				
Sample: 2008M01 2019M12				
Included observations: 144				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
OIL_P	-1.453845	0.186157	-7.809791	0.0000
C	316.4579	15.59264	20.29534	0.0000
R-squared	0.300468	Mean dependent var		79.49951
Adjusted R-squared	0.295542	S.D. dependent var		26.46833
F-statistic	60.99283	Durbin-Watson stat		0.089735
Prob(F-statistic)	0.0000			

Author's Computation Using Eviews 10

In discussing the result obtained from the OLS, interest will be on the coefficients of the variables, its signs, and the magnitudes. Also, interest is also on the significance of the variable's coefficients by checking the corresponding P-values. Of importance also is to know whether the model is of good fit or not; likewise, is to know whether the model as a whole is significant using statistical criteria.

The parameter estimate of Oil_P shows a value of -1.453845 signifying that it has a negative relationship with the Nigerian Naira. This implies that a percentage increase in Oil price will lead to a 1.4% decrease in the volatility of the Nigerian Naira. The probability value of the coefficient is 0.000 which means that the relationship between currency volatility and oil price change is highly significant at all critical values (1%, 5%, and 10%).

The R^2 of the model explains the percentage variation in the model that is accounted for by the changes in the independent variable(s) shows a value of 0.300468. This implies that 30% variation in the Nigerian Naira's volatility is explained by the changes in world oil price while the remaining 70% is accounted for by the stochastic error term that is, variable(s) that explain currency volatility that is not included in the model.

The probability (F-statistic) describes the overall significance of a given model. The F-Statistic shows a value of 0.0000. This shows that the model is of good fit since the f-statistic value is significant at 5%. This means that the independent variable is relevant in explaining the dependent variable.

Table 4.6: ARDL Cointegration Test

ARDL Bounds Test			
Date: 07/23/20 Time: 19:34			
Sample: 1991 2018			
Included observations: 28			
Null Hypothesis: No long-run relationships exist			
Test Statistic	Value	Parameter	
F-statistic	**5.220716**	3	
Critical Value Bounds			
Significance	Lower Bound	Upper Bound	
10%	2.45	**3.52**	
5%	2.86	4.01	
1%	3.74	5.06	

Author's Computation Using Eviews 10

The ARDL bounds test is generally conducted in the null hypothesis form, which indicates there is no cointegration. It comprises the following procedure: Testing the long-run relationship among the variables; estimation of the long run and short-run coefficients of the variables.

The decision rule of the F test is determined by the critical values to which the F-statistic value is compared. The lower critical values are based on the assumption that all the explanatory variables are integrated of order zero, whereas the upper critical values assume that the explanatory variables are integrated of order one (Pesaran et al., 2001). The decision rule for the F test is stated below:

1. Reject the null hypothesis of no cointegration if the F statistic is greater than the upper critical value;
2. Do not reject the null hypothesis of no cointegration if the F statistic is lesser than the lower critical value;
3. If the F statistic lies between the two critical values, then the decision can only be made if the orders of integration of the underlying explanatory variables are known[13]

Checking for the existence of a long-run relationship between Economic growth, Oil price changes and currency volatility, the result showed that F-statistics **(5.22)** is greater than the upper bound value at 5% level of significance; **3.52**. With the F-stat greater than the upper bound, we reject the null hypothesis of no long-run relationship. Therefore, we accept the alternative hypothesis of the existence of a long-run relationship between Economic growth, Oil price changes, and currency volatility. Since there are a long-run relationship between Economic growth, Oil price changes, and currency volatility; we can, therefore, estimate the long run and short-run models.

[13] Pesaran, M.H., Shin, Y. and Smith, R.J. Bounds testing approaches to the analysis of level relationships. J. Appl. Econometrics 16, 289–326. (2001)

ARDL Cointegrating And Long Run Form

Table 4.8: Short Run Estimate

Dependent Variable: NG_ECG				
Selected Model: ARDL (1, 0, 0, 0)				
Sample: 1990 2018				
Included observations: 28				
Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NG_FDI)	-0.42294	0.608383	-0.69519	0.4939
D(OIL_P)	0.02519	0.026287	0.958282	0.3479
D(NG_CU)	-0.00279	0.010725	-0.26007	0.7971
CointEq(-1)	**-0.60974**	0.177092	-3.44309	0.0022

Author's Computation Using Eviews 10

Table 4.9: Long Run Estimate

Dependent variable: NG_ECG				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
NG_FDI	-0.69364	1.021093	-0.67931	0.5037
OIL_P	0.041313	0.041216	1.002359	0.3266
NG_CU	-0.00457	0.017465	-0.26192	0.7957
C	3.887899	3.17257	1.225473	0.2328

Author's Computation Using Eviews 10

Tables 4.8 and 4.9 above show the short run and long-run estimates respectively. In the short run, it is revealed that aside from Oil_P which has a positive relationship with ECG, the other independent variables FDI and CU have a negative relationship with Economic growth in Nigeria. This result is also what is obtainable in the long run, only oil price changes have a positive relationship with economic growth.

In the short run, foreign direct investment has a coefficient of -0.42294, implying a negative relationship with economic growth. It, therefore, means that all other things being equal, a percentage increase in FDI will reduce economic growth by 42.3% and vice versa. This implies that FDI inflow has not translated to economic growth in Nigeria.

The negative relationship between FDI and ECG is observed not to be significant at 5% (0.4939), this points to the fact that FDI has not translated to economic growth in Nigeria. In the long run, the estimate shows a value of -0.69364, also implying an inverse or indirect relationship between FDI and ECG in Nigeria. Therefore, a percentage increase in FDI will result in a 69.3% reduction in ECG, holding all other factors constant.

As the coefficient of oil price changes shows a value of 0.02519. This implies that there is a direct or positive relationship between oil price changes and economic growth in Nigeria. A percentage increase in oil price will increase economic growth by 2.5%. The result showed a P-Value of 0.3479 (greater than 0.05), implying that the relationship between oil price and economic growth is not significant in the short run. In the long run, with a coefficient value of 0.041313, a one percent increase in oil price will increase economic growth by 0.004%, all other things being equal. The long-run relationship is not significant.

The coefficient of currency volatility shows a value of -0.00279 in the short run. This implies that there is a negative or indirect relationship between currency volatility and economic growth in Nigeria. A percentage increase in currency volatility will reduce economic growth by 0.27%. The result showed a P-Value of 0.7971, implying that the relationship between currency volatility and economic growth is insignificant at 5%. In the long run, the coefficient of currency volatility shows a value of -0.00457 indicating a negative and an inverse with economic growth in Nigeria. A percentage increase in oil prices will reduce economic growth by 0.45%. The long-run relationship is observed to be insignificant at 5%.

The coefficient of co-integration is equal to -0.60974 implying that in each period approximately 61 percent of shocks can be justified as a long-run trend. It further explains that deviations in the economic growth of Nigeria from the equilibrium are corrected 61 percent within a given year.

SOUTH AFRICA

Table 4.10: OLS Estimation for South Africa

Dependent Variable: SA_CU				
Method: Least Squares				
Sample: 2008M01 2019M12				
Included observations: 144				
Variable	Coefficient	Stand Error	t-Statistic	Prob.
OIL_P	0.278757	0.037086	7.516468	0.0000
C	89.73426	3.106365	28.88722	0.0000
R-squared	0.284625	Mean dependent var		79.49951
Adjusted R-squared	0.279587	S.D. dependent var		26.46833
F-statistic	56.4973	Durbin-Watson stat		0.089166
Prob(F-statistic)	0.0000			

Author's Computation Using Eviews 10

From Table 4.10, the parameter, estimate of Oil_P shows a value of 0.278757 signifying that it has a positive or direct relationship with the South African Rand. This implies that a percentage increase in Oil price will lead to a 0.27% increase in volatility of the South African Rand. The probability value of the coefficient is 0.000 which means that the relationship between currency volatility and oil price change is highly significant at all critical values (1%, 5%, and 10%).

The R^2 of the model explains the percentage variation in the model that is accounted for by the changes in the independent variable(s) shows a value of 0.284625. This implies that 28% variation in the South African Rand's volatility is explained by the changes in world oil price while the remaining 72% is accounted for by the stochastic error term that is, variable(s) that explain currency volatility that are not included in the model.

The probability (F-statistic) describes the overall significance of a given model. The F-Statistic shows a value of 0.0000. This shows that the model is of good fit since the f-statistic value is significant at 5%. This means that the independent variable is relevant in explaining the dependent variable.

Table 4.11: ARDL Bounds Cointegration Test

Test Statistic	Value	Parameter
F-statistic	8.775495	3
Critical Value Bounds		
Significance	Lower Bound	Upper Bound
10%	2.72	3.77
5%	3.23	4.35
1%	4.29	5.61

Author's Computation Using Eviews 10

Checking for the existence of a long-run relationship between Economic growth, Oil price changes and currency volatility, the result showed that F-statistics (**8.78)** is greater than the upper bound value at 5% level of significance; **3.77**. With the F-stat greater than the upper bound, we reject the null hypothesis of no long-run relationship. Therefore, we accept the alternative hypothesis of the existence of a long-run relationship between Economic growth, Oil price changes, and currency volatility. As a result of the existence of a long-run relationship between Economic growth, Oil price changes, and currency volatility; we can, therefore, estimate the long run and short-run models.

Table 4.12: ARDL Cointegrating And Long Run Form

Dependent Variable: SA_ECG
Selected Model: ARDL (1, 0, 0, 0)
Sample: 1990 2018
Included observations: 28

Short Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SA_FDI)	0.08176	0.133464	0.612601	0.0062
D(SA_CU)	0.054157	0.09261	0.584789	0.0144
D(OIL_P)	0.006104	0.008945	0.682371	0.5018
CointEq (-1)	**-0.97791**	0.207451	-4.71391	0.0001

Author's Computation Using Eviews 10

Table 4.13: Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SA_FDI	0.083607	0.13652	0.612415	0.0063
SA_CU	0.055381	0.092086	0.601405	0.0135
OIL_P	0.006242	0.009209	0.677801	0.5047
C	0.357937	0.752925	0.475395	0.639

Author's Computation Using Eviews 10

Tables 4.12 and 4.13 above show the short run and long-run estimates respectively. In the short run, it is revealed that all the independent variables have a positive relationship with ECG in South African. This result is also what is obtainable in the long run, all the variables have a positive relationship with economic growth.

In the short run, foreign direct investment has a coefficient of 0.08176, implying a positive relationship with economic growth. It, therefore, indicates that all other things being equal, a percentage increase in FDI will increase economic growth by 8.1% and vice versa. The positive relationship between FDI and ECG is observed to be significant at 5% (0.0062< 0.05), this means that FDI contributes significantly to economic growth in South Africa. In the long run, the estimate shows a value of 0.083607, also implying a positive relationship between FDI and

ECG in South Africa. Therefore, a percentage increase in FDI will result to an 8.3% increase in ECG, holding all other factors constant.

The coefficient of currency volatility shows a value of 0.054157 in the short run. This implies that there is a positive or direct relationship between currency volatility and economic growth in South Africa. A percentage increase in currency volatility will increase economic growth by 5.4%. The result showed a P-Value of 0.0135, implying that the relationship between currency volatility and economic growth is significant at 5%. In the long run, the coefficient of currency volatility shows a value of 0.055381 indicating a positive and a direct relationship with economic growth in South Africa. A percentage increase in oil prices will reduce economic growth by 5.5%. The long-run relationship is also observed to be significant at 5%.

The coefficient of oil price changes shows a value of 0.006104. This implies that there is a direct or positive relationship between oil price changes and economic growth in South Africa. A percentage increase in oil price will increase economic growth by 0.61%. The result showed a P-Value of 0.5018 (greater than 0.05), implying that the relationship between oil price and economic growth is not significant in the short run. In the long run, with a coefficient value of 0.006242, a percentage increase in oil price will increase economic growth by 0.62%. The long-run relationship is not significant.

The coefficient of co-integration is equal to -0.97791 implying that in each period approximately 98 percent of shocks can be justified as a long-run trend. Additionally, the deviations in the economic growth of South Africa from the equilibrium are corrected 98 percent within a given year.

4.3 The Granger Causality Test

Table 4.14: The Granger Causality Tests (Nigerian Model)
Sample: 1990 2018

Null Hypothesis:	Observation	F-Statistic	Prob.	Decision
NG_FDI does not Granger Cause NG_ECG	27	0.88119	0.4284	No causality
NG_ECG does not Granger Cause NG_FDI		0.19493	0.8243	No causality
NG_CU does not Granger Cause NG_ECG	27	0.03752	0.9632	No causality
NG_ECG does not Granger Cause NG_CU		0.27969	0.7587	No causality
OIL_P does not Granger Cause NG_ECG	27	0.52503	0.5988	No Causality
NG_ECG does not Granger Cause OIL_P		0.21147	0.811	No causality

Author's Computation Using Eviews 10

Table 4.15: Granger Causality Tests (Nigerian Model)
Sample: 1990 2018

Null Hypothesis:	Observation	F-Statistic	Probability	Decision
SA_FDI does not Granger Cause SA_ECG	27	0.06312	0.939	No causality
SA_ECG does not Granger Cause SA_FDI		3.63522	0.0432	One-way causality
SA_CU does not Granger Cause SA_ECG	27	1.08864	0.3541	No causality
SA_ECG does not Granger Cause SA_CU		0.25825	0.7747	No causality
OIL_P does not Granger Cause SA_ECG	27	1.18063	0.3258	No causality
SA_ECG does not Granger Cause OIL_P		0.54076	0.5898	No causality

Author's Computation Using Eviews 10

The Granger causality test is conducted to determine the direction of influence and causality between the variables in the VAR model. The causality can either be unidirectional, bidirectional, or may not exist (which implies that the two variables are independent of each other). The test for short-run causality is however carried out using the "Granger causality test" developed by Clive Granger in 1969

The results of the Granger causality test are shown in Table 4.14 and Table 4.15. Examining the causality among the variables in the model, the test results showed that the F-statistics of a causal relationship between economic growth and FDI, economic growth and Oil_P, and economic growth and currency volatility are not significant at all critical levels. We, therefore, accept the null hypothesis and conclude that no causality exists in the Nigerian model.

In the South African model, evaluating the causal relationship between economic growth and FDI. We observe a one-way causality running from economic growth to FDI. This also implies that it is economic growth that Granger causes or predicts FDI and not the other way round. The null hypothesis of no causality was rejected since the F-statistic, 3.63522, is significant at 5% (0.0432<0.05). Aside from the causal relationship between ECG and FDI, no other causal relationship exists.

4.4 Summary of Analysis

The main objective of this study as outlined in the first chapter was to examine the relationship between oil price and currency volatility in Nigeria and South Africa**. S**uffice to state that a few works of literature have been published in this regard but there is still a vacuum left to be filled in terms of conducting a cross country examination on both Nigeria and South Africa. In an attempt to empirically examine this relationship, the study adopted the OLS and the ARDL methods of estimation to understand the short run as well as the long-run interaction between oil price and currency volatility. The Granger causality test was also conducted to comprehend the nature of the causality among the variables in this study. The synopsis of the examined showed that a percentage increase in Oil price will lead to a 1.4% decrease in the volatility of the Nigerian Naira. The probability value of the coefficient is 0.000 which means that the relationship between currency volatility and oil price change is highly significant at all critical values (1%, 5%, and 10%). On the other hand, a percentage increase in Oil price will lead to a 0.27% increase in volatility of the South African Rand. The probability value of the coefficient is 0.000 which means that the relationship between currency volatility and oil price change is highly significant at all critical values (1%, 5%, and 10%).

The ARDL bounds test showed that a long-run relationship exists among Economic growth, FDI, oil price, and currency volatility in Nigeria and South Africa. Also, the ARDL short-run and long-run estimates showed that there is a direct relationship between oil price changes and economic growth in Nigeria. A percentage increase in oil price will increase economic growth by 2.5% and 4.1% respectively. For currency volatility, a percentage increase in currency volatility will reduce economic growth by 0.27% and 0.45% respectively. Furthermore, the short-run and long-run estimates for the South African implies that there is a positive or direct relationship between currency volatility and economic growth in South Africa and therefore a percentage increase in currency volatility will increase economic growth by 5.4% and 5.5% in the short run and long run respectively. Also, a percentage increase in oil price will increase economic growth by 0.61% and 0.62% in the short run and long run respectively.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Introduction

Chapter four was centered on the data analysis and interpretation of the result. The method of data analysis employed included the descriptive analysis and the inferential analysis. While the descriptive analysis comprised the summary of statistics, the inferential analysis consisted of the Ordinary Least Squares (OLS) and the Autoregressive Distributed Lags (ARDL). The ARDL gave insights on the short-run and long-run implications of the variables of interest in this study. However, this chapter concludes the study and is divided into three sections. The second section summarizes the empirical findings of the study while the third section makes inferential conclusions given the empirical findings. The third section presents recommendations in line with the empirical findings of the study.

5.2 Summary of Findings

This study was conducted to examine the relationship between oil price changes and currency volatility in Nigeria and South Africa. The study employed two models to carry out a thorough investigation of the subject matter. The study made use of monthly time series variables from January 2008 to December 2019 for the first model while annual time series data from 1990 – 2018 was used for the second model. The data for the research work was sourced from the US Energy Information Administration (EIA), World Development Indicators (WDI). Financial development (FID), Central Bank of Nigeria (CBN) Statistical Bulletin, and South African Reserve Bank (SARB). The preliminary stationarity tests revealed that all the variables in the model are stationary or stable at the level and at the first difference (that is after the series were differenced once).

The ordinary least squares result for Nigeria shows that there is a negative relationship between oil price and the Nigerian currency, the Naira. Additionally, a one percent increase in Brent oil price will lead to a 1.4% decrease in the volatility of the Nigerian Naira. In the South African model, there is a rather positive relationship between the South African rand and oil price changes. It is observed that a one percent increase in oil price will lead to a 0.27% increase in the volatility of the South African Rand.

The mixture of variables that are stationary at levels and that stationary at first difference prompted the author to conduct a bounds test of cointegration which revealed significant long-run relationships among the variables in the Nigerian and South African models. In the estimated ARDL model for Nigeria, the error correction term was significant and revealed that

deviations in the economic growth of Nigeria from the equilibrium are corrected 61 percent within a given year. For the South African Model, the error correction term shows that 98 percent of disequilibrium in the estimated model is corrected within one year. This means that after a change in any of the independent variables which lead to disequilibrium, the dependent variable adjusts or goes back to equilibrium at 98%. The speed of adjustment at 98% is high.

The short-run and long-run estimates for the Nigerian model shows that there is a direct or positive relationship between oil price changes and economic growth in Nigeria. A one percentage increase in oil price will increase economic growth by 2.5% and 4.1% in the short run and the long run respectively. For currency volatility, a one percent increase in currency volatility will reduce economic growth by 0.27% and 0.45% respectively. Furthermore, the short-run and long-run estimates for the South African scenario implies that there is a positive or direct relationship between currency volatility and economic growth in South Africa and therefore a percentage increase in currency volatility result in the economic growth of 5.4% and 5.5% in the short run and long run respectively. Also, a percentage increase in oil price will result in an economic growth of 0.61% and 0.62% in the short run and long run respectively.

5.3 Conclusion

Based on the empirical findings reported, this study concludes that the relationship between oil price changes and currency volatility is different for the two economies studied. The study however concludes that there is a negative relationship between oil price changes and currency volatility in Nigeria. Whereas in South Africa, the relationship between oil price changes and currency volatility is positive. This is in agreement with the submission of Fowowe (2014) that oil price increases lead to an increase in the South African rand-USD exchange rate.

5.4 Recommendation of the Study

In line with the findings of the study, the following recommendations are suggested:

For the Nigerian context, since Nigeria is an import-dependent country, foreign exchange management measures are needed in particular to meet the high demand for foreign currency which is peculiar to Nigeria's trade balance and overall economic performance. Sound monetary policy is advocated to achieve the stability of the exchange rate because the Nigerian economy is predisposed to exchange rate volatility. It is also recommended that the Nigerian government diversifies the economy to avoid or curb overdependence on crude oil and develop other sectors such as Agriculture and manufacturing to alleviate the impact of economic shocks (Ogundipe et al., 2014).

For the South African context, since there is a strong and positive relationship between world oil price and currency volatility, we recommend that when designing investment portfolios, investors (both foreign and local) pay critical attention to currency volatilities. Additionally, capital flight and currency management policies integrating expected oil price shocks are recommended. Currency hedging strategies for companies with dollarized obligations are recommended for both economies because currency volatilities have a profound impact on the economy.

REFERENCES

Abed, R. El *et al.*, (2016) 'Asymmetric effect and dynamic relationships between oil price shocks and exchange rate volatility: Evidence from some selected MENA countries', *Topics in Middle Eastern and African Economies*, 18(2), pp. 1–25. (4th August, 2020)

Akram, Q. F. (2000) 'PPP Despite Real Shocks: An Empirical Analysis of the Norwegian Real Exchange Rate', Norges Bank Working Paper, 7. Available at: http://ideas.repec.org/p/oxf/wpaper/30.html (4th August, 2020)

Aziz, M. I. A. (2009) 'Oil price and exchange rate: A comparative study between net oil-exporting and net oil-importing countries', *ESDS International Annual Conference* 30th November 2009, Institute of Materials, London (26th July, 2020)

Bamiro, O. A. (1994) 'National Technology Policy for Development: The Role of Research and Development Institutions'. Paper presented at the National Workshop on Technology Management, Policy and Planning in Nigeria, 18-21 October. (26th July, 2020)

Basher, S. A., Haug, A. A., and Sadorsky, P. (2011) 'Oil Prices, exchange rates, and emerging stock markets', *Energy Economics*, 34(2012): 227–240. doi: 10.1016/j.eneco.2011.10.005 (27th July, 2020)

Brahmasrene, T., Huang, J., and Sissoko, Y. (2014) 'Crude oil prices and exchange rates: Causality, variance decomposition, and impulse response', *Energy Economics*, Elsevier, vol. 44(C), pp. 407-412. doi: 10.1016/j.eneco.2014.05.011 (27th July, 2020)

Chantal, D. and Patrick, N. (2005) 'Foreign direct investment in Africa: performance, challenges, and responsibilities. *ATPC work in progress*; no. 21. no. 21, 26 p. Addis Ababa. doi: 10.1016/j.asieco.2005.07.002 (27th July, 2020)

Chen, S. and Chen, H. (2007) 'Oil prices and real exchange rates', *Energy Economics*, 29, pp. 390–404. doi: 10.1016/j.eneco.2006.08.003. (26th July, 2020)

Chete, L. N., Adeoti, J. O., Adeyinka, F M., and Ogundele, O. (2012) 'Industrial development and growth in Nigeria: Lessons and challenges', *Nigerian Institute of Social and Economic Research (NISER), Ibadan*, (8). (27th July, 2020)

Creswell, J. and Plano Clark, V. (2011) 'Designing and conducting mixed methods research', 2nd ed. London: SAGE Publication (27th July, 2020)

Englama, A., Duke, O. O., Ogunleye, T. S. and Isma'il, F. U. (2010) 'Oil Prices and Exchange Rate Volatility in Nigeria: An Empirical Investigation', 48(September), pp. 31–48. (27th July, 2020)

Fowowe, B. (2014) 'Modelling the Oil Price –Exchange Rate Nexus for South Africa', *International Economics*. 140, pp. 36-48, Elsevier. doi: 10.1016/j.inteco.2014.06.002. (4th August, 2020)

Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica: Journal of the Econometric Society*, 424-438. Available at: https://ezproxy.ncirl.ie/login?url=https://search.proquest.com/docview/37916251?accountid=103381 (4th August, 2020)

Hamilton, J. D. (1983) 'Oil and the Macroeconomy since World War 11', The Journal of Political Economy 91, 228-248. (27th July, 2020)

Hamisu, S. A. et al (2015) 'Dynamic relationship of exchange rates and crude oil prices in South Africa: Are there asymmetries?' *Research Journal of Finance and Accounting*, 6(6). (4th August, 2020)

Ibenta, S. N. O. (2012) International Trade and Finance, Ezu Book Ltd, Enugu (27th July, 2020)

Ji, Q., Jawad, H., Bouri E. and Suleman, M. T. (2020) 'Dynamic structural impacts of oil shocks on exchange rates: lessons to learn', *Journal of Economic Structures*. Springer Berlin Heidelberg, 9(20). doi: 10.1186/s40008-020-00194-5. (27th July, 2020)

Jin, G., (2008) 'The Impact of Oil Price Shock and Exchange Rate Volatility on Economic Growth: A comparative analysis for Russia, Japan, and China', *Research Journal of International Studies*, Issue 8, pp98-111 (4th August, 2020)

Kin, S. and Courage, M. (2014) 'The Impact of Oil Prices on the Exchange Rate in South Africa', *Journal of Economics*, 5(2), pp. 193–199. doi: 10.1080/09765239.2014.11884996. (4th August, 2020)

Krugman, P. (1983) 'Oil shocks and exchange rate dynamics In Exchange Rates and International Macroeconomics', *University of Chicago Press*, Vol 0-226-26250-2, p. 259 – 284, Available at: http://www.nber.org/chapters/c11382.pdf

Lee, B. R., Lee, K., and Ratti, R. A. (2001) 'Monetary policy, oil price shocks, and the Japanese economy', *Japan and the World Economy*, 13(3), 321-349. Available at: https://ezproxy.ncirl.ie/login?url=https://search.proquest.com/docview/38287502?accountid=103381 (27th July, 2020)

Mantai, M. M. and Alom, F. (2016) 'Impacts of oil price, exchange rate, and inflation on the economic activity of Malaysia', *OPEC Energy Review*, pp. 180–191. doi:10.1111/opec.12073

Mboweni, T. T. (2003) 'Overview of the South African economy'.

Mensah, E. K., Triacca, U., Bondzie, E. A., and Fosu, G. O. (2016) 'Crude oil price, exchange rate and gross domestic product nexus in an emerging market: A cointegration analysis', *OPEC Energy Review*, pp. 212–231. doi: 10.1111/opec.12076

Muhammad, Z., Suleiman, H. and Kouhy, R. (2012) 'Exploring oil price — exchange rate nexus for Nigeria', *OPEC Energy Review*, pp. 383–395. doi: 10.1111/j.1753-0237.2012.00219.x

Niyimbanira, F. (2015) 'Fuel Price and Exchange Rate Dynamics In South Africa: A Time Series Analysis', *Corporate Ownership & Control*, 12(4), pp. 185–193.

Ogundipe, O. M., Ojeaga, P. and Ogundipe, A. A. (2014) 'Oil Price and Exchange Rate Volatility in Nigeria Oil Price and Exchange Rate Volatility in Nigeria', *IOSR Journal of Economics and Finance (IOSR-JEF)*, 5(4), pp. 01–09. doi: 10.9790/5933-0540109. (27th July, 2020)

Okolo, C. V. and Udabah, S. I. (2019) 'Oil price and exchange rate volatilities: implications on the cost of living in OPEC member country — Nigeria', *Organization of the Petroleum Exporting Countries*, pp. 1–16. doi: 10.1111/opec.12157. (27th July, 2020)

Oriavwote, V. E., and Eriemo, N. O. (2012) 'Oil Prices and the Real Exchange Rate in Nigeria', *International Journal of Economics and Finance*, 4(6). doi: 10.5539/IJEF.V4N6P198 (18th June, 2020)

Oyelaran-Oyeyinka, B. (2011) 'Nigeria Yesterday and Tomorrow: An Economic Perspective of Industrial Regress, Dreams, and Visions', Invited Paper at Lead City University Ibadan. Available at: https://www.wider.unu.edu/sites/default/files/wp2014-019.pdf (18th June, 2020)

Ozcelebi, O. (2018) 'Impacts of Exchange Rate Volatility on Macroeconomic and Financial Variables: Empirical Evidence from PVAR Modeling', *IntechOpen*. doi: 10.5772/intechopen.74406 (18th June, 2020)

Qiang, W., Lin, A., Zhao, C., Liu Z., Liu M., and Wang X. (2019) 'The impact of international crude oil price fluctuation on the exchange rate of petroleum-importing countries: a summary of recent studies', Nat Hazards 95, 227–239. https://doi.org/10.1007/s11069-018-3501-y (18th June, 2020)

Rafiq, S., Ã, R. S. and Bloch, H. (2009) 'Impact of crude oil price volatility on economic activities: An empirical investigation in the Thai economy', *Resources Policy*, 34, pp. 121–132. doi: 10.1016/j.resourpol.2008.09.001. (27th July, 2020)

Ryan, G. (2019) 'Introduction to positivism, interpretivism and critical theory', (2018). doi: 10.7748/nr.2018.e1466. (18th June, 2020)

Sunde, T. (2013) 'Financial development and economic growth: empirical evidence from Namibia (1990Q1-2011Q4)', *Journal of Emerging Issues in Economics, Finance and Banking (JEIEFB)*, 1(1), pp. 52–65. (27th July, 2020)

Trung, V. and Vinh, N., (2011) 'The Impact of Oil prices, Real Effective exchange rate and Inflation on Economic Activity: Novel Evidence for Vietnam', St. Louis: Federal Reserve Bank of St Louis. Available at: http://ideas.repec.org/p/kob/dpaper/dp2011-09.html (4th August, 2020)

Turhan, I., Hacihasanoglu, E., and Soytas, U. (2012) 'Oil prices and emerging market exchange rates', *Emerging Markets Finance and Trade*, 49 (s1): 21-36 (4th August, 2020)

APPENDIX

Raw Data

Year	SA_ECG	NG_ECG	SA_FDI	NG_FDI	SA_CU	NG_CU	Oil_P
1990	-0.31779	11.77689	-0.06553	1.087951	2.587321	8.038285	23.76
1991	-1.01822	0.358353	0.205041	1.450318	2.761315	9.909492	20.04
1992	-2.13706	4.631193	0.002496	1.876018	2.852014	17.29843	19.32
1993	1.23352	-2.03512	0.008406	4.84779	3.267742	22.0654	17.01
1994	3.200001	-1.81492	0.26791	5.790847	3.550798	21.996	15.86
1995	3.099995	-0.07266	0.803047	0.762196	3.627085	21.89526	17.02
1996	4.299999	4.195924	0.553086	0.977521	4.299349	21.88443	20.64
1997	2.600002	2.937099	2.497286	0.862276	4.607962	21.88605	19.11
1998	0.500001	2.581254	0.399448	0.548616	5.528284	21.886	12.76
1999	2.399996	0.584127	1.100276	1.692558	6.109484	92.3381	17.9
2000	4.200003	5.015935	0.710489	1.641739	6.939828	101.6973	28.66
2001	2.699995	5.917685	5.983101	1.608284	8.609181	111.2313	24.46
2002	3.700382	15.32916	1.281412	1.964727	10.54075	120.5782	24.99
2003	2.949079	7.347195	0.44685	1.911463	7.564749	129.2224	28.85
2004	4.554553	9.250558	0.306847	1.374086	6.459693	132.888	38.26
2005	5.277056	6.438517	2.530174	2.82883	6.359328	131.2743	54.57
2006	5.603798	6.059428	0.229456	2.056024	6.771549	128.6517	65.16
2007	5.360476	6.59113	2.199883	2.189934	7.045365	125.8081	72.44
2008	3.191047	6.764473	3.447016	2.431643	8.261223	118.5667	96.94
2009	-1.53809	8.036925	2.576394	2.930908	8.473674	148.88	61.74
2010	3.039731	8.005656	0.983956	1.658475	7.321222	150.2975	79.61
2011	3.284168	5.307924	0.994021	2.154611	7.261132	153.8625	111.26
2012	2.213355	4.230061	1.167209	1.53903	8.209969	157.5	111.63
2013	2.485201	6.671335	2.244236	1.08024	9.655056	157.3117	108.56
2014	1.846992	6.309719	1.650494	0.825653	10.85266	158.5526	98.97
2015	1.193733	2.652693	0.478917	0.619546	12.75893	192.4403	52.32
2016	0.399088	-1.61687	0.747512	1.099404	14.70961	253.492	43.64
2017	1.414513	0.805887	0.588916	0.93228	13.3238	305.7901	54.13
2018	0.787056	1.937268	1.512253	0.502803	13.23393	306.0837	71.34

Observations	SA_CU	NG_CU	Oil_P
01/01/2008	122.5339	117.9768	92.18
01/02/2008	111.3524	118.21	94.99
01/03/2008	104.681	117.9218	103.64
01/04/2008	106.8419	117.8737	109.07
01/05/2008	110.3838	117.8342	122.8
01/06/2008	107.3805	117.8086	132.32
01/07/2008	111.4589	117.7671	132.72
01/08/2008	115.2067	117.742	113.24
01/09/2008	113.3363	117.7256	97.23
01/10/2008	98.6232	117.7243	71.58

01/11/2008	98.32835	117.7433	52.45
01/12/2008	98.19769	126.4756	39.95
01/01/2009	99.99145	145.7803	43.44
01/02/2009	101.4072	147.1444	43.32
01/03/2009	102.9313	147.7226	46.54
01/04/2009	113.1922	147.2272	50.18
01/05/2009	118.8033	147.8427	57.3
01/06/2009	122.1021	148.2018	68.61
01/07/2009	124.2608	148.589	64.44
01/08/2009	123.0421	151.858	72.51
01/09/2009	128.8682	152.3017	67.65
01/10/2009	127.7465	149.355	72.77
01/11/2009	126.4322	150.8469	76.66
01/12/2009	127.8789	149.6926	74.46
01/01/2010	129.3125	149.7792	76.17
01/02/2010	128.1009	150.2224	73.75
01/03/2010	133.5485	149.8285	78.83
01/04/2010	134.08	149.8927	84.82
01/05/2010	133.441	150.3125	75.95
01/06/2010	135.0207	150.1915	74.76
01/07/2010	134.3426	150.0986	75.58
01/08/2010	137.5359	150.2667	77.04
01/09/2010	139.2144	151.0332	77.84
01/10/2010	138.4743	151.25	82.67
01/11/2010	138.0538	150.2211	85.28
01/12/2010	142.9288	150.4799	91.45
01/01/2011	139.3425	151.5455	96.52
01/02/2011	133.0528	151.9391	103.72
01/03/2011	137.9929	152.5074	114.64
01/04/2011	139.3673	153.9673	123.26
01/05/2011	137.1795	154.8009	114.99
01/06/2011	139.0199	154.5029	113.83
01/07/2011	139.7487	151.8636	116.97
01/08/2011	133.1468	152.7154	110.22
01/09/2011	128.2889	155.2636	112.83
01/10/2011	123.4033	153.2569	109.55
01/11/2011	121.3806	155.7693	110.77
01/12/2011	122.4662	158.2074	107.87
01/01/2012	125.6963	158.3868	110.69
01/02/2012	129.8177	157.8681	119.33
01/03/2012	131.9306	157.5875	125.45
01/04/2012	128.7343	157.3314	119.75
01/05/2012	125.6246	157.2762	110.34
01/06/2012	124.2943	157.4388	95.16

01/07/2012	126.8071	157.4342	102.62
01/08/2012	125.3578	157.3796	113.36
01/09/2012	124.1945	157.3429	112.86
01/10/2012	118.5677	157.3156	111.71
01/11/2012	117.5586	157.308	109.06
01/12/2012	119.594	157.324	109.49
01/01/2013	116.7119	157.3012	112.96
01/02/2013	116.1418	157.2994	116.05
01/03/2013	114.796	157.3115	108.47
01/04/2013	115.9687	157.3051	102.25
01/05/2013	112.7262	157.3008	102.56
01/06/2013	105.9897	157.3065	102.92
01/07/2013	108.508	157.3167	107.93
01/08/2013	106.8012	157.3136	111.28
01/09/2013	107.8783	157.3157	111.6
01/10/2013	107.371	157.4166	109.08
01/11/2013	105.044	157.2734	107.79
01/12/2013	103.3519	157.2742	110.76
01/01/2014	99.60611	157.2916	108.12
01/02/2014	99.46636	157.3075	108.9
01/03/2014	102.1317	157.3008	107.48
01/04/2014	104.2688	157.2918	107.76
01/05/2014	105.6846	157.2873	109.54
01/06/2014	103.6444	157.2873	111.8
01/07/2014	104.5011	157.2873	106.77
01/08/2014	105.3854	157.2873	101.61
01/09/2014	103.6622	157.3006	97.09
01/10/2014	104.204	157.3141	87.43
01/11/2014	105.3454	159.9961	79.44
01/12/2014	102.5632	169.68	62.34
01/01/2015	104.4219	169.68	47.76
01/02/2015	105.3614	179.74	58.1
01/03/2015	104.0635	197.07	55.89
01/04/2015	105.3508	197	59.52
01/05/2015	104.4906	197	64.08
01/06/2015	102.2612	196.92	61.48
01/07/2015	102.7595	196.97	56.56
01/08/2015	99.99966	197	46.52
01/09/2015	94.73145	197	47.62
01/10/2015	95.6839	196.99	48.43
01/11/2015	93.07489	196.99	44.27
01/12/2015	87.80112	196.99	38.01
01/01/2016	82.56155	197	30.7
01/02/2016	85.29778	197	32.18

01/03/2016	87.09943	197	38.21
01/04/2016	91.38304	197	41.58
01/05/2016	87.35196	197	46.74
01/06/2016	89.78498	231.7614	48.25
01/07/2016	95.34897	294.5722	44.95
01/08/2016	98.86898	309.7304	45.84
01/09/2016	97.01171	305.225	46.57
01/10/2016	99.31575	305.2125	49.52
01/11/2016	101.0389	305.1818	44.73
01/12/2016	103.6529	305.2237	53.31
01/01/2017	105.6862	305.2024	54.58
01/02/2017	108.8571	305.3125	54.87
01/03/2017	111.4315	306.4022	51.59
01/04/2017	106.3327	306.0528	52.31
01/05/2017	107.0341	305.5381	50.33
01/06/2017	109.2124	305.715	46.37
01/07/2017	105.9476	305.8619	48.48
01/08/2017	103.7062	305.6674	51.7
01/09/2017	103.6589	305.8868	56.15
01/10/2017	100.7875	305.6238	57.51
01/11/2017	98.33877	305.9045	62.71
01/12/2017	105.4884	306.3139	64.37
01/01/2018	110.6176	305.7773	69.08
01/02/2018	113.4836	305.895	65.32
01/03/2018	113.8137	305.7429	66.02
01/04/2018	112.3194	305.61	72.11
01/05/2018	111.1116	305.8262	76.98
01/06/2018	106.1198	305.8711	74.41
01/07/2018	107.4938	305.8143	74.25
01/08/2018	102.9942	306.0571	72.53
01/09/2018	98.6887	306.2725	78.89
01/10/2018	101.4271	306.505	81.03
01/11/2018	105.1724	306.7119	64.75
01/12/2018	103.5045	306.9211	57.36
01/01/2019	105.7124	306.8455	59.41
01/02/2019	106.1466	306.7682	63.96
01/03/2019	102.9024	306.9238	66.14
01/04/2019	105.155	306.9625	71.23
01/05/2019	104.1503	306.95	71.32
01/06/2019	102.8225	306.9471	64.22
01/07/2019	106.8666	306.937	63.92
01/08/2019	100.5031	306.9325	59.04
01/09/2019	103.3841	306.919	62.83
01/10/2019	102.1342	306.9636	59.71

01/11/2019	102.7327	306.9475	63.21
01/12/2019	105.1144	306.95	67.31

Results

Dependent Variable: NG_CU

Method: Least Squares

Date: 07/23/20 Time: 19:26

Sample: 2008M01 2019M12

Included observations: 144

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OIL_P	-1.453845	0.186157	-7.809791	0.0000
C	316.4579	15.59264	20.29534	0.0000

R-squared	0.300468	Mean dependent var	79.49951
Adjusted R-squared	0.295542	S.D. dependent var	26.46833
S.E. of regression	22.21541	Akaike info criterion	9.053241
Sum squared resid	70080.46	Schwarz criterion	9.094488
Log likelihood	-649.8333	Hannan-Quinn criter.	9.070001
F-statistic	60.99283	Durbin-Watson stat	0.089735
Prob(F-statistic)	0.000000		

Dependent Variable: SA_CU

Method: Least Squares

Date: 07/23/20 Time: 19:27

Sample: 2008M01 2019M12

Included observations: 144

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OIL_P	0.278757	0.037086	7.516468	0.0000
C	89.73426	3.106365	28.88722	0.0000

R-squared	0.284625	Mean dependent var	79.49951
Adjusted R-squared	0.279587	S.D. dependent var	26.46833
S.E. of regression	22.46556	Akaike info criterion	9.075636
Sum squared resid	71667.62	Schwarz criterion	9.116883
Log likelihood	-651.4458	Hannan-Quinn criter.	9.092397
F-statistic	56.49730	Durbin-Watson stat	0.089166
Prob(F-statistic)	0.000000		

Nigerian Model

ARDL Bounds Test

Date: 07/23/20 Time: 19:34

Sample: 1991 2018

Included observations: 28

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	5.220716	3

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

ARDL Cointegrating And Long Run Form
Dependent Variable: NG_ECG
Selected Model: ARDL (1, 0, 0, 0)
Date: 07/23/20 Time: 19:59
Sample: 1990 2018
Included observations: 28

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NG_FDI)	-0.422944	0.608383	-0.695193	0.4939
D(OIL_P)	0.025190	0.026287	0.958282	0.3479
D(NG_CU)	-0.002789	0.010725	-0.260068	0.7971
CointEq(-1)	-0.609743	0.177092	-3.443086	0.0022

Cointeq = NG_ECG - (-0.6936*NG_FDI + 0.0413*OIL_P -0.0046*NG_CU + 3.8879)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NG_FDI	-0.693642	1.021093	-0.679314	0.5037
OIL_P	0.041313	0.041216	1.002359	0.3266
NG_CU	-0.004574	0.017465	-0.261919	0.7957
C	3.887899	3.172570	1.225473	0.2328

	NG_ECG	NG_CU	NG_FDI	NG_FID	OIL_P
Mean	4.627476	115.2871	1.767096	0.209168	48.65345
Median	5.015935	125.8081	1.608284	0.201821	38.26000
Maximum	15.32916	306.0837	5.790847	0.312360	111.6300
Minimum	-2.035119	8.038285	0.502803	0.156829	12.76000
Std. Dev.	4.031869	83.09229	1.184241	0.038266	32.86173
Skewness	0.376711	0.576691	1.916433	0.963555	0.698380
Kurtosis	3.246405	2.996246	6.885034	3.429884	2.134584
Jarque-Bera	0.759268	1.607452	35.98943	4.710753	3.262357
Probability	0.684112	0.447658	0.000000	0.094858	0.195699
Sum	134.1968	3343.326	51.24577	6.065881	1410.950
Sum Sq. Dev.	455.1672	193321.2	39.26793	0.041000	30237.02
Observations	29	29	29	29	29

	SA_ECG	SA_FDI	SA_FID	SA_CU	OIL_P
Mean	2.293882	1.236228	0.488256	7.363552	48.65345
Median	2.600002	0.803047	0.496287	7.045365	38.26000
Maximum	5.603798	5.983101	0.634178	14.70961	111.6300
Minimum	-2.137057	-0.065531	0.323269	2.587321	12.76000
Std. Dev.	2.009398	1.294343	0.103683	3.375013	32.86173
Skewness	-0.411948	1.912742	-0.351967	0.495660	0.698380
Kurtosis	2.609340	7.316032	1.821494	2.487221	2.134584
Jarque-Bera	1.004633	40.19214	2.276983	1.505168	3.262357
Probability	0.605127	0.000000	0.320302	0.471147	0.195699
Sum	66.52259	35.85060	14.15943	213.5430	1410.950
Sum Sq. Dev.	113.0551	46.90907	0.301004	318.9400	30237.02
Observations	29	29	29	29	29

South Africa

ARDL Bounds Test

Date: 07/23/20 Time: 20:28

Sample: 1991 2018

Included observations: 28

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	8.775495	3

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

ARDL Cointegrating And Long Run Form
Dependent Variable: SA_ECG
Selected Model: ARDL (1, 0, 0, 0)
Date: 07/23/20 Time: 20:33
Sample: 1990 2018
Included observations: 28

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SA_FDI)	0.081760	0.133464	0.612601	0.0062
D(SA_CU)	0.054157	0.092610	0.584789	0.0144
D(OIL_P)	0.006104	0.008945	0.682371	0.5018
CointEq(-1)	-0.977907	0.207451	-4.713906	0.0001

Cointeq = SA_FDI - (0.0836*SA_FDI + 0.0554*SA_CU + 0.0062*OIL_P + 0.3579)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SA_FDI	0.083607	0.136520	0.612415	0.0063
SA_CU	0.055381	0.092086	0.601405	0.0135
OIL_P	0.006242	0.009209	0.677801	0.5047
C	0.357937	0.752925	0.475395	0.6390

Granger Causality

Pairwise Granger Causality Tests
Date: 07/23/20 Time: 08:28
Sample: 1990 2018
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
NG_FDI does not Granger Cause NG_ECG	27	0.88119	0.4284
NG_ECG does not Granger Cause NG_FDI		0.19493	0.8243
NG_CU does not Granger Cause NG_ECG	27	0.03752	0.9632
NG_ECG does not Granger Cause NG_CU		0.27969	0.7587
OIL_P does not Granger Cause NG_ECG	27	0.52503	0.5988
NG_ECG does not Granger Cause OIL_P		0.21147	0.8110

Pairwise Granger Causality Tests
Date: 07/23/20 Time: 08:23
Sample: 1990 2018
Lags: 2

Null Hypothesis:	Observation	F-Statistic	Prob.
SA_FDI does not Granger Cause SA_ECG	27	0.06312	0.9390
SA_ECG does not Granger Cause SA_FDI		3.63522	0.0432
SA_CU does not Granger Cause SA_ECG	27	1.08864	0.3541
SA_ECG does not Granger Cause SA_CU		0.25825	0.7747
OIL_P does not Granger Cause SA_ECG	27	1.18063	0.3258
SA_ECG does not Granger Cause OIL_P		0.54076	0.5898