FOREIGN EXCHANGE RATES DYNAMICS AND STOCK PRICE BEHAVIOR IN NIGERIA: A SECTORAL ANALYSIS.

By

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CERTIFICATION

This is to certify that this thesis has been read and approved as meeting the requirements for the award of Doctor of Philosophy (Ph.D) Degree in Finance, in the Department of Accounting and Finance, School of Business and Governance, College of Humanities, Management and Social Sciences, Kwara State University, Malete, Kwara State.

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DECLARATION

I, Bashirat Oluwafunke OLOYIN-ABDULHAKEEM, (Matriculation Number: 14/27/PFI006), hereby declare that this thesis titled "*Foreign Exchange Rate Dynamics and Stock Price Behavior in Nigeria: A Sectoral Analysis"* is my work and has not been submitted or presented by me and to the best of my knowledge, by any other person for any course or qualification at this or any other academic or research institution. I also declare that the information provided herein are mine and those that are not mine, are properly acknowledged.

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DEDICATION

This work is dedicated to the Glory of God, The Almighty, The Ever Living and The Self Sufficient.

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ABSTRACT

The interdependence between foreign exchange rates dynamics and stock price behavior has been a debatable phenomenon all time long. It has also been an area of concern among foreign and local investors in building efficient hedging strategies and optimum portfolio. However, sectoral response to foreign exchange rate dynamics differs across sectors on the Nigerian Stock Market. Against this background, the study investigates the effects of foreign exchange rate dynamics on stock price behavior of the Banking, Consumer Goods, Insurance and Oil and Gas Sectors in Nigeria. The specific objectives are to: (i) examine the causal relationship between foreign exchange rate and stock prices of different sectors in Nigeria; (ii) investigate the effects of foreign exchange rate dynamics on stock prices of different sectors in Nigeria; (iii) examine the volatility spillover effects of exchange rate on sectoral stock returns in Nigeria; and (iv) examine the volatility transmission effects among the banking, consumer goods, insurance and oil and gas sectors stock returns in Nigeria. Weekly and Monthly secondary data of the selected sectors were sourced from the Nigerian Stock Exchange and Central Bank of Nigeria from 2008 to 2018. The study employed Autoregressive Distributed Lag (ARDL) model to examine the effects of foreign exchange rate and other macroeconomic determinants, while Exponential Generalized Autoregressive Distributed Conditional Heteroskedasity (EGARCH) model was used to examine the volatility spillover effects of foreign exchange rates on the selected sectors stock returns. Lastly, the BEKK-GARCH and the Dynamic Conditional Correlation (DCC) was used to examine the volatility transmission among the sectors. Findings revealed that:

(i) Causality between foreign exchange and stock prices differs across sectors in Nigeria, and are unidirectional in nature.

(ii) The insurance and the oil and gas sectors stock prices respond positively and negatively to foreign exchange rate dynamics both in the short and long run at 5% level of significance with p-values of 0.044 and 0.039. However, no significant impact was found on the banking and the consumer goods sector. Interest rate has negative impact on each of the sectors both in the short and long run. Also foreign external reserves and inflation rate have significant impact on the banking and consumer goods sectors stock prices at, 5% level of significance with p-values of 0.001,0.001 and 0.001,0.069 respectively.

(iii) Volatility spillover from exchange rate to insurance and oil and gas sector stock returns at 1% level of significant, however, study found no volatility spillover effects from exchange rate to the banking and the consumer goods sector; and

(iv) Volatility transmission and bidirectional shock are positive among sectors stock returns in Nigeria.

The study concluded that, foreign exchange rate dynamics have significant impact on the insurance and the oil and gas sector stock price behavior in Nigeria. Also, volatility spillover effects of foreign exchange rate are peculiar to the insurance and the oil and gas sectors. The study also concluded that, the banking and the consumer goods sector stock price are not influenced by foreign exchange rate in Nigeria.

The study therefore recommends that, investors in the insurance and the oil and gas sector can diversify their portfolio by including stocks in the banking and consumer goods to attain optimum portfolio.

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CHAPTER ONE

INTRODUCTION

1.1.Background to the Study

The wind of globalization, international integration, free capital influx across continents, economic liberalization and free foreign exchange rate interaction in different economies have stimulate the interest of all stakeholders to investigate the interdependence between foreign exchange rate dynamics and stock prices behavior across the globe. Of more interest on the nexus are the foreign and domestic investors in building efficient hedging strategies and portfolio diversification. The nexus between these two markets have received considerable attention in literature and have generated lots of empirical debates both in the developed and the developing economies. The crux of the academic debate is not far from the fact that both the stock market and the currency market play a major role in the determination of economic activities in a country.

Stock market or the equity market is an institution that serves as a mediator between the surplus unit and deficit unit by stimulating capital formation and socio economic development (Onakoya, 2013). The equity market strikes a balance by mobilizing fund from the surplus unit, thereby ensuring efficient resource allocation to the fecund sector of the economy in order to boost and promote economic development.The stock market also provide capital financing for long term projects and maintain discipline in the capital market for all participants by providing an investable atmosphere of maintaining fair prices for securities so as to enlarge the share ownership in the market. Hence, the economic performance of a country depends largely on the distribution and efficient allocation of resources among competing alternatives (Adeoye, 2015). Therefore, inadequate financial resources in an economy could affect every economic segment;

the government, foreign investors, local investors, private firms and household sectors and may invariably impact negatively on the political and social stability of any country.

The currency market on the other hand, is an institution where currencies of different countries are being traded on through exchange of goods and services usually referred to as exchange rate market. Foreign exchange market according to CBN (2016) is a market that reveals how a country's currency is competing with other countries' currencies in the international market through the forces of demand and supply, the market also reveals the strength or weakness of a country's performance in terms of their exchange rate stability to other countries. Exchange rate is an important macroeconomic instrument that signals the overall performance of a country and remains one of the most important rates in a country (Korsah and Fuso, 2016). Hence, a country will attain financial stability and monetary policy effectiveness through a stable exchange rate system and continuous growth in her capital market.

The establishment, growth and development of the Nigerian stock market over years, spur the internationalization of investment prospects in the country, increasing the level of foreign and local investments (Osaze, 2007). However, the Nigerian stock market has experienced high volatility over the years owing to persistence imbalance in the foreign exchange rate in Nigeria. Foreign exchange rate has undergone different phases since inception in Nigeria, moving from the regulated exchange rate system to the deregulated exchange rate system resulting to instability in the value of the naira.According to CBN, (2018), the naira saw continuous and huge depreciation between 2012 to 2018, as the naira plummeted from ₦156.21 in 2012, to ₦191.18 in 2015 and witnessed a major depreciation in 2016 when the naira dropped to ₦300 and recently in 2017, the naira stood at ₦359.99 and 365 per US dollar as at the last quarter of 2018.

The stock market do not operates in a vacuum, markets reacts quickly to changes in regulatory environment, economic and political climate, macro-economic instruments and particularly to exchange rate changes. Exchange rate fluctuation have real economic implications that affects price stability, economic stability and firm's profitability, and the impact on the financial system cannot be overlooked (Njiforti, 2015).

However, there is no gainsaying to fact that, despite the continuous foreign exchange instability and the shock of the global financial crisis in 2008 as well as the recent global economic recession in 2014, not all sectors were severely affected by the crisis. Some sectors were economically strong during this economic turmoil, such sectors contribute relatively to the Gross Domestic Product (GDP), for example, the agricultural sector contributed 42.6% growth in GDP in 2012 (Adigun, 2018). However, the banking sector, followed by the Consumer Goods sector felt the continuous decline of the naira value among all other sector in 2015, as most of the sectors performed poorly ranging between -0.39% for Alternative Security Market and -23.59% for the Banking sector. In the same vein, the index of Consumer Goods, Oil and Gas and Insurance sector stood at -17.41%, -6.20% and -4.70% respectively, except for the Industrial sector which saw an uptick of 1.27% (NSE, 2015). Hence, the need to empirically examine the interdependence between foreign exchange rates dynamics and stock price behavior on a disintegrated sectoral level in Nigeria.

1.2 Statement of the Problem

For over a decade after the global financial crisis in 2008, the Nigerian capital market has experienced continuous declining performance as indicated by market fundamentals. The market capitalization nose dive from ₦12.40 trillion in 2008 to ₦4.60 trillion in 2009, representing a declineof 62.18% (Njiforti, 2015).

The declining performance of the capital market for most of the years was due to sudden withdrawal of hedge fund, large portfolio outflows by foreign investors steadily retreating from the market, panic among domestic investors, stimulating more sell orders due to loss of investors' confidence and foreign exchange risk (NSE, 2016). The contagion effects of the global financial crisis cut across all economic segments in the country, for instance, the banking sector was severely affected among all other sectors by the international credit crunch which geared up panics within the banking sector, creating liquidity challenges for most of the banks (Njiforti, 2015).

Recently, the fall in crude oil price in 2014, generated macroeconomic reactions for most oil exporting economies including Nigeria (Tule, 2018). During this period, the real sector generally underperformed due to foreign exchange scarcities and high cost of production. Industries find it difficult to secure adequate raw materials needed for production owing to persistent disproportion in the supply of exchange rates in Nigeria. The impact cut across both small and large businesses, causing production plant shut down with a major decline in the consumer goods sector and industrial sector. This led to increased unemployment in the country, falling real income and declining consumer spending (Adigun, 2018).

The Central Bank of Nigeria (CBN) in an attempt to respond to the present economic condition and in consistent with the banks mandate of maintaining exchange rate stability, the CBN implemented a combination of policy reactions which include: (1) exchange rate depreciation; (2) Closing of the official foreign exchange window (RDAS/WDAS) and intervened only in the interbank market; and (3) Further liberalization of the foreign exchange market in June 2016, so as to enhance efficiency and transparency in its operation (Tule, 2016).

Despite the response and policy reaction of the CBN, the Nigerian Stock Exchange in 2016 attributed the declining performance of the market to prolonged foreign exchange dilemma, resulting from the international oil crunch. The NSE All Share Index began to retreat to negative territory as foreign portfolio and domestic trading activities declined year on year by 69.79% and 56.79% post global financial crisis. Investors increasingly adopt a flight to quality strategy resulting to persistent decline in stock price and the capital market performance at large (NSE, 2016).

Anecdotal evidence according to Nigerian Stock Exchange (NSE) reported that, sectoral response to the prolonged foreign exchange instability impacted an array of assets and differs across sectors of the Nigerian bourse. For instance in 2015, virtually all the sectors, including the banking industry trended downward except for the industrial sector which had an upswing of 1.27%. The banking sector exhibit the steepest drop for the year with 23.59%, followed by the consumer goods with 17.4%, while Oil and Gas and the insurance sector recorded 6.2% and 4.7% decline respectively (NSE, 2015).

However, the table turned for the industrial and the banking sector in 2016, as the banking sector took the lead and recorded an upward trend of 2.17%, while all other sectors recorded a negative return as the industrial sector recorded the steepest drop of 26.37%, followed by the Oil and Gas by 12.31% while the insurance sector and lotus Islamic index declined by 11.44% and 7.87% respectively (NSE, 2016).

Whereas, in 2017, the NSE witnessed a rebound in investment activities as the market began to gain its feet to become the world third best performing market and the first in Africa due to improvement in foreign exchange stability. The banking sector emerged as the top performing sector of the year with 73.32% increase, also the consumer goods and industrial sector delivered

strong performance owing to greater stability in the foreign exchange market with a return of 36.97% and 23.84% respectively (NSE, 2017).

Foreign exchange rate have economic inferences that affects all economic sectors, earlier studies (Maku and Atanda, 2010; Owolabi and Adegbite, 2013 and Mohammed and Victor, 2015) indicated that the financial position of any economy that is mainly determined by the capital market is susceptible to its foreign exchange dynamism most especially import dominated countries like Nigeria. Notably, previous studies such as(Adeniyi, 2010; Osisanwo and Atanda, 2012; Onakoya, 2013; Usman and Adejare, 2014; Adeniji, 2015; Nkoro and Uko, 2016; Kurotamunobaraomi and Ebiware, 2017) examined exchange rate and stock price on the aggregate market. Their findings was generalized across all sectors, however, the general conclusion may not be applicable to individual sectors of the economy as sectoral sensitivity to exchange rate dynamics differs across sectors. To support this submission, is the argument of Narayan & Sharma (2011) who opined that, market are heterogeneous as individual sector have their own policies and regulations within which they operates. Therefore, it can be contended that individual sector on the Nigerian stock market respond or react differently to foreign exchange rates dynamics, hence sectoral analysis is pertinent which is the crux of this research work.

In addition, statistical tool such as the Exponential Generalized Autoregressive conditional Heteroskedasity (EGARCH) models and Multivariate GARCH (MGARCH)were used to evaluate the volatility spillover effect of exchange rate on stock returns and volatility transmission among selected sectors. This study identified sectoral and methodological inadequacies in previous studies, which this study attempted to bridge in order to broaden the

frontier of knowledge beyond the aggregate nature of the market and disintegrate to sectoral analysis with findings more peculiar to individual sector on the Nigerian capital market.

1.3 Research Questions

In line with the issues raised in the problem statement, the following research questions are generated:

i. What is the causal relationship between foreign exchange rate and stock prices of different sectors in Nigerian?
ii. What are the effects of foreign exchange rate dynamics on stock price behavior of different sectors in Nigeria ?
iii. Is there volatility spillover effect of exchange rate on stock returns of different sectors in Nigeria?
iv. How does volatility transmission of one sector affects other sectors of the economy in Nigeria?

1.4 Objectives of the Study

The main objective of this study is to analyze the interdependence between foreign exchange rate and stock price behavior on a disintegrated sectoral level in Nigeria, while the specific objectives are to:

i. examine the causal relationship between foreign exchange rate and stock prices of different sectors in Nigeria;
ii. investigate the effects of foreign exchange rate dynamics on stock price behavior of different sectors in Nigeria;
iii. examine the volatility spillover effect of exchange rate on sectoral stock returns in Nigeria; and

iv. examine the volatility transmission among sectoral stock returns in Nigeria.

1.5 Research Hypotheses

In order to provide a framework for analyzing the interdependence of foreign exchange rate dynamics and stock price behavior in Nigeria, the following hypotheses were formulated and stated in null form to guide the study:

H_{01}: There is no significant causal relationship between foreign exchange rate and stock prices of different sectors in Nigeria.

H_{02}: Foreign exchange rate dynamics does not have significant effects on stock price behavior of different sectors in Nigeria.

H_{03}: There is no volatility spillover effect of exchange rate on stock returns of different sectors in Nigeria.

H_{04}: There is no volatility transmission among sectoral stock returns in Nigeria.

1.6 Justification for the Study

The interdependence of foreign exchange rate dynamics and stock price behavior has received considerable attention across the globe. Surprisingly however, despite lots of empirical and theoretical stands, researchers are yet to give a clear cut agreement on the nexus between foreign exchange rate and stock prices. Empirical evidences showed that previous studies (Adeniyi, 2010; Osisanwo and Atanda, 2012; Onakoya, 2013; Usman and Adejare, 2014; Adeniji, 2015; Nkoro and Uko, 2016; Kurotamunobaraomi and Ebiware, 2017) in Nigeria focused on the aggregate market. However, the heterogeneity of sectoral sensitiveness of exchange rate dynamics is insufficient in literature particularly in Nigeria, and this necessitated the need for this current study.

The motivation for this study is to provide broad understanding of sectoral response of stock prices to exchange rate dynamics. Understanding the interdependence between foreign exchange rate and stock price behavior, will help the stakeholders, particularly the foreign and local investors in hedging and diversifying their portfolio especially during economic downturn. This will give them opportunity to take best investment decisions. In addition, it will help to determine the contagion effect of one sector on the other, which will serve as a guide to financial analyst, asset managers and investors in building well diversified portfolio that will enable higher returns and low risk.

Furthermore, the study is expected to guide the policy makers, particularly the Security and Exchange Commission (SEC) and the Central Bank of Nigeria, in making appropriate financial planning through monetary and exchange rate stabilization policies, that will enhance the better performance of the two markets taking into consideration the long run effects of all economic factors that can influence investment decisions in Nigeria. The study is also expected to guide the government to identify and diversify resources to viable sectors of the economy that need more attention other than the oil sector this will help in stabilizing the naira against major currencies, thus increasing productivity and exportation of goods and also increases foreign exchange earnings in Nigeria. This in the long run may enhance currency stability, improves level of employment, strengthen investor's confidence, reduces investors flight to other economies and foster economic growth.

The study will also broaden the frontier of knowledge to better the understanding of sectoral sensitiveness of stock price behavior to foreign exchange rate dynamism on the Nigeria stock exchange market, thus, bridging the sectoral gap in literature. More importantly, it could serve as reference point to further studies in this area of study.

1.7 Scope of the Study

The scope of this study is to examine the interdependence between exchange rate dynamics and stock price behavior of different sectors of the economy on the Nigeria stock market, using Foreign Exchange rate as the main explanatory variable on All Share Index (ASI) of individual sectors as the dependent variable.

The study is divided into two categories: The first category dealt with the short run and long run effects of foreign exchange rate dynamics on sectoral stock price behavior. For this category, monthly data of all explanatory variables and the dependent variable was used spanning from January, 2008 to October, 2018 (130 months) for the aggregate market and January, 2009 to October, 2018 (118 months) for each of the selected sectors, which represent a total of 472 observations.

The second category investigates the volatility spillover effects of foreign exchange rate on each of the selected sectors and the volatility transmission among sectors. For this category, highly frequency data (daily or weekly) which are capable of capturing the degree of changes in financial time series is important in volatility measures. Weekly data of All Share Index for each of the selected sectors and foreign exchange rate to US dollar was used to examine the volatility spillover effects of exchange rate on sectoral stock returns in Nigeria. The period Span within the first week of January, 2009 to October, 2018 (508 weeks) for the four sectors representing a total of 2032 observations.

The study investigated four sectors namely; the Banking Sector, Consumer Goods Sector, Insurance Sector and the Oil and Gas Sector, out of the twelve sectors on the Nigerian stock market. These four sectors were selected based on the fact that, they constitute the first four sectors with sectoral index on the Nigerian stock market in 2008, which were selected based on

their liquidity and market capitalization. The choice of the year 2008 represents the year in which the global financial crisis was felt across globe, and also the year, in which the Nigeria stock exchange established sectoral indices to meet up with international market standard index for measuring global and local economic sector performance, although, the sectoral indices were not available until January, 2009.

1.8 Organization of the Study

The research work is organized into five chapters in order to address the research questions and achieve the stated objectives. Chapter one is the introductory chapter, which discusses the research background in relation to foreign exchange rate dynamics and stock price behavior in Nigeria. The statement of the problem, research questions, research objectives, research hypotheses, justification and scope of the study were also presented in chapter one.

Chapter two is the literature review, which discusses the conceptual issues, theoretical reviews and empirical reviews on foreign exchange rates and stock prices. Conceptual issues discussed includes: the concept of foreign exchange and exchange rate dynamics, the stock market and stock price behavior, factors affecting stock price behavior in Nigeria and brief overview of the Nigerian stock exchange market. The chapter also discussed relevant theories which includes; the flow oriented theory, the portfolio balanced theory and the arbitrage pricing theory. And lastly, related empirical studies on exchange rate dynamics and stock price were reviewed from developed economies to developing economies, where summary and gaps in literature were identified.

Chapter three presents the study's methodology which includes the theoretical framework, model specifications, research design, nature and sources of data. The chapter also presents details on

the estimation procedure which includes: stationarity test, ARDL model/ bound test, Exponential Generalized Autoregressive Conditional Heteroskedasity (EGARCH) models and Multivariate Generalized Autoregressive Conditional Heteroskedasity (MGARCH) model of BEKK- GARCH and the Dynamic Conditional Correlation (DCC).

Chapter four discusses the empirical results of the estimations in relation to existing literature on foreign exchange rate dynamics and stock price behavior. Chapter five concludes the research work and presents the summary, conclusion, recommendations and contributions to knowledge as well as suggestions for further studies.

CHAPTER TWO

LITERATURE REVIEW

This chapter discusses literature review, which consist of conceptual review, theoretical review, empirical review as well as gaps identified from the previous studies.

2.1Conceptual Review

This section reviewed concepts of foreign exchange rate and exchange rate dynamics, stock price and stock price behavior as well as the factors affecting stock price behavior in Nigeria.

2.1.1Foreign Exchange Rate

Foreign exchange rate according to CBN (2016) is the price of a country's currency expressed in terms of another currency.It is the market price for which a local currency can be traded for another. Exchange rate plays a critical role in international trade as it constitutes larger measure of the economy that affectsimportation, services and exportation. It is a national and economic indicator that responds swiftly to economic and political changes in the developed economies.

2.1.2 Foreign Exchange Rate Dynamics

Foreign exchange rate dynamics is the swings or movements in exchange rate over time due to changes in macroeconomic fundamentals, policies and system of exchange rate in place at a particular period. Exchange rate dynamics follow the form of volatility, misalignment, revaluation/ devaluation and appreciation/depreciation of a country's currency owing to forces of demand and supply (Tule, 2018).

i. **Volatility of Exchange Rate**

In a floating exchange rate system, exchange rate changes as events unfold in the international market almost every day or even on hourly basis. Exchange rate is said to be volatile when there are frequent movements within a short period of time. Therefore, the degree of frequency by

which the price of foreign exchange rate changes over time is referred exchange rate volatility (Emenike, 2014). The more the degree of price changes over time, the more volatile the exchange rate is, and the exchange rate market is said to witness high volatility. Volatility causes fear in the foreign exchange market as well as the financial market because investors are uncertain of their expectations on a daily basis. Investors and international traders are mostly affected by volatility in exchange rate as a result of uncertainties in the currency market (CBN, 2016).

ii. Misalignment of Exchange Rate

Misalignments of exchange rateoccur when foreign exchange rate deviate from its equilibrium. Simply put, exchange rate is misaligned when it digresses from the original stability that should have prevailed in an economically balanced situation. Undervaluation or overvaluations are often the consequences of exchange rate misalignment in an economy. External competitiveness and economic behavior of a country are largely influenced when misalignments occur (Adigun, 2018).

iii. Appreciation/Depreciation of Exchange Rate

This often occurs in a floating exchange rate system, appreciation of a currency will occur when there is an increase in value of a domestic currency relative to one or more foreign currencies. Also, a country's currency will said to have been depreciated when demand for additional domestic currency is needed to purchase a foreign currency at any given period. Thus, currency depreciation is the fall in value of a domestic currency in relation to one or more foreign reference currency or currencies (Mbutor, 2010).

iv. Revaluation /Devaluation of Exchange Rate

This is relative to a fixed exchange rate regime, with authority solely with the Central Bank to adjust the official value of the currency subject to government authorization. The value of exchange rate relative to foreign currency can either be increased taking the form of revaluation or decrease as the case may beto denote devaluation. Therefore, a deliberate increase in the value of a domestic currency relative to a foreign currencydone in order to strengthening the domestic currency is referred to exchange rate revaluation, while devaluation takes the opposite direction (Obadan, 2016). This study however, concentrates of the exchange rate volatility among all the dynamics of foreign exchange rate in the examination of stock price behavior of each of the selected sectors in Nigeria.

2.1.3.Stock Market and Stock Price Behavior

The equity market or stock market is an institution where issuing and trading of stocks of publicly held companies, bonds and other class of securities takes place. The equity market mediates between surplus and deficit unit by stimulating capital formation and socio economic development. The equity market strikes a balance through mobilization of fund from the surplus unit, thereby ensuring efficient resource allocation to prolific sector so as to boost and promote economic development (Onakoya, 2013). The stock market also provide capital financing for long term investments and maintain discipline for all stakeholders so as to widen the share ownership by providing the enabling atmosphere and maintain fair prices for securities.

Stock market behaves differently at different time depending on the trend and other economic factors in the country, stock market behavior is cyclical in nature as its moves from bullish position to a bearish one, stock markets reacts promptly to macroeconomic changes such as interest rate, inflation rate, oil price and exchange rate changes and also to international and domestic changes such as war, terrorist attacks, domestic or political unrest and so on.

2.1.4 Factors Affecting Stock Price Behavior in Nigeria

Stock prices changes due to the forces of supply and demand within the market, stock prices are either positively or adversely affected due to so many reasons within and outside the economic system. Which include information, performance, investors sentiments, economic and political shocks. Stock market investmentsare long-term in nature, as such, economic or political instability of any economy exert greater impact on the performance of the market (Kurotamunobaraomi and Ebiware, 2017).

Regulatory authorities in Nigeria have instituted numerous policies to ensure monetary and price stability, by controlling key macroeconomic variables which are expected to interact in order to ensure strong market performance. The ability of the Central Bank to curtail inflation, stabilize the value of the naira, maintain a well-managed external reserves and creating an enabling investment climate for long term growth and development are pivotal to maintaining price stability (Obadan, 2016). Slight changes in these macroeconomic variables affects investor's sentiments and attitude towards the market and causes stock price movement, some of the key macroeconomic variables that affects stock price movement are as follows:

i. Interest Rate

Interest rate is the cost of capital paid by the debtors for the use of credit borrowings and returns for parting with liquidity by lenders (Banks) which varies in term and maturity. Interest rates is a major tool in monetary policy to control money in circulation and also useful in gauging financial market conditions (CBN, 2016).

Interest rate is also the measurement of time value of money as explained by the finance theory, which is one of the key determinants of stock prices. Interest rate changes have ripple effect on the entire market, and differ across sectors, the financial sector and the industrial sector will feel

the impact of changes when the monetary policy rate is changed. An increase in the MPR by the CBN done in a bit to control inflation, will increases the cost of borrowing, reduces corporate earnings and firms profitability, curtail expansion and also reduces consumer spending and subsequently reduces the stock price (Amarasinghe, 2015).

Interest rate affects the level of consumption as well as the pattern of investment, an increase in interest rate, increases the cost of capital of listed firms and as such reduces the profitability of firm which will reduce the level of investment and also amount to poor market performance(Tella, 2016). Hence, Understanding the interdependence between interest rate and stock price is of primary importance to investors so as to better their understanding while taking investment decisions.

ii. Money supply

Money Supply as a monetary instrumentis used by the regulatory authorities to control the overall level of economy. Economists argued that,increase in money supply signal a strong financial stability in the country and provide better access to credit for corporate sectors leading to business expansion and increases earning. Increase in money supply implies increase indemand for money, which reflect increase in economic activities, and hence increase in cash flow and causes increase in stock prices (CBN, 2016). The monetary value and the perceived risk in holding the stock is relative to price of the equity, therefore, an asset is said to be worth investing on if the perceived risk is low and high monetary value likewise, stock will be unattractive if the perceived risk is high. Contrarily, if there is a negative shock on Money supply, the monetary value of a stock is affected through its effect on the interest rate. In essence, tightening money supply increases interest rate, and also increases discount rate, and subsequently leads to stock devaluation. Tightening money supply denotes a

deceleratingeconomic activity, decreases firm's profitability, increases investors risk premium, and stock becomes unattractive (Bernanke and Kuttner, 2005).

iii. Inflation Rate

Inflation rate is measured by consumer price index and according to CBN (2015), it is defined as a persistent rise in the general prices of goods and services in an economy. Changes in inflation rate impact positively or otherwise on firms profitability, reduces the purchasing power of money, lowering real incomes and subsequently reduces investment appetite.Inflation can also be referred to as a tax on real income balance that reduces real returns to savings that affects the financial system. Thus increased inflation reduces the present value of net income and future cash flows, also, inflation increases the cost of living, and hence, investors will shift their investment capital to consumption and as such reduces the market performance (CBN, 2016).

iv. Foreign External Reserve

Foreign external reserves according to IMF consist of official public sector foreign assets that are readily available to, and controlled by the monetary authorities, for direct financing of payment imbalances and directly regulating the magnitude of such imbalances through the intervention in the exchange markets to affects the currency exchange rate and/or other purposes (CBN, 2016). Foreign reserve includes foreign direct investment, portfolio and other investments. Foreign reserves are often use as an economic tool to maintain liquidity position during economic crisis and also to provide confidence and assurance to investors in other to prevent capital flight. According to Adigun (2018), financial market often reacts to foreign external reserves in Nigeria, as it often shows the wellbeing of a country in the international market.

2.2 Theoretical Review

This section presents theories that support the nexus between foreign exchange rate and stock price behavior. The dynamics of foreign exchange rate and stock prices was formulated on two fundamental theories over four decades which were the flow oriented or traditional theory and the stock oriented or the portfolio balanced theory.

2.2.1The Flow Oriented Theory

The Flow Oriented Theory often referred to as the traditional approach of exchange rate was propounded in the early 80's by Dornbusch and Fisher and lately in that same decade by Gavin (1989), According to Dornbusch and Fischer's (1980) theories of exchange rate, suggest that movements in exchange rates affect the international competitiveness of firms and trade balance which, in turn, affects real income and output and consequently affects stock prices. Also Gavin (1989) postulated that, Stock prices react to exchange rate changes and affect aggregate demand through wealth and liquidity effects, thereby influencing demand for money and the exchange rate.

Therefore, the theory suggests that the dynamism in exchange rate may affect stock prices which, in turn, affect domestic and foreign investor's investment decisions. For example, depreciation in exchange rate not only affects the demand and supply of financial assets but the returns on stocks and bonds are also affected, thus changes in returns on financial assets could occur due to exchange rate movements. The flow oriented theory envisages some degree of interdependence between stock prices and exchange rates. However, the direction of relationship between the variables depends largely on whether the country is an import dominated or export dominated (Kal, Arslaner and Arslaner, 2015).

In the flow oriented model, currency movement influence firms earnings and hence causes change in stock prices which in turn have an impact on the overall market performance. The

following related studies were built upon this theory both in the developed and developing economies in the likes of (Mbutor 2010; Adaramola, 2012; Husam, 2012; Kumar, 2013; Issahaku, Ustarz and Domanban, 2013; Lim andSek, 2014; Daniel, 2014; Kalim and Syed, 2015; Mohammad and Victor, 2015; Pramod, Rangan and Puja, 2016; Kennedy and Nourizad, 2016; Jamaludin, Ismail and Ab-Manaf, 2017).

2.2.2 The Stock Oriented or Portfolio Balanced Theory

The "Stock-Oriented Economic Theory" as captured in the portfolio balance model was propounded by Branson and Frankel (1983). The theory suggest that, increase in stock prices will drive capital flows, which increase the demand for domestic currency and cause exchange rate to appreciate. In contrast to "flow oriented" models, "stock-oriented" or 'portfolio balance theory postulate that movements in stock prices Granger-cause movements in the exchange rate via capital account transactions.

In other words, stock price is expected to affect exchange rate with a negative correlation since a decrease in stock prices reduces domestic wealth, which leads to a fall in domestic money demand and interest rate. Besides, the decrease in domestic stock prices induces foreign investors to lower demand for domestic assets and domestic currency. These shifts in demand and supply of currencies cause capital outflows and the depreciation of domestic currency. Also, when stock prices rise, foreign investors become willing to invest in a country's equity securities and so, these investors derive paybacks from international diversification thereby inducing capital inflows and increased in the domestic currency (Poornima and Ganeshwari, 2016).

Both the traditional approach and the portfolio approaches predict a dynamic relationship between exchange rate volatility and stock prices. Investors are generally more sensitive to market uncertainty; therefore, instability in the local stock market as a result of exchange rate

fluctuations may cause capital flight, the similitude of this was experienced in 2015 and 2016 on the Nigerian stock exchange market, as investors particularly foreign investors took a flight strategy and steadily withdrew from the market due to currency instability (NSE, 2016). Similar studies such as (Tahir and Wong, 2005; Tsai, 2012; Kubo, 2012; Subair and Salihu, 2013; Ayub and Masih, 2014; Poornima and Ganeshwari, 2016; Ray and Saha, 2016; Korsah and Fosu, 2016; Hassanain, 2017; Haughton and Iglesias, 2017) have their studies built on the portfolio balanced theory across the globe.

2.2.3The Arbitrage Pricing Theory

Arbitrage pricing theory was propounded by Ross (1976), as a result of much criticisms and weaknesses embedded in the Capital Asset Pricing Model (CAPM) on both theoretical and empirical grounds.This is evidenced by its unrealistic assumptions, difficulty of its empirical testing, holding that a security expected rate of return is a function of only one factor (i.e the general stock market), whereas the APT is based on the assumption that equilibrium market prices should be perfect, in such a way that prices will move to eliminate buying and selling without arbitrage opportunities.

Investors have homogeneous risk expectations and are risk averse,with no transaction cost and taxes exist within the market. Hence APT is concerned with a multi-factor model (that is, multiple Beta (β) model), the theory argues that risk factors (in the APT) arise from changes in some fundamental economic and financial variables such as interest rates, inflation, money supply, oil prices, exchange rate among others could also influence the price of an asset (Uwubanmwen and Obayagbona, 2012).

The theory holds that the expected return of a financial asset can be modeled as a linear function of several macro-economic factors or theoretical market indices, where sensitivity to changes in

each factor is represented by a factor-specific beta coefficient. The model-derived rate of return is used to price the asset correctly – as the asset price should equal the expected end of period price discounted at the rate implied by the model. If the price diverges, arbitrage would return it back to line. Previous studies (Saeed, 2012; Owolabi and Adegbite, 2013; Ouma and Muriu, 2014; Oyinlola, *et al*., 2014; Saizal and Sarma, 2015; Ray and Saha, 2016; Khalid and Khan, 2017; Shadi and Nada, 2017) have found this theory relevant to the interaction of macroeconomic variables on stock price behavior.

However, this study is anchored on the flow oriented theory, which postulated that movement in exchange rate affect international competitiveness of firms and trade balance. The flow oriented theory argued that movement in exchange rate causes stock prices movement through wealth and liquidity effects. Hence this study hypothesized that exchange dynamics affects stock price behavior in Nigeria.

2.3 Empirical Review

This section presents a review of relevant empirical studies on foreign exchange dynamics and stock price behavior, the behavior of stock market in relation to exchange rate dynamics has been extensively deliberated on across countries using different methodology and econometrical tools. The review will be categorized into (i) developed economies and (ii) emerging and developing economies and empirical reviews in Nigeria.

2.3.1Evidence from Developed Economies.

Yang and Yung (2004) studied the volatility spillover between stock prices and exchange rates using bivariate EGARCH model,study revealed direct volatility spillover from stock prices to exchange rate. Also, Phylaktis and Ravazzolo (2005) analyzed the long run and short run

dynamics between stock prices and exchange rates in the United States using co-integration and multivariate Granger causality test. Findings revealed that foreign exchange rates have significant and positive impact on stock market returns. And thus, concluded that, exchange rate appreciation have positive impact on stock market return.

Aloui (2007) employed a multivariate EGARCH model to investigate the volatility spillovers between exchange rate and stock indexes in Europe. Study revealed significant volatility spillovers from foreign exchange market to the stock market. In addition, Choi, Fang and Fu (2009) employed the EGARCH model to investigate the volatility spillover between stock market and foreign exchange rate. Study found volatility spillover effects from stock market to exchange rate.

Akel (2014) examined the causal transmission mechanism between foreign exchange rate and stock market using linear and non-linear causality test. Study found a unidirectional causality from exchange rate to stock prices for 4 countries and no causal relationship was found in other countries. Study concluded that, causality between exchange rate and stock prices varies across countries. Also, the study of Moore and Wang (2014) revealed no significant impact of exchange rate on the U.S stock market returns, however, interest rate is found to be the major determinants of the U.S stock market.

Furthermore, Mozumder, Vita, Kyaw and Larkin (2015) examined volatility spillover effects between exchange rate and stock price using the GARCH model. Study found that volatility spillover effect from stock market to exchange rate particularly for the developed economies;however, volatility spill from opposite direction for the emerging economies. However, these studies failed to assess the impact of other key variables such interest rate and inflation rate which are vital in volatility spillover effects between exchange rate and stock

prices. Kennedy and Nourizad (2016) investigated the volatility of exchange rate of the U.S. dollar and stock market volatility using a GARCH(1, 1) model and weekly data for the period January 1, 1999 through January 25, 2010. The study posited that increased exchange rate volatility exerted positive significant effect on the volatility of stock returns in the United State particularly when major drivers of financial volatility were controlled for.

Haughton and Iglesias (2017) found significant impact of stock price on exchange rate movements in tranquil sub-period.The GARCH model was employed to assess the effects among share price index (SP), foreign reserves, exchange rate and money market rate (MM) using monthly data. Study found mild relationship between the variables in 5 countries while no relationship within the other 2 countries. Also, Hassannain (2017) examined the interaction between stock prices and exchange rate in Kuwait and Saudi Arabia. An existence of long run relationship was found between real exchange rate and stock prices in Kuwait, while short run relationship was found in the Saudi Arabian market.

Wong (2019) examined volatility spillovers between real stock price returns and exchange rate returns in Malaysia within the period of October 2000 to March 2017. The study employed Component-GARCH model with asymmetric effect was used to decompose volatility into permanent and transitory component which are common in the crisis period. Study also made use of Seemingly Unrelated Regressions (SUR) framework to assess the volatility spillover between stock returns and real exchange rate. Study revealed that volatility spillover of permanent component between real exchange rate returns and real stock price returns are stronger than the transitory components.

However, these studies suffers sectoral implications, as most of these studies focus more on the aggregate market return which assertions/findings cannot be generalized on each sector even

within the same market. Sectors have different policies, regulations and rules that binds their operation which makes them differs in response to exchange rate dynamics.

2.3.2Evidence from Emerging and Developing Economies.

Walid, Chaker, Masood and Fry (2011) examine changes in exchange rate on four emerging market volatilities (Malaysia, Hong Kong,Mexico and Singapore). Study employed EGARCH model of the Markov-Switch (MS), an evidence of switching regime behavior was found in the four countries market volatility, study also found regime dependent in the of one country on the other in the relationship between stock prices and exchange rates. Patel (2012) employed Augumented Dickey fuller and Johansen co-integration on macroeconomic determinants andstock market performance in Indian.Long run equilibrium relationship exist macroeconomic variables and stock market indices, also study proved that exchange rate granger causes to stock market indices.

Türkyılmaz and Balıbey (2013) examined the shock and volatility transmission among exchange rate, interest rates and stock prices, study employed MGARCH (BEKK-GARCH model) on monthly data in Turkey. Findings showed significant shocks and volatility transmission among the variables,also study found that the market are integrated and respond to information that influences not only the return but also their volatility. The study of Lim and Sek (2014) in Asia examined stock return and exchange rate volatility and foundbidirectional causality between stock returns and exchange rate volatilityin Korea, Thailand and Indonesia. Moreover, the study found significant effects of exchange rate volatility, money supply, interest rate andforeign reserveson stock return volatilitiesof the 3 countries.

Abdulqayyum and Mohammad (2014) examined the dynamic relationship and volatility spillovers between the stock market and the foreign exchange market in Pakistan using Johansen

co-integration on weekly data from 1997 to 2012. Study found no support for long-run relationship between the two markets. Study further employed bivariate EGARCH framework to modeled volatility spillover and the result showed a two-way volatility spillovers indicating that the returns of the stock market are more sensitive to exchange rate volatility. And also the returns in the foreign exchange market are also affected by the stock market returns and the volatility of stock market returns. Hence the study concluded that there is strong link between the volatility of foreign exchange market and the volatility of returns in stock market in Pakistan.

Mbulawa (2015) analysed the interdependence between interest rates, exchange rates and stock market performance with the aid of Vector Error Correction Model on monthly data within two inflationary periods (the pre- hyperinflationary and hyperinflationary period). The study revealed that interest rate had mixed impact on performance of stock market in the pre-hyperinflationary phase. Also bidirectional causality was foundbetween stock market and exchange rates. However, a positive impact of exchange rate was found on stock market performance amidst hyperinflationary period.

In addition, Poornima and Ganeshwari (2016) in support for the portfolio balanced theory, investigate the dynamic connection between exchange rate and NIFTY stock index on daily indices. Correlation analysis revealed a negative coefficient between the variables,also Granger causality showed unidirectional causal relationship between NIFTY stock returns and exchange rates. So also, Najaf & Najaf (2016) assessed the dynamic behavior of stock movement in India and volatility of exchange rate. Johansen co-integration and granger causality was used and concluded on negative relationship between exchange rate volatility and the Indian stock market. Studyfurther revealed unidirectional causality from stock market to exchange rate.

In addition, a negative impact was found in the work of Ray and Saha (2016) who examined stock returns and macroeconomic variables of Bombay Stock Exchange (BSE) such as inflation rate (INFLA), gross domestic product (GDP), exchange rate (EX), gold price (GLD), oil price (OIL). Johansen co-integration test was used to investigate the long-run relationship among the variables, study also examined stock returns volatility in response to changes in macroeconomic variables using GARCH (1,1) model. Study found negative significant impact of exchange rate on stock returns while other variables were negative and insignificant to BSE stock return. However, these studies fall short of sectoral analysis, as the findings on the general market cannot be generalized and might hide significant information peculiar to each sector. Also the methodology used in the study of Ray and Saha (2016) is restrictive in nature and cannot allow for an explicit testing when dealing with volatility spillover effects of assets pricing.

Khalid and Khan (2017) empirically examined the link between stock market return,interest rate, inflation rate and exchange rate in Pakistan.Study used ARDL to investigate the long run co-integrating relationship between the variables and found an existence of long-run relationship between exchange rate, inflation rate, interest rate and stock market returns. The results also showed that exchange rate was insignificant but impacted positively on PSX index while inflation rate was positively significant to stock market return. However, interest rates have a negative significant impact in the long run on the PSX market returns. In the same vein, Jamaludin, Ismail and Ab Manaf (2017) investigate the Islamic stock market returns in relation to exchange rate, inflation rate and money supply in Singapore, Malaysia and Indonesia, using monthly data. The study employed panel least square regression model to ascertain the effects of macroeconomic variables on market returns.Findings showed that exchange rate and inflation

rate significantly influence stock market returns, while money supply has no significant influence on stock market return.

Rekha and Mary (2017)examined the relationship between stock market returns in Indian and volatility of exchange rate on daily closing prices for 10 years, the study employed ADF and GARCH to establish the relationship and volatility effect on both variables and posited a high degree of exchange rate volatility on Indian stock market returns.

2.3.3 Evidence from African Countries.

Chinzara (2010) examined the uncertainty of macroeconomic variables and volatility of South African stock market with the aid of Augmented Autoregressive GARCH (AR-GARCH) and Vector autoregressive models (VAR). The study found that macroeconomic uncertainties significantly affects stock market, specifically, exchange rate changes and interest rate are the major variables that influence stock market variability particularly during financial crises.

Furthermore, Bonga and Hoveni (2011) examined the interdependence between exchange rate volatility and the equity market volatility in South Africa. Multi-step GARCH model was used to establish the volatility effect, study found volatility spillover effects from the equity market to exchange rate market. Their findings were ascribed to highforeign participation in South Africa, whereby foreign investors interest in local stock are often relaxed when pressure of volatility increases.

Kenani, Maoni, Kaunda and Nyirenda (2012) investigated the short-run and long-run dynamic relationship between stock prices and exchange rate in Malawi. Study found no causal relationship between stock prices and exchange rate and also no evidence of long-run relationship between the two variables. Mlambo, Maredza and Sibanda (2013) investigatedexchange rate volatility on stock market returns in Johannesburg using monthly data.

Study employed GARCH model a weak relationship was found between exchange rate volatility and stock market returns. However, positive significant impact of interest rate was found on stock market returns in Johannesburg.

Furthermore, Kirui, Wawire and Onono (2014) in Kenya found significant positive influence of exchange rate on stock price behavior in theirinvestigationof macroeconomic variables and the Nairobi stock market returns. Study employed Engle-Granger two step methods to examine the relationship between macroeconomic variables and stock market returns, in addition, study employed TGARCH model to establish the leverage effects and persistence of volatility, using a quarterly data. The regression result revealed significant positive impact of exchange rate on stock returns, while and insignificant impact was found between stock returns and other macroeconomic variables. Furthermore, study found presence of leverage effects and asymmetric information through the TGARCH model for Treasury bill, exchange rate and Gross Domestic Product.

Ouma and Muriu (2014) examined stock market returns and macroeconomic variables in Kenya. Study employed OLS to examine the influence of interest rates, exchange rate, inflation rate and GDP on the stock market return. Findings showed significant negative effects of exchange rate on stock market return, while inflation rate and GDP were significant and impacted positively on the stock return. However the study concluded that interest rate is not a determining factor of the stock market return in Kenya.

In addition, Sichoongwe (2016) investigated stock market returns and exchange rate volatility in Zambia using GARCH (1,1) model. Study found significant negative relationship between exchange rate volatility and stock market returns. Similarly, Worlu and Omodero (2017) examined macroeconomic variables and performance of stock market for four major Africa

countries: Ghana, Kenya, South Africa and Nigeria within the period 2000 to 2015. Time series data and multiple regression techniques were used to analyze the influence of GDP, inflation and real exchange rate on stock market performance in Africa. Study found negative insignificant influence of macroeconomic variables on share price index for four major countries in Africa. Hence, the portfolio balanced theory was supported for most of the African countries as negative impact of exchange rate was profoundly noticed within the continent.

2.3.4 Empirical Evidence from Nigeria.

Maku and Atanda (2010) investigated the effects of macroeconomic shocks on the Nigerian capital market using Error Correction Model (ECM). The study posited that the NSE all -share index respond to changes in the inflation rate, exchange rate, and money supply and real output. Thus, the Nigerian capital market both in the long-run and short-run has simultaneous significant response to external shock and other macroeconomic indicators. Also, the long run and short run effects of exchange rate and stock market development was examined by Adaramola (2012) using Johansen co-integration tests. Study specified a bi-variate model and found that exchange rate have positive and negative significant impact on stock market development both in the short run and long run.Study also found unidirectional causality from exchange rate to stock market performance through the granger causality test.

Furthermore, Osisanwo and Atanda, (2012) analyzed stock market determinants using Ordinary Least Square regression, Study found interest rate, money supply and exchange rate as the main determinants of stock returns in Nigeria. Owolabi and Adegbite (2013) analyzed capital market performance and inflation rate in Nigeria using Johansen co- integration model, study found negative and positive significant relationship between inflation and market capitalization in the

short-run and the long run. However the study concluded that inflation has weak significant effects on the Nigerian capital market performance. In addition, Ibrahim and Agbaje (2013) examined the dynamic interrelationship between inflation rates and stock market returns using monthly data. Study employed the ARDL model and found long-run co-integration between inflation rate and stock returns in Nigeria.

David and Mike (2013) examined the dynamic interaction between stock prices and exchange rate using the Granger-Sim Causality test. Study found bi-directional causal relationship between foreign exchange rate movement and stock prices in Nigeria. Study further posited that the interaction between exchange rate and stock price in Nigeria is consistent with the presumptions of the flow oriented and portfolio theories. Usman and Adejare (2014) examined the influence of exchange rate, interest rate andthe Nigerian capital market performance using multiple regression techniques. Study found positive and negative significant impact of exchange rate and interest rate on the Nigerian capital market performance.

In addition, Oyinlola, Adeniyi and Omisakin (2014) investigateddynamics effects of exchange rate and stock prices in Nigeria. Study employed Johansen and Gregory-Hansen co-integration analyses and EGARCH model on daily data. Study showed no long run relationship between stock prices and exchange rate, and found a unidirectional relationship from stock prices to exchange rate. Mohammad and Victor (2015) examined exchange rate volatility and stock market performance in Nigeria. The study employed GARCH and Error Correction Model and found significant negative impact of exchange rate and inflation rate on the Nigerian stock market performance. While interest rate showed positive significant effects on the Nigerian stock market performance. Also the study through pairwise granger causality test proved a unidirectional relationship between the variables.

Adeniji (2015) examined the link between macroeconomic variables and stock market volatility in Nigeria. Study employed GARCH (1, 1) model, bi-variate and multivariate VAR Granger causality through regression analysis using monthly data. Study found that exchange rate and interest rate are significantly related to stock market volatility and also causality runs from both variables to stock market. Also, GDP, inflation and money supply have no significant relationship with stock prices in Nigeria. Nkoro and Uko (2016) examined exchange rate volatility, inflation rate and stock market volatility in Nigeria using GARCH-S. Study found negative long run significant relationship in exchange rate volatility and inflation rate on stock market returns in Nigeria. Therefore, study posited that Nigerian markets are influenced by their domestic indicators such as exchange rate and inflation.

Kurotamunobaraomi and Ebiware (2017) examined inflation rates and stock prices of quoted firms in Nigeria using Ordinary Least Square regression, Johansen Co-integration and Granger Causality Test to investigate the influence of exchange rate, money supply, interest rate and inflation rate on stock price. The study found no long run relationship among the variables and concluded that exchange rate, money supply and inflation rate portray statistically significant impacton stock prices in the short run. However, interest rate showed negative impact on stock prices,furthermore, study found unidirectional causal relationships from stock price to interest rate and exchange rate.

2.3.5 Sectoral Evidence of Foreign Exchange Rate Dynamics and Stock Price Behavior in literature.

All the studies mentioned earlier analyzed the dynamics of exchange rates and stock prices on the aggregate market. These studies suffer sectoral limitations and based their findings and

presumptions on the fact that markets are homogeneous in nature. However, Narayan & Sharma (2011) disputed on the homogeneity of the market, and posited that, firms and indeed sector that made up the market, have different structures, regulations and policies that guide their operations. Thus, concluded that markets are heterogeneous in nature.

In line with Narayan and Sharma's view, Tahir and Wong (2005) examined the relationship between exchange rate and stock price in Pakistan of four sectors (the general index, the financial sector index, industry sector index and the service sector index) of the Karachi Stock Exchange. Their findings also support the portfolio balanced model and posited that general stock index affect exchange rate in the short run. However, the study also showed that exchange rate movement can affect the prices of service sector which implies that exchange rate can serve as policy tools to improve the quality of the service sector in Pakistan.

Zakri (2013) investigated the effects of exchange rates of four trading partners of the U.S. on the U.S. stock market and on ten sectors of the U.S. economy, using regression and correlation analysis. The study found differing impact of exchange rates of individual country's currencies on U.S stock market return. First, no significant impact of the China yuan was found on any of the sector except for the energy sector. The Japanes yen significantly affects seven out of the ten sectors excluding Telecomunications, utilities and the health sectors. Also, the British pound has positive significant impact on seven sectors while the Euro has positive significant impact on five sectors and negative effects on one sector. Finally, the study found energy sector to be more volatile among the sectors while, non-durable sector to be the least volatile.

In addition, Emenike and Peter (2014) examined the domestic volatility transmission between the banking sector, consumer goods sector and shariah complaints equities sectors in Nigeria using BEKK- MGARCH model on the daily stock returns of these sectors. Study found

unidirectional shock and volatility transmission from the banking sector to the consumer goods sector and the shariah complaints equities sectors, while a bidirectional volatility transmission was found from the consumer goods sector to shariah complaints equity sectors. Although, other key sectors on the Nigerian stock market were not included in the study, also the study failed to take into consideration the long run and short run effects of foreign exchange rate volatility on the sectors under study.

Saizal and Sarma (2015) investigated the impact of macroeconomic variables namely economic crisis, interest rate, inflation, exchange rate, economic development, money supply and economic liberalization on stock returns volatility in four economic sectors.Thestudy showed that current stock returns volatility is persistent in influencing future stock returns performance across all economic sectors. Particularly, the financial sector exhibit 100% volatility persistent, study also found leverage effects in the finance sector, indicating that negative news bring high magnitude of volatility compared to positive news. Also the generalized least square revealed that all economic variables such as exchange rate, inflation rate and economic growth were significant and they are the major determinants of stock return in all the sectors.

Mouna and Anis (2016) investigated Market, interest rate, and exchange rate risk effects on financial stock returns during the financial crisis. Study employed weekly data through Causal-in-mean and Variate GARCH-in-mean model.Study concluded that there is causal relationship between exchange rate, interest rate and stock returns for most of the countries. Also study found long term impact of interest rate on the financial service sector and insurance sector but with limited impact on the banking sector. Furthermore, study found positive and negative volatility spillover effects on the banking, insurance and the financial service sector for most of the countries, but with much impact on the insurance sector stock returns.

Amin and Janor (2016) examined the co-movement between exchange rates and stock prices of both the market and industries (industrial sector and consumer goods sector) in Malaysia from March 1994 to December 2013. The study applied vector error correction model including the Long Run Structural Model (LRSM) and variance decompositions to examine the relationship between exchange rate, stock price and interest rate. Study found the direction of causality runs from exchange rates to stock prices which are consistent with flow oriented theory. However, the impact of exchange rate varies across sectors, the study found consumer goods sector to be mostly affected by exchange rate with minimal effect of interest while industrial sector have less impact.

Gathogo, Mungatu and Mulyungi (2017) present a sectorial approach to evaluate the effects of macroeconomic variables on market capitalization across the listed companies in Nairobi security exchange in Kenya, the study used secondary data covering a five-year period from 2010 to 2015. Mixed research design of both descriptive and correlational techniques was employed. The study found that Exchange rate had a positive significant influence on market capitalization in Agricultural sector; Industrial allied sectors while a negative effect on Finance and investment sectors and as well as the commercial and services sectors. Also, inflation had a positive influence on the stock market Performance in investment sector and a negative influence on all other sectors. Furthermore, Interest rate had a positive significant impact on the market capitalization in Agricultural sector and Commercial sectors however, a negative influence was found on Investment sectors. The study also found that fuel prices had a negative influence on the market capitalization in the Automobile sectors while having a positive influence on the market capitalization in all the other sectors. On the final note, the study showed that sectorial characteristics had a moderating effect on the relationship between macroeconomic variables of

exchange rate, Interest rate, Inflation, fuel prices and the market capitalization at the Nairobi security exchange.

More recently, Akanni and Isah (2018), examined exchange rate movements on sectoral stock prices in Nigeria, the study made use of both linear and Non-linear ARDL to check whether there is evidence of asymmetry within the markets. Study found only three sectors (conglomerates sectors, consumer goods sector and financial service sector) with asymmetry behavior to exchange rate changes, other sectors were insignificant and thus posited that, exposure of firms stock prices to exchange rate movement are identical in the long-run irrespective of exchange rate changes. Furthermore, the study found positive and significant effects of exchange rate for oil and gas sector in the long-run and concluded that exchange rates have positive and significant impacts on the consumer goods and financial services sector on the Nigeria stock market. Other studies like (Jayasinghe and Tsui, 2008; Safitri and Kumar, 2015; Mouna and Anis, 2016) share the same view and posited that individual sector responds differently to exchange rate volatility most especially during crisis period as individual sector are heterogeneous in nature.

2.4Summaryand Gaps Identified in Literature

From the review of existing literatures, it can be deduced that there are no clear cut agreement on the effect of foreign exchange rate dynamics and stock price behavior in virtually all economies. Previous studies have examined foreign exchange rate alongside with one or combination of two relevant variables on the aggregate stock market as most studies presumed that the market are homogeneous. However, in reality, market are thus heterogeneous, as individual firms and indeed sectors that made up the market have different structures and of course have different policies and regulations that govern their operations (Narayan and Sharma 2011).

Hence, sectoral sensitivity to exchange rate dynamics varies across sectors even within the same market. However, very few studies like that of (Jayasinghe and Tsui, 2008; Zakri, 2013; Safitri and Kumar, 2015; Amin and Janor, 2016; Mouna and Anis, 2016; Gathogo, *et al*., 2017) examined foreign exchange rate and stock prices on a disintegrated sectoral level. In view of this, it can be said that, sector sensitivity in stock prices to exchange rate dynamics have not received much attention particularly in Nigeria and that constitute the gap this study bridge in literature.

Furthermore, Wooldridge (2006) argued that the effects of one variable on the other will not be established unless other relevant variables are held constant; literatures have not been able to reach an affirmative conclusion with regards to the effect of exchange rates on stock prices. Hence some studies like, (Owolabi and Adegbite, 2013; Ouma and Muriu, 2014; Oyinlola, *et al*., 2014; Khalid and Khan, 2017), were of the opinion that foreign exchange alone cannot influence stock price behavior. Therefore, this study identified macro economical gap in terms of foreign reserves and money supply in the examination of stock prices behavior in Nigeria, more importantly on a disintegrated sectoral level.

Furthermore, the study examined volatility spillover effect of exchange rate on stock price behavior on sectoral basis, using Exponential Generalized Autoregressive Conditional Heteroskedasity (EGARCH) model, that allows for an explicit testing of volatility spillover without imposing additional restriction.The EGARCH uses natural log of the conditional variance to eliminate the non-negativity constraints imposed by the GARCH model. In addition, the study examined the volatility transmission within the banking sector, insurance sector, oil and gas sector and the consumer goods sector of the economy on the Nigeria stock market using the two forms of Multivariate GARCH models namely: the BEKK model and the Dynamic Conditional Correlation.

2.5 Summary of Empirical Literature

Table 2.5.1: Foreign Exchange Rate and Stock Price Behavior Empirical Evidence from Developed Economies

Author	Research Title	Techniques	Findings
Yang & Yung (2004)	Price and Volatility Spillovers between Stock Prices and Exchange Rates: Empirical Evidence from the G-7 Countries	EGARCH	The result revealed a direct impact of stock prices on exchange rate and volatility spillover from stock prices to exchange rate.
Phylakits & Ravazzolo (2005)	Stock prices and exchange rate dynamics	Co-integration and multivariate granger causality	Study posited that exchange rate have positive significant impact on stock prices.
Yau & Nieh (2006)	Interrelationships among stock prices of Taiwan and Japan and NTD/Yen exchange rate	TECM and Granger causality	The study showed no existence of long-term relationship between exchange rate and stock prices of Japan and Taiwan.
Aloui (2007)	Price volatility spillovers between exchange rates and stock indexes for the pre and post — euro period	EGARCH	Findings revealed a bidirectional spillover effects between exchange rate and stock prices, however, the study concluded that volatility spillover was periodical in nature.
Jayasinghe & Tsui (2008)	Exchange rate exposure of sectoral returns and volatilities: Evidence from Japanese industrial sectors.	ARDL	Study found significant evidence of exposed returns but the effect varied within the sector, as some industries were positively affected while others proved negative.
Raghavan & Dark (2008)	Returns and volatility spillover between foreign exchange market and stock market in Australia.	GARCH	The study concluded that volatility spillover effect of exchange rate affects stock market in Australian.
Richards & Simpson (2009)	The Interaction between Exchange Rates and Stock Prices	Dynamic OLS and fully- modified OLS	Study revealed positive significant relationship between the two variables. Also, causal relationship was found from stock market to exchange rate. Although, an inconsistent result was found from the two methods. While a positive

			significant effect was found from the use of DOLS, a negative result was found from MOLS.
Choi, Fang & Fu (2009)	Volatility spillover between market returns and exchange rate in New Zealand	EGARCH	Study showed existence of volatility spillover from stock market returns to exchange rate changes. Also, study found that past volatilities affect present volatilities in the two markets.
Parsva & Lean (2011)	The Analysis of Relationship between Stock Prices and Exchange Rates: Evidence from Six Middle Eastern Financial Markets.	Co-integration and VECM	The study found causal relationship between exchange rate and stock prices for most of the countries. However, bidirectional relationship was found for Iran, Oman and Egypt, while a unidirectional causal effect was found in Kuwait.
Akel (2014)	Relationship between exchange rates and stock price in transition economies.	Linear and non-linear causality	The posited that causal relationship exists from exchange rate to stock prices both in the pre and post euro periods.
Moore & Wang (2014)	Dynamics linkage of exchange rates and stock prices in the developed and developing countries	Correlation	The study found that trade balance is the major determinants in the developed countries and also concluded that interest rate remain the driving force of the emerging markets.
Mozumder, Vita, Kyaw & Larkin (2015)	Volatility Spillover between Stock Prices and Exchange Rates: Evidence of the global financial crisis	EGARCH	Study revealed volatility spillover effect of stock price to exchange rate for the developed economies while contrasting evidence was found for the emerging market.
Kennedy & Nourizad (2016)	Effects of exchange rate volatilityon stock market volatility	GARCH	The study exerted that exchange rate volatility pose positively and statistically significant to stock market return volatility.
Haughton & Iglesias (2017)	Movements of exchange rate, stock price volatility in Caribbean and Latin America.	Correlation and GARCH	The result showed a very mild relationship between stock prices and exchange rate movement in 5 countries. Nevertheless, the study concluded that stock prices have significant impact on exchange rate movement when volatility risk was

			introduced as part of the variables.
Hassanain (2017)	Real exchange rate movements and stock prices.	ARDL and DCC-GARCH Model	The study found a long run relationship between real exchange rate and stock index in Kuwait, while a short run correlation exist in Saudi Arabian.
Lei, S. (2017)	Research on the Relationship between Interest Rate and Stock Price in China	Co integration regression analysis.	Study found no significant relationship on stock prices in china both in the short and long run.
Pícha, V. (2017).	Money supply and its effects on stock market.	VECM	Study found positive significant influence of money supply on equity market both in the long run and short run of the US stock market.
Wong, H. T. (2019)	Volatility spillovers between exchange rate and stock price returns in Malaysia.	C-GARCH and Seemingly Unrelated Regression (SUR)	Study revealed that volatility spillover of permanent component between real exchange rate returns and real stock price returns are stronger than the transitory components

Source: Author's Compilation, (2019).

Table 2.5.2: Foreign Exchange Rate and Stock Price Behavior Empirical Evidence from Emerging and Developing Economies

Author	Research Title	Techniques	Findings
Adjasi, Harvey, & Agyapong (2008)	Exchange rate volatility and the Ghana stock market	GARCH	Study found negative relationship exist between exchange rate and stock returns in Ghana.
Rahman & Uddin (2009)	Dynamic Relationship between Stock Prices and Exchange Rates	Granger Causality	Findings showed significant causal relationship from stock price to exchange rate in the US.
Gaurav, Aniruddh & Ankita (2010)	A Study of Exchange Rates Movement and Stock Market Volatility.	Granger Causality	The study proved that stock prices granger causes exchange rate.
Tian, & Ma (2010)	The relationship between stock returns and the foreign exchange rate	ARDL	The study showed positive significant influence of money supply and exchange rate on stock price. Hence an existing co-integration among variables.
Zhao (2010)	Exchange Rate and Stock Price: Evidence	VAR and M-GARCH	Findings revealed no evidence of volatility spillover effects

	from China		among exchange rate and stock prices in China.
Kutty (2010)	Causal relationship between stock prices and exchange rate.	Granger Causality	Findings showed no evidence of causal relationship between stock price and exchange rate.
Chinzara (2010)	Uncertainties of macroeconomic variables and stock market.	VAM and AR-GARCH Model	The study revealed positive volatility between stock market and treasury bill rate, exchange rate and gold price, however, a negative volatility on inflation rate.
Walid, Chaker, Masood & Fry (2011)	Stock market volatility and exchange rates	EGARCH	Findings revealed evidence of volatility spillover effects from exchange rate to stock market.
Zia & Rahman (2011)	Foreign exchange rate and stock prices in Pakistan.	Granger Causality	Findings showed no causal relationship between stock prices and exchange rate.
Pal & Mittal (2011)	Macroeconomic indicators and the Indian stock market.	Co-integration	The study revealed that only exchange rate and inflations rate have significant influence on the Indian stock market.
Bonga & Hoveni (2011)	Exchange rate volatility and the equity market.	GARCH	The study found volatility spillover effects from stock market to exchange rate.
Diamandis & Drakos (2011)	Financial liberalization, exchange rates and stock prices: Exogenous shocks in four Latin American countries	Co-integration and Granger Causality Technique	The study posited that, there is no long run relationship between stock prices and exchange rate among the four Latin American countries.
Patel (2012)	Macroeconomic determinants and stock market performance.	Johansen Co-integration	Findings revealed causal relationship from exchange rate to stock market, and also found long run integration among the variables.
Araghi & Pak (2012)	Exchange rates changes and the Tehran stock market.	GARCH	The study found a mild positive influence of exchange rate on the stock market.
Tsai (2012)	Stock prices and exchange rate in Asia.	Quantile Regression Analysis.	The study concluded on the portfolio balanced theory which outlines that change in stock price index will affect domestic currency.
Akbar, Ali,	Stock Prices and	Co-integration and	The study found positive effects

&Khan (2012)	Macroeconomic Variables.	VECM	of interest rate and money supply on stock prices. While foreign reserve and inflation have negativeimpact.
Husam (2012)	Stock prices and exchange rates dynamics: Evidence from emerging markets	Co-integration and Granger Causality	The study concluded on a long run relationship between the two variables and also bidirectional causality from both ends.
Kenani, Maoni, Kaunda, & Nyirenda (2012)	Stock Prices and Exchange Rates dynamics: Evidence from Malawi	VECM and Granger Causality	The study found that past volatilities of stock price can be used as a predictor for present volatilities.
Sifunjo, & Mwasaru (2012)	Exchange Rate and Stock Prices in Kenya.	VECM	The study revealed that nominal exchange rate significantly influence stock prices.
Kumar (2013)	Volatility spillover between stock prices and exchange rates.	GARCH	The result showed bi-directional volatility spillover between stock and foreign exchange markets in the IBSA countries.
Maheen & Ullah (2013)	Impact of Foreign Exchange rate on stock prices.	VECM	The study found short run significant effects of exchange rates on stock market returns.
Serpil & Mesut (2013)	The Relationships among Interest Rate, Exchange Rate and Stock Price: A	BEKK- MGARCH	The study concluded that all variables are significantly integrated to shock transmission and volatility spillover also, all variables react to information that influence return and volatility.
Gul & Khan (2013)	An application of arbitrage pricing theory on KSE-100 index	Co-integration	Findings showed that exchange and money supply have significant impact on stock market returns.
Liang, Lin & Hsu (2013)	Stock Prices and Exchange Rates	Panel Granger Causality	Study revealed that exchange rate impact negatively on stock price in the ASEAN countries.
Issahaku, Ustarz, & Domanban (2013)	Macroeconomic Variables and Stock Market Returns in Ghana: Any Causal Link?	VECM	Study showed significant impact of FDI, inflation rate and money supply on stock market returns in Ghana.
Khodaparasti (2014)	The role of macroeconomic	Co-integration	The study posited that exchange rate is positively and

	variables in the stock market in Iran.		significantly related to stock market index while no significant impact was felt on stock market from money supply and consumer price index.
Abdulqayyum, & Mohammad (2014)	Volatility Spillover between foreign exchange rates and Stock Market returns.	VAR-EGARCH Model.	Findings revealed no co-integrating evidence between foreign exchange rates and market returns.
Ayub & Masih (2014)	Interest rate, exchange rate, and stock prices of Islamic banks.	Co-integration	The results showed that ER displayed a negative significant relationship on Islamic bank stock prices.
Safitri & Kumar (2014)	Exchange rates, GDP, interest rates, and inflation rates on stock price index of plantation sector	VECM	Study found that exchange rate and other macroeconomic factors (i.e. interest rates and inflation) have no significant influence in explaining Indonesia Plantation sector.
Ouma & Muriu (2014)	The impact of macroeconomic variables on stock market returns in Kenya	OLS	The study concluded that exchange rate is significant but has negative impact on stock return prices in Kenya while inflation rate and GDP were significant and impacted positively on the stock return.
Kirui, Wawire, & Onono (2014)	Stock markets returns and macroeconomics variables: A Case of Nairobi Securities Exchange, Kenya	TGARCH and Engle Granger two step Model	The study concluded that exchange rate affects stock return and also have a negative relationship on stock market return in Nairobi.
Mbulawa (2015)	Exchange rate, interest rate and Stock Market Performance in Zimbabwe.	VECM	The study concluded on a mix outcome base on the period. While a unidirectional causality between stock and exchange rate in the pre hyperinflationary phase, a bidirectional movement from stock to exchange rate in the hyperinflationary period.
Umer, Sevil, & Kamisli (2015)	Exchange Rates dynamics and Stock Prices: Evidence from Emerging Markets	ARDL	Study found out that co-movement between exchange rate and stock prices were stronger during the crisis period than the tranquil period also causality run from exchange

			rate to stock prices in the crisis period while causality run from stock prices to exchange rate in the tranquil period. Nevertheless, inconsistence long run equilibrium exists between the two variables.
Amarasinghe, (2015)	Interest Rate and the Colombo stock market returns.	Granger causality and regression	Study found that interest rate granger causes market returns. In addition, significant impact of interest rate was found on stock returns in Colombo.
Cuestas & Tang (2015)	Asymmetric exchange rate exposure of stock returns	MS-SVAR	Study posited causal effects from stock market to foreign exchange market. In addition, the study indicated that spill-over effects during financial crisis have longer durations than non -financial crisis.
Ihsan, Baloch & Kakakhel (2015)	Stock market returns and exchange rate.	Granger Causality	Study found no causal relationship between stock market returns and exchange rate.
Poornima & Ganeshwari (2016)	Relationship between Exchange Rates and Stock Market Index	Correlation and Granger Causality	Study found negative relationship between exchange rate and stock market returns.
Ray & Saha (2016)	Stock return volatilities and macroeconomic variables.	GARCH	The study found that only exchange rate was negatively significant to BSE stock market return, other macroeconomic variables were insignificant and negatively affects stock market return.
Huy (2016)	The linkage between exchange rates and stock prices	Toda Yamamoto and VDA	The study concluded on a unidirectional causality from stock market to exchange rate supporting the portfolio balanced theory in the pre- crisis period, while the traditional model was supported in the post crisis period.
Dejan, Jovan & Vera (2016)	Dynamic Nexus between Exchange Rate and stock prices in the major East European economies	DCC	The study revealed stock prices influence changes in exchange rate and are more significant during global financial crisis.

Najaf & Najaf (2016)	A study of exchange rates movement and stock market volatility	Johansen Co-integration and Granger Causality	The study concluded on a unidirectional causality between stock returns and exchange rate in India.
Korsah, & Fosu (2016)	Stock market capitalization and exchange rates movements.	VECM	The study found long run negative significant impact of exchange rates on stock market capitalization.
Aruna, Kumar & Kurain (2016)	Influence of Exchange Rate on BSE Sensex & NSE Nifty	Co-integration	The study found no relationship between stock price and exchange rates.
Katusiime, Agbola & Shamsuddin (2016)	Exchange rate volatility–economic growth nexus in Uganda.	ARDL	The study concluded that exchange rate volatility positively affects economic growth in Uganda.
Sichoongwe, (2016)	Exchange Rate Volatility and Stock Market returns.	GARCH	Findings revealed negative effects of exchange rate on stock market returns.
Jamaludin, Ismail & Ab Manaf (2017)	Macroeconomic Variables and Stock Market Returns	Panel least Square Regression Techniques	Study concluded that both conventional and Islamic stock market returns are significantly affected by the exchange rate and inflation rate, while money supply was found to be insignificant
Rekha & Mary (2017)	Foreign Exchange Rate Volatility and market returns	GARCH	The study found high degree of volatility of exchange rate on stock market returns in India.
Khalid & Khan (2017)	Macroeconomic Variables and Stock Market Volatility.	ARDL	The study revealedpositive impact of inflation rate and exchange rate on stock market return while interest rates have negative effects.
Worlu & Omodero (2017)	Macroeconomic Variables and Stock Market Performances in Africa.	Multiple Regression	The study found an adverse effects of exchange rate, inflation rate, and GDP on share price index in the four African countries
Shuangqun (2017)	Research on the Relationship between Interest Rate and Stock Price in China.	OLS and ECM	The study found an uncertain relationship between interest rate and stock price in China.
Otieno, Ngugi & Wawire (2017)	Exchange rate, inflation rate and stock market returns in Ghana	ARDL	Study found significant long run co-integration between inflation rate and exchange rate on stock market returns in Ghana.

Charles & Richard (2018)	Effects of Interest Rate on Stock Market Returns in Kenya.	ARFIMA and Granger causality.	The study established co-integrating residuals among the variables of interest which are fractionally integrated. Also, study revealed that interest and 3-month treasury bill granger causes stock market returns.

Source: Author's Compilation, (2019).

Table 2.5.3: Foreign Exchange Rate and Stock Price Behavior Empirical Evidence from Nigeria

Author	Research Title	Techniques	Findings
Maku & Atanda (2010)	Determinant of Stock market performance in Nigeria: Long Run Analysis.	ECM	The study showed long run significant effects of microeconomic variables on stock market performance in Nigeria.
Adaramola (2012)	Exchange Rate Volatility and Stock Market Behavior	Co-integration Granger Causality	The study asserted that stock market price respond positively to exchange rate changes.
Osisanwo & Atanda (2012)	Stock market returns determinants in Nigeria	OLS	The study found that macroeconomic variables and external shock influence stock market changes in Nigeria
Ibrahim & Agbaje (2013)	Stock Return and Inflation rates in Nigeria	ARDL and ECM	Findings revealed long run relationship between inflation and stock market returns in Nigeria.
Zubair (2013)	Exchange rates and stock market index: a causal relationship	TVAR	The study revealed no significant impact of exchange rate on stock market index, also the granger causality showed absence of causality in both variables.
Subair &Salihu (2013)	Exchange Rate Volatility and the Stock Market: The NigerianExperience	GARCH and ECM	The report states that exchange and inflation rate have negative significant impact on stock market performance while interest revealed a positive impact.
David & Mike (2013)	Exchange rate variability and stock prices in Nigeria	Granger sim causality	Findings showed two way causal relationships between stock price and exchange rate in Nigeria.
Oyinlola, Adeniyi & Omisakin (2014)	Exchange rates and stock price dynamics in Nigerian	EGARCH and Granger Causality	The study found one-way causal relationship from stock price to exchange rate. And also posited that, there is no long run

			relationship between the two variables.
Ibrahim & Musah (2014)	An Econometric Analysis of the Impact of Macroeconomic Fundamentals on Stock Market Returns	VECM and Johansen Multivariate Co-integration approach.	The study found negative significant effects between interest rate, industrial production and exchange rate in the long run. However, money supply and inflation rate proved positive.
Amarasinghe & Dharmaratne (2014)	Dynamic relationship between Exchange rate and Stock Returns	Granger Causality and Regression	Findings revealed that stock return granger cause exchange rate. However, regression result showed no significant impact of stock returns on exchange rate, thus a contradictory position between the two methods.
Adeniji (2015)	Macroeconomic variables volatility and stock market prices volatility in Nigeria.	GARCH and VAR Granger causality	The study revealed that only exchange rate and interest rate have significant influence on stock market volatility.
Muhammad & Victor (2015)	Exchange rate volatility and the Nigerian capital market performance	GARCH, ECM and Pairwise Granger Causality	The study revealed that exchange rate volatility has strong negative influence on the Nigerian stock market performance.
Omankhanlen, Senibi & Senibi (2016)	Stock price movements and macroeconomic indicators.	Co-integration analysis and VECM	Study concluded that inflation rate, exchange rate and oil prices are major determinant of share prices in Nigerian.
Nkoro & Uko (2016)	Exchange rate, Inflation and Stock Prices Volatility	GARCH-S	Findings revealed that exchange rate volatility and inflation rates affect stock prices volatility negatively in Nigeria.
Kurotamunobaraomi & Ebiware (2017)	Inflation and Stock Prices	OLS and Granger Causality	Study posited on positive significant impact of exchange rate, inflation rate and money supply on stock prices in Nigeria.
Salisu & Ndako (2017)	Modeling stock price-exchange rate nexus in OECD countries: A new perspective	Panel ARDL	The study support the portfolio balanced theory and for the full OECD, the Euro area, and the non-Euro area. The findings are more prominent for the post global financial crisis.
Oniore & Akatugba (2017)	Impact of Monetary Policy on Stock Market Prices in	Dynamic OLS (DOLS) and Fully modified OLS	Study found inconsistent result from the two methods used, while positive significant impact of

	Nigeria.	(FMOLS)	money supply and exchange rate was found on stock prices in Nigeria using the DOLS, a contrasting result was found between exchange rate and money supply using the FMOLS. Hence, study concluded that, money supply and exchange rate are macroeconomic variables that can predict the stock prices behavior in Nigeria.

Source: Author's Compilation, (2019).

Table 2.5.4:Sectoral Evidence of Foreign Exchange Rate Dynamics and Stock Price Behavior in literature

Author	Research Title	Techniques	Findings
Tahir & Wong (2005)	Linkage between Stock Market Prices and Exchange Rate: A Causality Analysis for Pakistan.	Granger causality and co-integration techniques	Findings revealed unidirectional causality from stock prices to exchange rate in the aggregate market, while the service sector proved otherwise and found exchange rate to granger causes stock prices movements in the service sector.
Kouki, Harrathi & Haque (2011)	A Volatility Spillover among Sector Index of International Stock Markets	VAR- BEKK model and DCC model	The study asserted that linkages in the international financial markets are sectoral dependents and found high integrated volatility between the banking sector, real estate and oil sector however, less integration was found in the industrial and service sector.
Zakri (2013)	The association between exchange rates and stock returns	Correlation and Regression analysis	The study revealed that association of stock return varies among individual country's currencies and also asserted that energy sector is the most volatile while the nondurable sectors is the least volatile among the ten sectors of the U.S economy.
Emenike & Peter (2014)	Domestic volatility transmission among sectors in Nigeria	BEKK-MGARCH	Findings revealed bidirectional shock and volatility transmission among the banking sector, consumer goods sector and the shariah complaint equity stocks in Nigeria.
Saizal	The Dynamic Stock	GLS and EGARCH	The study found a significant impact

&Sarma (2015)	Returns Volatility and Macroeconomic Factors in Malaysia: A Sectoral Study		of all the economic variables employed on the stock market return in Malaysia.
Mouna & Anis (2016)	Exchange rate, interest rate and market risk effects on the financial stock returns.	Causal-in-mean and Variate GARCH-in-mean model.	Study concluded that there is causal relationship between exchange rate, interest rate and stock returns for most of the countries. Also study found long term impact of interest rate on the financial service sector and insurance sector but with limited impact on the banking sector. Furthermore, study found positive and negative volatility spillover effects on the banking, insurance and the financial service sector for most of the countries, but with much impact on the insurance sector stock returns.
Amin & Janor (2016)	Exchange rates and stock prices movement.	ECM and Long run Structural Model	Study concluded that exchange rates granger causes stock prices, which are consistent with flow oriented theory. The influence of exchange rate, however, varies across industries with importing firms appearing as the most volatile.
Gathogo, Mungatu & Mulyungi (2017)	Effect of macroeconomic variables on market capitalization of firms listed in Nairobi stock exchange	Regression and ANOVA	The study asserted that macroeconomic variables influence market capitalization in Kenya which is based on sectorial characteristics, while exchange rate is positively significant to some sectors and adverse impact was felt on other sectors. Also interest rate, inflation rate and fuel prices impact on market capitalization was not consistence among all sectors in the Nairobi security exchange in Kenya.
Nyangasi & Olukuru (2017)	Volatility Spillover of the Agriculture Sector on the Nairobi Securities Exchange	Multivariate VARMA- GARCH	Study found volatility spillover among sectors in Kenya particularly between the commercial service sector and the industrial sector.
Akanni & Isah (2018)	Exchange rate movements on sectoral stock prices	Linear ARDL and non- linear ARDL.	Study found high proportionate relationship of exchange rate for most of the sectors stock in Nigeria except

	of Nigeria firms: is there evidence of Asymmetry?		for conglomerates, consumer goods and financial service sectors.
Ahmed and Naguib (2018)	DCCs among Sector Indexes and Dynamic Causality between Foreign Exchange and Equity Sector Volatility: Evidence from Egypt	DCC-MGARCH and bootstrap granger non-causality test.	Study found varying volatility persistence among sectors. Study revealed positive correlation among pair of the banking, construction and material sector, chemical sector, financial service sector (excluding banking), industrial goods and automobile sector and the telecommunication sector. And posited that, heterogeneity patterns of information flow among the sectors pairs in Egypt.

Source: Author's Compilation, (2019)

CHAPTER THREE

METHODOLOGY

This chapter presents the methodology of this research work; which is mainly concerned with the procedure for determining the effects of exchange rate dynamics and stock price behavior of different sectors in Nigeria. The methodology in particular zeros in on the model specifications, sources and types of data, population and sample size and method of data analysis employed.

3.1 Theoretical Framework

The theoretical explanation as to the direction of effects between stock prices and exchange rates has witnessed several attempts, majorly through the traditional (flow-oriented) approach and portfolio (stock-oriented) approach. Postulates of the flow-oriented approach of Dornbusch and Fisher, 1980, proposed that movements in exchange rate causes stock prices movements. This can be represented in a causality language as a unidirectional causality from exchange rate fluctuations to stock price movement. This study is therefore carried out on the presumptions of the flow oriented theory, which is represented in a mathematical form as thus;

Stock Price= $f\ (\Delta exchange\ rate)$----------(3.1)

where:

Stock price is proxy by All Share Index of each of the selected sectors, however, in order to capture the behavior of stock prices, the study made use of stock returns which is given as;

$R_t = [(P_t - P_{t-1}) + D_{t-1}]/P_{t-1}$

Where:

R_t is Stock Return at time t;

P_{t-1}= Initial Stock Price;

P_t= Stock Price at time t; and

D_{t-1} = Dividend paid in previous period.

3.2 Model Specifications

This section presents the model specification in line with each of the objectives, which includes, the Augmented granger causality model, the Autoregressive distributed Lag model (ARDL), the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model, and two Multivariate GARCH models.

3.2.1 Model Specification for Hypothesis One:

H_{0i}: There are no significant causal relationship between foreign exchange rate and stock prices of different sectors in Nigeria.

The study employedAugmented Granger causality proposed by Toda and Yamamoto (1995) to examine the direction of relationship between exchange rate and stock prices of the Banking; Consumer goods; Insurance; and Oil and gas sector. The model specification of Augmented Granger causality is given in the following equations.

Aggregate Market

$$ASI_t = \alpha_0 + \sum_{j=1}^{k+dmax} \alpha_{1j} ASI_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{2j} EXRATE_{t-j} + \epsilon_{1t}$$

$$EXRATE_t = \alpha_0 + \sum_{j=1}^{k+dmax} \alpha_{1j} EXRATE_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{2j} ASI_{t-j} + \epsilon_{1t} \quad \text{..... (3.2)}$$

Sectoral Causality Model

$$BNK_t = \beta_0 + \sum_{j=1}^{k+dmax} \beta_{1j} BNK_{t-j} + \sum_{j=1}^{k+dmax} \beta_{2j} EXRATE_{t-j} + \epsilon_{2t}$$

$$EXRATE_t = \alpha_0 + \sum_{j=1}^{k+dmax} \alpha_{1j} EXRATE_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{2j} BNK_{t-j} + \epsilon_{2t} \quad \text{.....(3.3)}$$

$$CG_t = \beta_0 + \sum_{j=1}^{k+dmax} \beta_{1j} CG_{t-j} + \sum_{j=1}^{k+dmax} \beta_{2j} EXRATE_{t-j} + \epsilon_{3t}$$

$$EXRATE_t = \alpha_0 + \sum_{j=1}^{k+dmax} \alpha_{1j} EXRATE_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{2j} CG_{t-j} + \epsilon_{3t} \quad \text{.....(3.4)}$$

$$INS_t = \beta_0 + \sum_{j=1}^{k+dmax} \beta_{1j}\, INS_{t-j} + \sum_{j=1}^{k+dmax} \beta_{2j}\, EXRATE_{t-j} + \epsilon_{4t}$$

$EXRATE_t = \alpha_0 + \sum_{j=1}^{k+dmax} \alpha_{1j}\, EXRATE_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{2j}\, INS_{t-j} + \epsilon_{4t}$……(3.5)

$$OG_t = \beta_0 + \sum_{j=1}^{k+dmax} \beta_{1j}\, OG_{t-j} + \sum_{j=1}^{k+dmax} \beta_{2j}\, EXRATE_{t-j} + \epsilon_{5t}$$

$EXRATE_t = \alpha_0 + \sum_{j=1}^{k+dmax} \alpha_{1j}\, EXRATE_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{2j}\, OG_{t-j} + \epsilon_{5t}$ …….(3.6)

Where;

ASI is AllShare Index of the aggregate market,

EXRATE is exchange rate;

BNK representsBanking sector all share index;

CG is Consumer goods sector all share index;

INS is Insurance sector all share index;

OG is Oil and gas sector all share index;

k is the lag length,

(k + dmax) is the order of VAR;

$\alpha_j's, \beta_j's, \gamma_j's, \delta_j's$, and $\vartheta_j's$ are parameters to be estimated; and

$\epsilon_{1t}, \epsilon_{2t}, \epsilon_{3t}, \epsilon_{4t}$and $\epsilon_{5t}$are error terms that are assumed to be white noise.

3.2.2 Model specification for Hypothesis Two:

H_{0ii}: Foreign exchange rate dynamics does not have significant effects on stock prices of different sectors in Nigeria.

The study employed the ARDL model in the form of unrestricted error correction model (ECM) for flow-oriented models (i.e. stock price as the dependent variable). This study however adopted and modified the model of Umer *et al.* (2015) which is Stated as:

$\Delta SP_t = c_1 + \sum_{i=1}^{n} \mu_1 \Delta SP_{t-1} + \sum_{i=1}^{n} \infty_1 \Delta EX_{t-1} + \sum_{i=1}^{n} \beta_1 \Delta FR_{t-1} + \sum_{i=1}^{n} \alpha_1 \Delta IR_{t-1} + ¥_5 SP_{t-1} + ¥_6 EX_{t-1} + ¥_7 FR_{t-1} + ¥_8 IR_{t-1} + U_{SPt}$ (3.7)

This study however includes other macroeconomic variables such as (money supply and inflation rate) as control variables, in order to give better understanding of exchange rate dynamics and stock price behavior in the market as a whole and on each of the selected sectors in Nigeria. According to the Arbitrage Pricing Theory, exchange rate is not the only determinant factor to asset price changes. Therefore, other macroeconomic determinants of stock prices are used as control variables, hence the model for this study is stated as:

$$\Delta ASI_t = \alpha_{0t} + \sum_{i=0}^{n} \beta_i \, \Delta ASI_{t-i} + \sum_{i=0}^{n} \gamma_i \, \Delta EXRVOL_{t-i} + \sum_{i=0}^{n} \delta_i \, \Delta FR_{t-i} + \sum_{i=0}^{n} \theta_i \, \Delta INT_{t-i} + \sum_{i=0}^{n} \vartheta_i \, \Delta INF_{t-i} + \sum_{i=0}^{n} \tau_i \, \Delta MS_{t-i} + \emptyset_1 ASI_{t-1} + \emptyset_2 EXRVOL_{t-1} + \emptyset_3 FR_{t-1} + \emptyset_4 INT_{t-1} + \emptyset_5 INF_{t-1} + \emptyset_6 MS_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.8)$$

Where:

Δ = denotes the first difference operator;

ect = error correction term;

ASI = All Share Index;

EXRVOL = Foreign Exchange Rate Volatility;

FR = Foreign Reserve;

INT = Interest Rate;

INF = Inflation Rate;

MS = Money Supply; and

ε_t = disturbance term.

Subscript t indicates that the variables are observed over time

This model will be estimated for each of the selected sectors of the Nigerian stock market.

3.2.3 Model Specification for Hypothesis Three:

H_{0iii}: There is no volatility spillover effect of exchange rate on stock returns of different sectors in Nigeria.

The Exponential GARCH model was used to model the volatility spillover effect of exchange rate on sector stock returns. Nelson (1991) introduced the EGARCH model, the natural log of conditional variance in the EGARCH was used to correct the weakness of GARCH model. Nelson and Cao (1992) argued that the GARCH models are too restrictive, as the GARCH model imposes positive constraints on the parameters which cannot test for volatilities in financial time series data.EGARCH give room for an clear testing of volatility spillover without imposing furtherconstraints. The volatility model for the market returns and exchange rate are expressed in the mean and variance equation which is given as:

The mean and variance equations are expressedin equations 3.8.

$$RASI_t = \alpha_0 + \alpha_1 RASI_{t-1} + \varepsilon_t$$

$$log(h_t) = \gamma + \sum_{j=1}^{q} \delta_j \left| \frac{\varepsilon_{t-j}}{\sqrt{h_{t-j}}} \right| + \sum_{j=1}^{q} \vartheta_j \frac{\varepsilon_{t-j}}{\sqrt{h_{t-j}}} + \sum_{i=1}^{p} \theta_j \, log(h_t) + \tau EXRVOL_t \ldots\ldots\ldots\ldots\ldots (3.9)$$

Where:

RASI is return series of aggregateAll Share Index;

EXRVOL is exchange rate volatility generated from the EGARCH;

$log(h_t)$ = the natural log of the variance series;

ε_t = the disturbance term;

$\gamma, \delta j, \vartheta j, and\ \theta j$ are the parameters to be estimated.

Taking the log of the variance series makes the leverage effect to be exponential instead of quadratic, and therefore the estimates of the conditional variance are guaranteed to be non-negative. To test for asymmetries the parameters of importance are the ϑs while the parameters of importance in testing the leverage effects are the θs. If $\vartheta_1 = \vartheta_2 = \cdots = 0$, then the model is symmetry. When $\vartheta_j < 0$, then positive shocks (good news) generate less volatility than negative shocks (bad news).

The model is specified and tested on each of the selected sectors. The mean and variance equations of each sector are as follows:

Modeling for Banking Sector

$$RASI_{Bt} = \alpha_0 + \alpha_1 RASI_{Bt-1} + \varepsilon_{Bt}$$

$$log(h_{Bt}) = \gamma + \sum_{j=1}^{q} \delta_j \left| \frac{\varepsilon_{Bt-j}}{\sqrt{h_{Bt-j}}} \right| + \sum_{j=1}^{q} \vartheta_j \frac{\varepsilon_{Bt-j}}{\sqrt{h_{Bt-j}}} + \sum_{i=1}^{p} \theta_j\, log(h_{Bt}) + \tau EXRVOL_t \ldots\ldots\ldots (3.10)$$

Modeling for Consumer Goods Sector

$$RASI_{CGt} = \alpha_0 + \alpha_1 RASI_{CGt-1} + \varepsilon_{CGt}$$

$$log(h_{CGt}) = \gamma + \sum_{j=1}^{q} \delta_j \left| \frac{\varepsilon_{CGt-j}}{\sqrt{h_{CGt-j}}} \right| + \sum_{j=1}^{q} \vartheta_j \frac{\varepsilon_{CGt-j}}{\sqrt{h_{CGt-j}}} + \sum_{i=1}^{p} \theta_j\, log(h_{CGt}) + \tau EXRVOL_t \ldots.. (3.11)$$

Modeling for Insurance Sector

$$RASI_{INSt} = \alpha_0 + \alpha_1 RASI_{INSt-1} + \varepsilon_{INSt}$$

$$log(h_{INSt}) = \gamma + \sum_{j=1}^{q} \delta_j \left| \frac{\varepsilon_{INSt-j}}{\sqrt{h_{INSt-j}}} \right| + \sum_{j=1}^{q} \vartheta_j \frac{\varepsilon_{INSt-j}}{\sqrt{h_{INSt-j}}} + \sum_{i=1}^{p} \theta_j\, log(h_{INSt}) + \tau EXRVOL_t .. (3.12)$$

Modeling for Oil and Gas Sector

$$RASI_{OGt} = \alpha_0 + \alpha_1 RASI_{OGt-1} + \varepsilon_{OGt}$$

$$log(h_{OGt}) = \gamma + \sum_{j=1}^{q} \delta_j \left| \frac{\varepsilon_{OGt-j}}{\sqrt{h_{OGt-j}}} \right| + \sum_{j=1}^{q} \vartheta_j \frac{\varepsilon_{OGt-j}}{\sqrt{h_{OGt-j}}} + \sum_{i=1}^{p} \theta_j\, log(h_{OGt}) + \tau EXRVOL_t \quad (3.13)$$

3.2.4 Model Specification for Hypothesis Four

H_{0iv}: There are no volatility transmissions amongsectoralstock returns in Nigeria.

In order to test for this hypothesis, two approaches of the MGARCH model was employed, which are the BEKK-GARCH and the Dynamic Conditional Correlation (DCC).

The first approach is the BEKK- GARCH model proposedby Baba, Engle, Kraft, and Kroner,(1990) andEngle and Kroner (1995) This model equation is given as follows:

$H_t = CC' + \sum_{j=1}^{p} \sum_{k=1}^{K} A_{kj}\, \omega_{t-j}\omega_{t-j} A_{kj} + \sum_{j=1}^{q} \sum_{k=1}^{K} B_{kj}\, H_{t-j} B_{kj}$ .....(3.14)

Where:

A_{kj}, B_{kj} are N by N parameter matrices and;

C is N by N lower triangular matrix. This model economizes the number of parameters to estimate and allow cross dynamics of conditional covariance.

Dynamic Conditional Correlation (DCC) Approach

The second approach is the dynamic conditional correlation (DCC) that model conditional covariance matrix indirectly. It has the form as follows:

$H_t = D_t \Gamma_t D_t$ .....(3.15)

Where:

$D_t = diag(h_{1t}^{1/2}, \ldots, h_{Nt}^{1/2})$is diagonal matrix of conditional variances

Γ_t is the conditional correlation matrix of r_t.

$\Gamma_t = (\rho_{ij,t})$ is positive, definite and symmetric with $\rho_{ij} = 1 \; \forall \; i,$ each $h_{jt}$is modeled by a univariate GARCH process.

Bollerslev (1990) proposed the CCC model where Γ_t is assumed to be constant. This model simplifies the estimation. However, assuming that Γ_t is constant is not realistic in practice. The Dynamic Conditional Correlations model introduced by Engle (2002) is however specified by allowing$\Gamma_t$to be time varying, which is given as:

$$\Gamma_t = diag\left(Q_t^{\frac{1}{2}}\right) Q_t diag\left(Q_t^{\frac{1}{2}}\right) \quad \text{.....(3.16)}$$

Where:

$Q_t = (1 - \alpha - \beta)\bar{Q} + \alpha\mu_{t-1}\mu_{t-1} + \beta Q_{t-1}$ is N×N symmetric, positive definite matrix.

μ_t is the standardized residuals matrix.

$\bar{Q}$ is the N×N unconditional variance matrix of μ_t

α and β are non-negative scalar parameters with α and β < 1.

3.3 Method of Data Analysis

The methods used to analyze and achieve each of the objectives of this study are summarized in Table 3.1.

Table 3.1: Summary of Research Questions, Objectives, Hypotheses and Statistical Tools Employed

S/N	Research Questions	Research Objectives	Research Hypotheses	Statistical Tools Employed
1	What is the causal relationship between foreign exchange rate and stock prices of different sectors in Nigerian?	To examine the causal relationship between foreign exchange rate and stock prices of different sectors in Nigeria.	H_{01}: There are no significant causal relationship between foreign exchange rate and stock prices of different sectors in Nigeria.	Augmented Granger Causality
2	What are the effects of foreign exchange rate dynamics on stock prices behaviorof different sectors in Nigeria?	To investigate the effects of foreign exchange rate dynamics on stock price behavior of different sectors in Nigeria.	H_{02}: Foreign exchange rate dynamics does not have significant effects on stock price behavior of different sectors in Nigeria.	ARDL Model
3	Is there volatility spillover effect of exchange rate on stock returns of different sectors in Nigeria?	To examine the volatility spillover effect of exchange rate on stock returns of different sectors in Nigeria.	H_{03}:There is no volatility spillover effect of exchange rate on stock returns of different sectors in Nigeria.	EGARCH Model
4	How does volatility transmission of one	To examine the volatility transmission	H_{04}: There are no volatility transmissions	BEKK-GARCH Model and DCC

	sector affects other sectors of the economy on the Nigeria stock market?	among sectoral stock returns in Nigeria.	among sectoral stock returns in Nigeria.	

Source: Author's Compilation (2019).

3.4 Estimation Procedure

Determining the relationship and the effects of foreign exchange rate dynamics and stock price behavior will facilitate the understanding of how these two variables interacts with each other both in long run and short run, also understanding the volatility spillover effects will better the understanding of all key players in both markets. The study employed Bond Test/ Autoregressive Distributed Lag (ARDL) test proposed by Peseran *et al.* (2001) to examine the dynamic effects of exchange rate on stock price behavior on the banking sector, insurance sector, oil and gas sector and the consumer goods sector of the Nigeria stock exchange market. The ARDL model is applicable for both non-stationary time series as well as for times series with mixed order of integration which is capable of assessing the short run dynamic effects without losing information on the long run relationship among financial time series data(Shrestha & Bhatta, 2018). However, in order to justify the applicability of the ARDL test, necessary pretest such as unit root and co-integration test was conducted.

The unit root test is important in any financial time series data to (i) detect the stationarity of the variables used in this study such as (All Share Index and Foreign Exchange Rate) (ii) establish the order of integration in order to ensure stability in subsequent econometrics models and (iii) determine whether the variables exhibit structural breaks which are mostly found in financial time series data. In view of these, the study employed unit root test that can adjust for one or

more structural breaks which is ADF break point unit root test as the conventional unit root of ADF, PP and KPSS are not suitable for financial time series data with structural breaks.

Furthermore, the study used Exponential Generalized Autoregrssive conditional Heteroskedasity (EGARCH) model to assess the volatility spillover effects of exchange rate on stock returns on both the aggregate market and each of the selected sectors. The EGARCH uses natural log of the conditional variance which allows for explicit testing of volatility spillover without imposing additional restrictions. Lastly, the study used MGARCH model (BEKK and DCC) to assess the contagion effects which are often important in financial applications such a portfolio selection, volatility transmission, asset valuation and so on, the MGARCH model explains movement in covariance over time thereby, providing a realistic specification of the variance matrix and also ensuring its positivity(Shrestha & Bhatta, 2018).

The dynamic conditional correlation (DCC) model, a generalization of the Constant Conditional Correlation (CCC) proposed by Tse and Tsui (2002) and Engle (2002) was used to examine the volatility transmission within the sectors.The DCC guarantee that the time dependent conditional correlation matrix are positive for each of the period and does not assume a constant correlation which is quite restrictive as in the case of the CCC. In addition, the study made use of BEKK-GARCH model in conjunction with the DCC to assess the volatility transmission within the sectors. The BEKK model allows for dynamic dependence of conditional variances of one variable on the lagged values of another variable, the BEKK model is flexible and is relatively parsimonious compare to the Diagonal Vector Error Correction (DVEC) which are very restrictive for cross dynamics and are not suitable for volatility transmission.

3.5 Research Design

This study employed an *ex-post facto*research design in obtaining the variables used for the study. *Ex-post facto* design seek to reveal possible relationship by observing an existing condition or state of affairs and searching back in time for plausible contributing factor, which is suitable for research in business and social science discipline (Simon and Goes, 2013).

3.6 Nature and Sources of Data

The data used for this study are mainly secondary data sourced from the Nigerian Stock Exchange and the Central Bank of Nigeria. The variables whose data were sourced include:

a. All share index (ASI) of the aggregate market and also indices of the banking sector, insurance sector, oil and gas sector and the consumer goods sector was sourced from the Nigerian Stock Exchange facts books of various edition.
b. Foreign exchange rate, interest Rate, Money Supply (M2), foreign external Reserve and inflation rate was sourced from the Central Bank of Nigeria statistical bulletin.

CHAPTER FOUR

RESULTS AND DISCUSSION OF FINDINGS

This chapter presents and discusses the results of the trend analysis, descriptive statistics and preliminary analysis such as unit root test. The chapter also provide inferential approach used which include the correlation matrix, test of ARCH effect, augmented Granger causality, ARDL short run error correction model and its long run coefficient. The empirical results on the volatility spill over effects and volatility transmission was provided through univariate Exponential Generalised Autoregressive Conditional Heteroscedasticity (EGARCH), and Multivariate GARCH models of BEKK and DCC. Thereafter, the discussions of findings in line with the stated objectives were presented.

4.1 Trend Analysis

This section presents, a trend analysis of foreign exchange, foreign external reserves, inflation rates, money supply, interest rate and All Share Index of the banking sector, consumer goods sector, insurance sector, and oil and gas sector, as well as the aggregate market using multiple line graphs. The trend analysis is presented in order to show the movement of each variable over time so as to be sure of the appropriate method of analysis to be used considering their trend nature. The time trend analysis were presented in Figure 4.1

The trend analysis presented in Figure 4.1 revealed that, all share index of each sector as well as the aggregate market are highly unstable over the period in concern, however, it can also be seen that the instability in all share index over time varies across each of these sectors. For instance, mere observation revealed that all share indices of banking and consumer goods are relatively more unstable when compare to the insurance sector and the oil and gas. This simply implies that

the fluctuations in stock price and consequently, its volatility differ across sectors and the movement in aggregate all share index is caused more by some sectors than others.

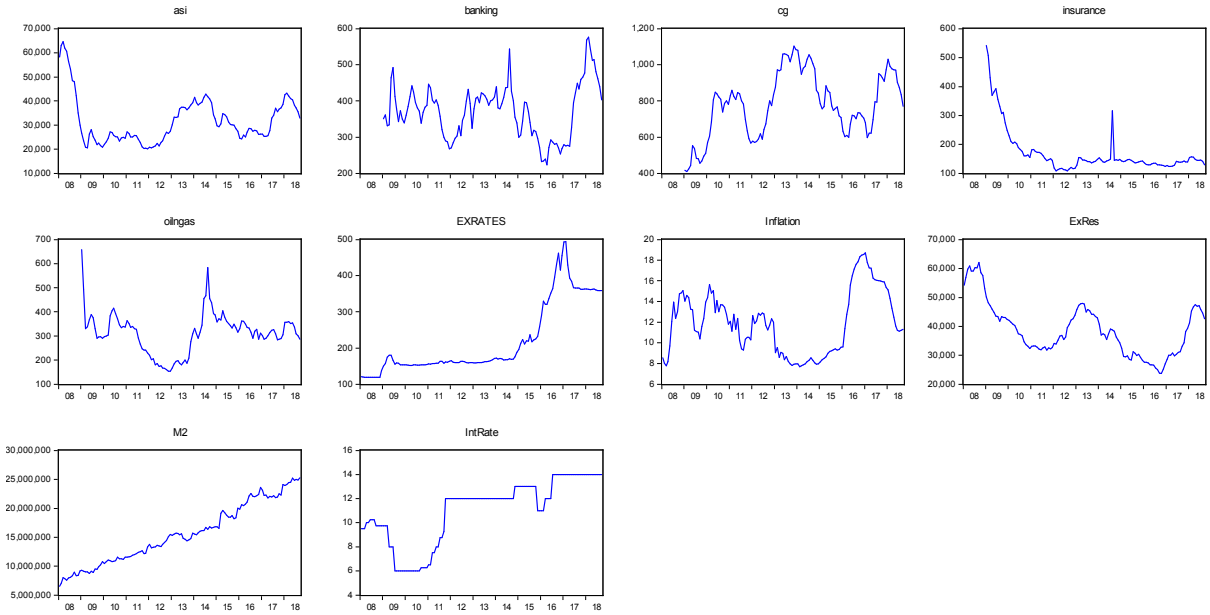


Figure 4.1: Trend Analysis

Source: Author's Computations, (2019).

The time movement of exchange rate, which for most of the period was relatively unstable, is seen to be upward from 2014 and reach its peak in the late 2016 to early 2017. This showed that the value of exchange rate was relatively stable for the earlier part of the period, however, the later part of the period shows a sharp drop in the value of naira, indicating that exchange rate in Nigeria has been relatively unstable. This period coincided with the period of drastic fall in crude oil price that affects most oil exporting economies including Nigeria.

Inflation rate is also unstable within the period, but the figure also revealed that, it has its lowest values during the months in 2008 which coincides with the period of global financial crisis and its highest values during the period when Nigeria was in a state of economic recession which islasted between 2015 till the middle months in 2017. Furthermore, external reserve was falling for most of the period reaching its lowest in 2016; however, maintain an upward position till the

end of the period. This indicates that foreign reserve has been unstable for the period under study. Broad money supply is upward trending throughout the period. Although, its movement is characterised by rises and falls month-in month-out but its long run path maintains an upward trend. The time movement of interest rate shows that interest rate was relatively constant for many periods and exhibits upward and downward movement in some periods.

4.2 Descriptive Statistics

The descriptive statistics results presented in Table 4.1., showedkey figures, including Mean, Standard Deviation (SD), Minimum and Maximum values are reported in order to give the overall description about data used in the model. The skewness (Skew), kurtosis (Kurt) and the Jarque-Bera (JB) results were also presented in order to test for the normality of the data.

Table 4.1: Summary of Descriptive Statistics of Variables

Statistics	Mean	Max	Min	S/D	Skew	Kurt	J/B	prob
Banking	371.35	577.14	223.74	74.36	0.29	2.89	1.73	0.042
C/Goods	780.31	1103.07	409.68	176.78	-0.13	2.19	3.48	0.175
Insurance	169.49	541.79	107.85	78.11	2.79	10.85	451.80	0.000
Oil & gas	311.47	658.60	153.97	84.55	0.53	5.12	27.49	0.000
Aggregate	31692.2	64689.3	20230.6	9653.9	1.36	4.88	58.64	0.000
Exc. rate	218.74	494.70	118.69	99.42	1.15	2.94	28.56	0.000
INF	11.91	18.72	7.71	3.05	0.39	2.16	7.03	0.030
FR	38704.7	62081.9	23689.9	9125.7	0.68	2.94	10.05	0.007
MS	15530436	25277071	6527673	5205988	0.25	1.90	7.81	0.020
INT	11.01	14.0	6.0	2.68	-0.74	2.29	14.58	0.000

Source: Author's Computations, (2019).

The banking sector all share index has monthly average of 371.35, while the standard deviation stood at 74.36, indicating a minimal spread over the period. The maximum all share index for banking sector in a month is 577.14 and the minimum all share index is 223.74. The skewness and kurtosis values are low and this indicates that the data is not skewed and likely to be

normally distributed. Jarque-Bera statistic further showed that the data is not normally distributed with its significant value of 1.73 and p-value of 0.042, indicating a rejection of null hypothesis of normality.

The table further showed that consumer goods sector, have the highest average all share index among the selected sectors which stood at 780.31, which indicates that, the consumer goods sector stock is fast moving among the selected sector in Nigeria within the period of concern. The standard deviation stood at 176.78 which showed high variations in stock price, minimum all share index is 409.68, while its maximum value is 1103.07. The skewness and kurtosis values are also very low, which showed that the data is not skewed and likely to be normally distributed. Jarque-Bera statistic revealed that the data is normally distributed with its insignificant value of 3.48 and p-value of 0.175, indicating there is no enough evidence to reject the null hypothesis of normality.

The insurance sector has the lowest average ofall share index among the selected sector with a mean value of 169.49 and a very low variations over the period of concern which stood at 78.11. This suggest low patronage of investors in the insurance sector stock in Nigeria, which implies that, investors often consider the insurance sector as being weak among other sectors in Nigeria (Proshareng, 2017). The skewness and kurtosis as well as the Jarque-Bera statistic indicated that the data is not normally distributed with its highly significant value of 451.80 and p-value of 0.000, indicating there is enough proof to reject the null hypothesis of normality. Therefore, the data for this variable is non-normal which may be as a result of the presence of outliers in the data.

The minimum value of the oil and gas sector is 153.97 while the maximum value is 658.60. This indicates a wide disparity in the oil and gas sector stock price on the Nigeria stock exchange. The

mean value of the oil and gas sector is 311.47 over the period, whilethe standard deviation stood at 84.55. This signifies high patronage of investors in the oil and gas sector stock, which implies that, the oil and gas sector stock are often considered as one of the highly traded stock on the Nigeria stock market (NSE, 2015). The skewness and kurtosis values are also high, whichimplies that, the data is skewed and likely not to be normally distributed. Jarque-Bera statistic confirms that the data is not normally distributed with its value of 27.49 and p-value of 0.000, indicating there is sufficient evidence to reject the null hypothesis of normality.

The result shows that aggregate all share index has monthly average of 31,692.2. The maximum all share index witnessed in a month is 64,689.3 and the minimum all share index achieved in one month is 20,230.6. Standard deviation stood at 9,653.9, indicating a minimal spread over the period. The skewness and kurtosis values indicate that the data is skewed and likely not to be normally distributed. Jarque-Bera statistic further confirms that the data is not normally distributed with its highly significant value of 58.64 and p-value of 0.000, indicating a rejection of null hypothesis of normality.

Mean value of foreign exchange rate is 218.74, while themaximum exchange rate experienced in a month is ₦494.70 and minimum exchange rateis ₦118.69, with standard deviation of 99.42. This implies high variability in the value of the naira to US dollar within the period of concern, an evidence to show that the naira has not been relatively stables over years. The skewness and kurtosis values are indication that the data is skewed and likely not to be normally distributed. Jarque-Bera statistic confirms that the data is not normally distributed with its value of 28.56 and p-value of 0.000, indicating there is sufficient evidence to reject the null hypothesis of normality.

Also, minimum value of inflation rate is 7.71 while the maximum value is 18.72 with an average value of 11.91, which indicates wide range of inflation rate in Nigeria. The skewness and

kurtosis values are indication that the data is skewed and has tail and likely not to be normally distributed. Jarque-Bera statistic confirms that the data is not normally distributed with its value of 7.03 and p-value of 0.030, indicating there is sufficient evidence to reject the null hypothesis of normality.

Monthly average for external reserve is 38,704.7 million U.S. Dollars whilethe highest external reserves witnessed for a month is 62,081.9 million U.S. Dollars and the lowest external reserves witnessed for a month is 23,689.9 million U.S. Dollars. Standard deviation for external reserves over the period stood at 9,125.7 million U.S. Dollars. The skewness and kurtosis values of 0.68 and 2.94 are indications that the data is skewed and likely not to be normally distributed. Jarque-Bera statistic confirms that the data is not normally distributed with its value of 10.05 and p-value of 0.007, indicating there is sufficient evidence to reject the null hypothesis of normality.

Monthly average for broad money supply in form of mean is ₦15,530,436 million. The maximum broad money supply witnessed for a month is ₦25,277,071 million while the minimum for a month is ₦6,527,673 million. Standard deviation stood at ₦5,205,988 million. The skewness and kurtosis values of 0.25 and 1.90 are indications that the data is skewed and likely not to be normally distributed. Jarque-Bera statistic confirms that the data is not normally distributed with its value of 7.81 and p-value of 0.020, indicating there is sufficient evidence to reject the null hypothesis of normality.

Result further revealed that, interest rate is 11.01% whilethe maximum for a month is 14% and minimum value of 6%, this indicate high disparity in the rate of interest in Nigeria over the period of concern. Standard deviation for interest rate over the period stood at 2.68%. The skewness and kurtosis values of -0.74 and 2.29 are indications that the data is skewed and likely not to be normally distributed. Jarque-Bera statistic confirms that the data is not normally

distributed with its value of 14.58 and p-value of 0.000, indicating there is sufficient evidence to reject the null hypothesis of normality.

In sum, the descriptive statistics, particularly those related to the distribution of the variables shows that all variables are not normally distributed except for consumer goods sector. This may result from the presence of outliers in the data implying that some observations have outrageously high or low values relative to other observations in the same variable. A logarithm transformation of the data for all variables (except those for inflation and interest rate which are already in rates) were then conducted to minimize the influence of these outliers on the result. Moreover, the major issue of concern with regard to normality is the residual of the estimated model which may eventually be normally distributed even with the combination of non-normally distributed variables.

4.3 Preliminary Analysis

This section presents preliminary test conducted prior to the proper estimation of the models specified, given the nature of data employed which is time series data. The preliminary test presented include, pairwise correlation test, the unit root test which was used to determine the stationarity of each variable and their respective order of integration. Co-integration test was also carried out to examine the long run co-integrating relationship among the variables. These tests are necessary aspect of any policy driven time series analysis, especially as it provides the leeway to avoiding the spurious regression syndrome.

4.3.1 Pairwise Correlation Test

Table 4.2 presents the result of pairwise correlation analysis which was used to examine the relationships that exist among the variables of the model. Most importantly, to check if none of

the variables relationships have correlation coefficient as high as 0.8, which is a commonly used as benchmark to signal problematic multi-collinearity.

Table 4.2: Pairwise Correlation Matrix

	ASI	Banking	CG	Insurance	Oil & Gas	Ex. Rates	Inflation	Ext. Res.	M2	Int. Rate
ASI	1.0									
Banking	0.66	1.0								
CG	0.65	0.59	1.0							
Insurance	-0.22	0.17	-0.47	1.0						
Oil & Gas	0.22	0.19	-0.02	0.49	1.0					
Ex. Rates	0.21	-0.10	0.01	-0.30	0.07	1.0				
Inflation	-0.34	-0.18	-0.41	0.06	0.02	0.64	1.0			
Ex. Res.	0.28	0.62	0.18	0.44	-0.11	-0.39	-0.29	1.0		
M2	0.52	0.04	0.34	-0.53	0.02	0.67	0.28	-0.31	1.0	
Int. Rate	0.51	-0.04	0.34	-0.51	-0.17	0.63	0.04	-0.19	0.62	1.0

Source: Author's Computations, (2019).

Results showed that all the correlation coefficients are well below 0.8 which is an indication of absence of problematic multi-collinearity in the model.

4.3.2 Unit Root Test

Given the frequency of the data employed in this study, a breakpoint unit root test that is capable of adjusting for structural break in financial time series data is more appropriate to examine the stationarity of each variable. Augmented Dickey-Fuller breakpoint unit root test was conducted with innovational outlier break type, break selection based on Minimize Dickey-Fuller t-statistic, and automatic lag selection based on Schwarz Information Criterion. The results are presented in Table 4.3 for levels and first differences of the time series. With the nature of trend in each variable shown in Figure 4.1, the trend and intercept option was chosen while conducting unit root test for the variables in order to prevent the influence of the time trend in each variable on the results.

Table 4.3: Augmented Dickey-Fuller Breakpoint Unit Root Test

	At level			At First Difference			
Variables	**T-Stat**	**Crit.Val**	**P-Val**	**T-Stat**	**Crit.Val**	**P-Val**	**Orderof Integration**
ASI	-4.28	-5.17	0.35	-7.78	-5.17	0.00	I(1)
Banking	-4.12	-5.17	0.45	-10.04	-5.17	0.00	I(1)
Cons. Goods	-3.43	-5.17	0.84	-8.84	-5.17	0.00	I(1)
Insurance	-6.63	-5.17	0.00				I(0)
Oil and Gas	-4.91	-5.17	0.09	-10.42	-5.17	0.00	I(1)
Exch. Rate	-4.65	-5.17	0.17	-10.60	-5.17	0.00	I(1)
Inflation	-5.64	-5.17	0.01				I(0)
Ext. Reserve	-3.46	-5.17	0.83	-8.22	-5.17	0.00	I(1)
M2	-5.55	-5.17	0.02				I(0)
Interest Rate	-3.99	-5.17	0.53	-13.26	-5.17	0.00	I(1)

Source: Author's Computation, (2019).

The ADF breakpoint unit root results presented in Table 4.3 revealed that at 5% significant level, all share index of insurance, inflation rate, and money supply are stationary series at levels. This is evident from their respective p-values less than 0.05 and their respective test statistics greater than their critical values at 5% level of significance. Hence, they are integrated-of-order-zero series, i.e. I(0) series. All other variables such as aggregate all share index, all share index of banking, consumer goods and oil and gas, exchange rate, external reserves and interest rate are not stationary series at level but are integrated-of-order-one series I(1) because they became stationary only after first differencing. This is evident from their respective p-values being greater than 0.05 and their respective test statistics less than their critical values, at levels, while at first difference, their respective p-values are less than 0.05 and their respective test statistics are greater than their critical values.

Since the decision rule is to reject the null hypothesis that a variable has unit root (i.e. the variable is a non-stationary series) if p-value is less than significance level (or if t-statistic is greater than the 5% critical value) and accept null hypothesis if otherwise, the result suggests rejection of null hypothesis in cases of all share index of insurance, inflation rate, and broad money supply and non-rejection of null hypothesis in cases of aggregate all share index, all share index of banking, consumer goods and oil and gas, exchange rate, external reserves and interest rate, at level. However, at first difference, the result suggests rejection of null hypothesis in cases of aggregate all share index, all share index of banking, consumer goods and oil and gas, exchange rate, external reserves and interest rate.

The implication of this result is that using Ordinary Least Squares (OLS) method to estimate the parameters of the model will lead to a spurious regression results if there is no long run co-integration. This necessitates the test of co-integration to check if at all there is a long-run relationship among the series. Since the breakpoint unit root test conducted above shows that the variables employed in the model are combination of stationary and non-stationary series, the appropriate step is to conduct the ARDL bounds test approach to co-integration developed by Pesaran, *et al.* (2001) to verify if a long run equilibrating relationship exists among the variables. The result of the bounds test approach is presented in Table 4.4.

4.3.3 Bounds Tests Approach to Co-integration

The ARDL bounds test approach to co-integration was conducted for five different models namely, the banking sector, consumer goods sector, insurance sector, and oil and gas sector as well as the aggregate market All Share Index. The ARDL bounds test procedure states a null hypothesis of no long-run relationships among the variables of a model.

Table 4.4: ARDL Bounds Test Approach

Aggregate		**Banking**		**Consumer Good**		**Insurance**		**Oil and Gas**	
F-stat	K	F-stat	K	F-stat	K	F-stat	K	F-stat	K
5.03	5	4.69	5	6.04	5	4.50	5	5.70	5
Critical Bounds									
I(0) Bound	I(1) Bound	I(0) Bound	I(1) Bound	I(0) Bound	I(1) Bound	I(0) Bound	I(1) Bound	I(0) Bound	I(1) Bound
3.12	4.25	3.12	4.25	3.12	4.25	3.12	4.25	3.12	4.25

Source: Author's Computation, (2019).

If the F-statistic value is greater than I(1) bound, the null hypothesis should be rejected and accept null hypothesis if the value is less than I(0) bound. On the other hand, the test is inconclusive if the F-statistic value falls in between the bounds. The F-statistic values of the test are 4.69, 6.04, 4.50, 5.70 and 5.03 for the banking sector, consumer goods sector, insurance sector, oil and gas sector and the aggregate market respectively, with five independent variables included in each model. The I(0) and I(1) bounds at 5% significance level for each of the models are 3.12 and 4.25 respectively. This shows that the F-statistic is greater than I(1) bound for each of the models. This indicates that the test is significant in all cases and suggests the rejection of null hypothesis. A conclusion can then be made that there exist long-run relationships among the stationary and non-stationary series of each of the models.

4.4 Inferential Analysis

This section presents the analysis of data through the inferential approach. This is necessary in order to make necessary inferences and generalizations from the data analyses. The inferential tools used in this section include the Augmented Granger Causality, Autoregressive Distributed Lag (ARDL) short run error correction model and long run co-integration, univariate Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model, and Multivariate Generalized Autoregressive Conditional Heteroskedasticity (MGARCH) model of BEKK and DCC.

4.4.1 Augmented Granger Causality Test

The first objective sought to examine the causal relationship between foreign exchange rate and stock prices of each of the selected sector. In order to achieve this objective, Augmented Granger Causality test through the VAR granger causality/ Wald test approach, suggested by Toda and Yamamoto (1995) was used. This approach computes statistics that asymptotically follow the chi-square (χ^2) distribution irrespective of the order of integration of the variables (Clarke & Mirza, 2006). Table 4.5 presents the panel result of Augmented Granger Causality test which show the causal relationship between foreign exchange rate and all share index of the selected sectors.

Table 4.5: Augmented Granger Causality Test – ASI of Sectors and Exchange Rate Volatilities

Banking Sector ASI and Exchange Rate Volatility (A)		
Variable	Chi-squared	Prob.
Banking to Exchange rate	3.600	0.731
Exchange rate to Banking	16.254	0.013
Consumer Goods Sector ASI and Exchange Rate Volatility (B)		
Variable	Chi-squared	Prob.
Consumer goods to Exchange rate	12.020	0.062
Exchange rate to Consumer goods	1.662	0.948
Insurance Sector ASI and Exchange Rate Volatility (C)		
Variable	Chi-squared	Prob.
Insurance to Exchange rate	4.648	0.589
Exchange rate to Insurance	8.154	0.227
Oil & Gas Sector ASI and Exchange Rate Volatility (D)		
Variable	Chi-squared	Prob.
Oil & Gas to Exchange rate	1.906	0.928
Exchange rate to Oil & Gas	7.289	0.295

Source: Author's Computation, (2019).

Table 4.5 presents the Toda-Yamamoto augmented Granger causality test for all share index of each of the selected sectors and exchange rate volatility. The result is presented in four panels,

panels A, B, C and D for the causal relationship between foreign exchange rate volatility and the banking sector, consumer goods sector, insurance sector and the oil and gas sector.

The Panel result in table 4.5 revealed that exchange rate volatility granger causes the banking sector stock price at 5% level of significance. This is shown by its chi-squared value of approximately 16.25 (and its p-value of 0.013) which is high (low) enough to provide evidence to reject the null hypothesis that there is no causal relationship from exchange rate volatility to banking all share index volatility. This implies that, exchange rate volatility granger causes stock price of the banking sector in Nigeria; this could be as a result of the foreign exchange rate risk exposures of the banks through forex trading and bank balances outside Nigeria. This result validates the flow-oriented theory which states that, movement in stock prices is caused by the movement in exchange rate.

The results in panel B of Table 4.4 also indicated that the consumer goods sector stock price granger causes exchange rate volatility in Nigeria. This is evidenced by its chi-square value of 12.020 (and its p-value of 0.062) which is significant at 10% level, provides enough evidence to reject the null hypothesis that there is no significant causal relationship between exchange rate and the stock prices in Nigeria. The result showed a unidirectional causality running from the consumer goods sector stock price to exchange rate, this validates the portfolio balanced theory which postulate that movement in the stock prices increases/ decreases the demand for domestic currency, thereby causes exchange rate changes.

However, contrary to the results in the banking and the consumer goods sector, the result of the insurance and the oil and gas sector stock presented in panel C and D, showed that, there is no significant causal relationship between foreign exchange rate and the insurance and as well as the oil and gas sector stock prices in Nigeria. Lastly, the result of the aggregate market is also

presented, in order to assess the direction of flow between foreign exchange rate and the aggregate market index. This is presented in Table 4.6.

Table 4.6: Augmented Granger Causality Test – Aggregate ASI and Exchange Rate Volatilities

Dependent variable: All Share Index Volatility		
Variable	Chi-squared	Prob.
Ex. rate Volatility	1.780	0.971
ASI Volatility	20.373	0.005

Source: Author's Computation, (2019).

Results presented in Table 4.6 revealed that exchange rate volatility does not granger causes the aggregate all share index volatility. However, even at the slightest 1% level of significance, the result revealed that, aggregate all share index volatility has a causal effect on exchange rate volatility. This is shown by its chi-squared value of approximately 20.37 (and its p-value of 0.005) which is high (low) enough to provide enough evidence to reject the null hypothesis that there is no causal relationship between All Share Index and Exchange Rate Volatility.

This result validates the portfolio balanced theory which postulates that, increase or decrease in stock prices have positive or negative influence in the demand for local currency which causes the movement in exchange rate.

4.4.2 ARDL Short Run Error Correction Model and Long Run Estimates

Given the result of the ARDL bounds test, the study proceeds to co-integration, in order to provide answers to objective two which seeks to examine the effects of foreign exchange rate on stock price behaviour of each of the sectors. This necessitate an error correction mechanism in line with the autoregressive distributed lag approach,the ARDL model requires the inclusion of lag values of the dependent and independent variables.

In order to have parsimonious results, the models were set to choose the best model through automatic model selection method of Akaike Information Criterion (AIC) which evaluates a large number of models before selecting the best among them. Tables 4.7, 4.8, 4.9 and 4.10 present the results of short run error correction model and long run co-integrating regression for banking, consumer goods, insurance, and oil and gas sectors, respectively. Each of these models was estimated with time trend variable in order to account for the trend nature of the variables of the models.

4.4.2.1 Effect of Foreign Exchange Rate dynamics on the Banking Sector Stock Price Behavior in Nigeria.

The result presented in Table 4.7 which seeks to examine the impact of foreign exchange rate volatility and other macroeconomic variables on stock price behavior of the banking sector is the selected model out of 12,500 evaluated models through the automatic model selection method of Akaike information criterion (see appendix).

Table 4.7: ARDL Short Run Error Correction and Long Run Estimates – Banking Sector

Short Run Error Correction				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGBANKING(-1))	-0.119	0.101	-1.178	0.242
D(EXVOLA)	-0.245	22.013	-0.011	0.991
D(LOGEXRES)	-6.083	0.073	-83.853	0.000
D(LOGM2)	0.101	0.199	0.506	0.614
D(INTRATE)	-0.144	0.007	-21.713	0.000
D(INFLATION)	0.325	0.003	101.151	0.000
D(@TREND())	-0.000	0.002	-0.186	0.852
CointEq(-1)	-0.676	0.067	-10.125	0.000
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOLA	-0.363	32.589	-0.011	0.991
LOGEXRES	-9.004	0.965	-9.327	0.000
LOGM2	0.149	0.298	0.500	0.618
INTRATE	-0.213	0.018	-11.502	0.000
INFLATION	0.482	0.049	9.793	0.000
C	-0.010	4.937	-0.002	0.998
@TREND	-0.001	0.003	-0.185	0.853
R-squared	0.848			
Adjusted R-squared	0.837			
F-statistic	74.001			
Prob(F-statistic)	0.000			
Durbin-Watson stat	1.952			

Source: Author's Computation, (2019).

Table 4.7 shows that the short-run model indicates that external reserves, interest rate and inflation rate are major short-run determinants of banking sector stock prices.These are evident from each of their p-values which are lower than the conventional levels of significance making them to be statistically significant in influencing banking sector stock prices. Exchange rate volatility and broad money supply are not short-run determinants of stock prices of banking sector.

External reserves and interest rate show negative signs, indicating they influence banking sector stock prices negatively while inflation rate shows a positive sign, indicating it influences banking sector stock prices positively. The significant negative coefficient of external reserves indicates

that a percentage increase in external reserves will lead to a decline in banking sector stock prices by about 6.08%, and vice versa. Similarly, the significant negative coefficient of interest rate indicates that a percentage point increase in the interest rate will lead to a decline in banking sector stock prices by about 0.14%, and vice versa. On the contrary, the significant positive coefficient of inflation rate indicates that a percentage point increase in the rate of inflation will lead to an increase in banking sector stock prices by about 0.33%, and vice versa. The result also included the lag effect of banking sector stock prices which is seen to be statistically insignificant. The error correction term (cointeq) in one period lag is negative and statistically significant, a condition to achieve convergence of the model, which measures the speed of adjustment to long-run equilibrium, its significant negative coefficient indicates that about 67.5% of disequilibrium is adjusted in each period (i.e. month), and it will take less than two periods for equilibrium to be achieved.

The result of the long-run estimates indicates that external reserves, interest rate and inflation rate are still the major long-run determinants of banking sector stock prices. Exchange rate volatility and broad money supply are not long-run determinants of stock prices of banking sector. These are evident from each of their p-values. The p-values of external reserves, interest rate and inflation rate are lower than the conventional levels of significance making them to be statistically significant in influencing banking sector stock prices in the long-run. On the other hand, the p-values of exchange rate volatility and broad money supply are higher than the conventional levels of significance (even 10%) making them to be statistically insignificant in influencing banking sector stock prices in the long-run.

External reserves and interest rate show negative signs, indicating they influence banking sector stock prices negatively while inflation rate shows a positive sign, indicating it influences banking

sector stock prices positively. The significant negative coefficient of external reserves indicates that a percentage increase in the stock of external reserves will lead to a long-run decline in banking sector stock prices by about 9.0%, and vice versa. Similarly, the significant negative coefficient of interest rate indicates that a percentage point increase in the rate of interest will lead to a long-run decline in banking sector stock prices by about 0.21%, and vice versa. On the contrary, the significant positive coefficient of inflation rate indicates that a percentage point increase in the rate of inflation will lead to a long-run increase in banking sector stock prices by about 0.48%, and vice versa.

The model statistics such as R-squared (and Adjusted R-squared), F-statistic (and its p-value), and Durbin-Watson statistic are also reported in Table 4.7. The reported R-squared for this model shows a value of 0.848, indicating that the model explains about 84.8% of variations in banking sector stock prices. F-statistic has a value of 74.0 and p-value of 0.000, indicating that the overall model is statistically significant. These jointly imply the model is in good fit. Durbin-Watson statistic indicates that the model is free from the problem of serial correlation as its reported value can be approximated to 2.

4.4.2.2 Effect of Foreign Exchange Rate Dynamics on the Consumer Goods Sector Stock Price Behavior in the Nigeria

Table 4.8: ARDL Short Run Error Correction and Long Run Estimates – Consumer Goods Sector

Short Run Error Correction				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGCG(-1))	0.410	0.097	4.199	0.000
D(EXVOLA)	0.176	16.118	0.011	0.991
D(LOGEXRES)	0.339	0.039	8.677	0.000
D(LOGM2)	-0.256	0.145	-1.771	0.079
D(INTRATE)	-0.037	0.004	-8.808	0.000
D(INFLATION)	-0.001	0.008	-0.238	0.812
D(INFLATION(-1))	0.009	0.010	0.922	0.358
D(INFLATION(-2))	-0.014	0.010	-1.448	0.150
D(INFLATION(-3))	-0.003	0.007	-0.427	0.670
D(@TREND())	0.956	0.001	757.140	0.000
CointEq(-1)	-0.119	0.034	-3.462	0.000
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOLA	1.478	135.000	0.011	0.991
LOGEXRES	2.845	0.849	3.352	0.001
LOGM2	-2.151	1.476	-1.457	0.148
INTRATE	-0.309	0.089	-3.480	0.000
INFLATION	0.067	0.036	1.835	0.069
C	-0.110	19.928	-0.005	0.995
@TREND	8.0153	2.315	3.461	0.000
R-squared	0.944			
Adjusted R-squared	0.937			
F-statistic	143.601			
Prob(F-statistic)	0.000			
Durbin-Watson stat	2.000			

Source: Author's Computation, (2019).

Table 4.8 shows that the short-run model indicates that external reserves, broad money supply, and interest rate are major short-run determinants of consumer goods sector stock prices. Exchange rate volatility and inflation rate are not short-run determinants of stock prices of consumer goods sector. These are evident from each of their p-values. The p-values of external reserves, broad money supply and interest rate are lower than the conventional levels of

significance (at least 10% in the case of broad money supply) making them to be statistically significant in influencing consumer goods sector stock prices.

Broad money supply and interest rate show negative signs, indicating they influence consumer goods sector stock prices negatively while external reserves shows a positive sign, indicating it influences consumer goods sector stock prices positively. The significant negative coefficient of broad money supply indicates that a percentage increase in broad money supply will lead to a decline in consumer goods sector stock prices by about 0.26%, and vice versa. Similarly, the significant negative coefficient of interest rate indicates that a percentage point increase in the rate of interest will lead to a decline in consumer goods sector stock prices by about 0.04%, and vice versa. On the contrary, the significant positive coefficient of external reserves indicates that a percentage increase in external reserves will lead to an increase in consumer goods sector stock prices by about 0.34%, and vice versa.

The result also included the lag effect of consumer goods sector stock prices which is seen to be statistically significant, indicating that the behaviour of stock price of consumer goods sector in the past period affect its behaviour in the present. The error correction term (cointeq) in one period lag is negative and statistically significant, a condition to achieve convergence of the model. Since it measures the speed of adjustment to long-run equilibrium, its significant negative coefficient indicates that only about 11.9% of disequilibrium is adjusted in each period, and it will take about nine periods for equilibrium to be achieved.

The result of the long-run estimates indicates that external reserves, interest rate and inflation rate are the major long-run determinants of consumer goods sector stock prices. Exchange rate volatility and broad money supply are not long-run determinants of stock prices of consumer goods sector. These are evident from each of their p-values. The p-values of external reserves,

interest rate and inflation rate are lower than the conventional levels of significance making them to be statistically significant in influencing consumer goods sector stock prices in the long-run.

External reserves and inflation rate show positive significant influence on the consumer goods sector stock prices while interest rate impact consumer goods sector stock prices negatively. The significant positive coefficient of external reserves indicates that a percentage increase in external reserves will lead to a long-run increase in consumer goods sector stock prices by about 2.85%, and vice versa. Similarly, the significant positive coefficient of inflation rate indicates that a percentage point increase in the rate of inflation will lead to a long-run increase in consumer goods sector stock prices by about 0.07%, and vice versa. On the contrary, the significant negative coefficient of interest rate indicates that a percentage point increase in the rate of interest will lead to a long-run decline in consumer goods sector stock prices by about 0.31%, and vice versa.

The reported R-squared for this model shows a value of 0.944, indicating that the model explains about 94.4% of variations in insurance sector stock prices. F-statistic has a value of 143.6 and p-value of 0.000, indicating that the overall model is statistically significant. These jointly imply this model is in good fit. Durbin-Watson statistic indicates that the model is free from the problem of serial correlation as its reported statistic value is 2.

4.4.2.3 Effect of Foreign Exchange Rate Dynamics on the Insurance Sector Stock Price Behavior in Nigeria

The short-run model in table 4.9 showed that exchange rate volatility (in the third period lag), external reserves (in the second and third period lags), broad money supply, and interest rate are major short-run determinants of insurance sector stock prices. Only inflation rate is not a short-run determinant of stock prices of insurance sector

Table 4.9: ARDL Short Run Error Correction and Long Run Estimates – Insurance Sector

Short Run Error Correction				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGINSURANCE(-1))	-0.257	0.088	-2.910	0.004
D(EXVOLA)	-0.358	3.147	-0.113	0.909
D(EXVOLA(-1))	1.628	3.633	0.448	0.655
D(EXVOLA(-2))	0.947	3.402	0.278	0.781
D(EXVOLA(-3))	-7.629	3.081	-2.476	0.015
D(LOGEXRES)	0.432	0.318	1.357	0.177
D(LOGEXRES(-1))	-0.284	0.496	-0.573	0.568
D(LOGEXRES(-2))	1.239	0.491	2.520	0.013
D(LOGEXRES(-3))	-0.679	0.331	-2.050	0.043
D(LOGM2)	-0.530	0.273	-1.935	0.055
D(INTRATE)	-0.017	0.008	-2.122	0.036
D(INFLATION)	0.002	0.004	0.452	0.652
D(@TREND())	0.005	0.002	2.242	0.027
CointEq(-1)	-0.272	0.061	-4.433	0.000
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOLA	3.508	1.725	2.033	0.044
LOGEXRES	0.720	0.267	2.694	0.008
LOGM2	-1.945	0.873	-2.227	0.028
INTRATE	-0.064	0.026	-2.406	0.018
INFLATION	0.007	0.015	0.472	0.638
C	28.759	14.854	1.936	0.055
@TREND	0.0199	0.007	2.602	0.010
R-squared	0.901			
Adjusted R-squared	0.885			
F-statistic	56.360			
Prob(F-statistic)	0.000			
Durbin-Watson stat	2.119			

Source: Author's Computation, (2019).

Exchange rate volatility, external reserves (in the third period lag), broad money supply and interest rate show negative signs, indicating they influence insurance sector stock prices negatively while external reserves (in the second period lag) shows a positive sign, indicating it influences insurance sector stock prices positively. The significant negative coefficient of exchange rate volatility indicates that a percentage point increase in exchange rate volatility will lead to a decline in insurance sector stock prices by about 7.63%, and vice versa. Similarly, the significant negative coefficient of broad money supply indicates that a percentage increase in the

stock of broad money supply will lead to a decline in insurance sector stock prices by about 0.53%, and vice versa. In the same vein, the significant negative coefficient of interest rate indicates that a percentage point increase in the rate of interest will lead to a decline in insurance sector stock prices by about 0.02%, and vice versa. Also, the significant negative coefficient of external reserves in the third period lag indicates that a percentage increase in external reserves in the present period will lead to a decline in insurance sector stock prices in the third period by about 0.68%, and vice versa.

On the contrary, the significant positive coefficient of external reserves in the second period lag indicates that a percentage increase in the stock of external reserves in the current period will lead to an increase in insurance sector stock prices in the second period by about 1.24%, and vice versa.

The included lag effect of insurance sector stock prices is seen to be statistically significant, indicating the behaviour of stock process of insurance sector in the past period affect its behaviour in the present. The error correction term (cointeq) in one period lag is negative and statistically significant, a condition to achieve convergence of the model. Since it measures the speed of adjustment to long-run equilibrium, its significant negative coefficient indicates that only about 27.2% of disequilibrium is adjusted in each period (i.e. month), and it will take less than four periods for equilibrium to be achieved.

The result of the long-run estimates indicates that exchange rate volatility, external reserves, broad money supply, and interest rate are the major long-run determinants of insurance sector stock prices. Inflation rate is not a long-run determinant of stock prices of insurance sector. These are evident from each of their p-values. The p-values of exchange rate volatility, external reserves, broad money supply, and interest rate are lower than the conventional levels of

significance making them to be statistically significant in influencing insurance sector stock prices in the long-run.

Exchange rate volatility and external reserves showed positive signs, indicating they influence insurance sector stock prices positively while broad money supply and interest rate show negative signs, indicating they influence insurance sector stock prices negatively. The significant positive coefficient of exchange rate volatility indicates that a percentage point increase in exchange rate volatility will lead to a long-run increase in insurance sector stock prices by about 3.50%, and vice versa. Similarly, the significant positive coefficient of external reserves indicates that a percentage increase in the stock of external reserves will lead to a long-run increase in insurance sector stock prices by about 0.72%, and vice versa. On the contrary, the significant negative coefficient of broad money supply indicates that a percentage increase in the stock of broad money supply will lead to a long-run decline in insurance sector stock prices by about 1.95%, and vice versa. The significant negative coefficient of interest rate also indicates that a percentage point increase in the rate of interest will lead to a long-run decline in insurance sector stock prices by about 0.06%, and vice versa.

The reported R-squared for this model shows a value of 0.902, indicating that the model explains about 90.2% of variations in insurance sector stock prices. F-statistic has a value of 56.36 and p-value of 0.000, indicating that the overall model is statistically significant. These jointly imply this model is in good fit. Durbin-Watson statistic indicates that the model is free from the problem of serial correlation.

4.4.2.4 Effect of Foreign Exchange Rate Dynamics on the Oil and Gas Sector Stock Price Behavior in Nigeria

Table 4.10 showed that the short-run model indicates that exchange rate volatility (in the third period lag) and interest rates are the major short-run determinants of oil and gas sector stock prices. External reserves, broad money supply, and inflation rate are not short-run determinant of stock prices of oil and gas sector.

Exchange rate volatility (in the third period lag) and interest rate show negative signs, indicating they influence oil and gas sector stock prices negatively. The significant negative coefficient of exchange rate volatility (in the third period lag) indicates that a percentage point increase in exchange rate volatility in the current period will lead to a decline in oil and gas sector stock prices in three periods to come by about 5.02%, and vice versa. Similarly, the significant negative coefficient of interest rate indicates that, a percentage point increase in the rate of interest will lead to a decline in oil and gas sector stock prices by about 0.02%, and vice versa.

The included three period lag effects of oil and gas sector stock prices is seen to be statistically significant, indicating that, the behaviour of stock prices of oil and gas sector in the past periods affect its behaviour in the present period. The error correction term (cointeq) in one period lag is negative and statistically significant, a condition to achieve convergence of the model. Since it measures the speed of adjustment to long-run equilibrium, its significant negative coefficient indicates that only about 14.3% of disequilibrium is adjusted in each period (i.e. month), and it will take less than ten periods for equilibrium to be achieved.

Table 4.10: ARDL Short Run Error Correction and Long Run Estimates – Oil and Gas Sector

Short Run Error Correction				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGOILNGAS(-1))	0.245	0.095	2.565	0.011
D(LOGOILNGAS(-2))	0.189	0.087	2.162	0.033
D(LOGOILNGAS(-3))	-0.198	0.087	-2.272	0.025
D(EXVOLA)	-3.175	2.325	-1.365	0.175
D(EXVOLA(-1))	-2.507	2.707	-0.926	0.356
D(EXVOLA(-2))	2.422	2.533	0.956	0.341
D(EXVOLA(-3))	-5.023	2.225	-2.257	0.026
D(LOGEXRES)	0.057	0.059	0.970	0.334
D(LOGM2)	-0.247	0.208	-1.187	0.238
D(INTRATE)	-0.018	0.007	-2.349	0.020
D(INFLATION)	-0.001	0.003	-0.374	0.709
D(@TREND())	0.004	0.002	1.941	0.055
CointEq(-1)	-0.142	0.050	-2.854	0.005
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOLA	4.587	2.195	2.089	0.039
LOGEXRES	0.404	0.459	0.879	0.381
LOGM2	-1.731	1.287	-1.344	0.181
INTRATE	-0.128	0.040	-3.185	0.001
INFLATION	-0.008	0.022	-0.371	0.711
C	29.486	21.635	1.362	0.176
@TREND	0.027	0.011	2.541	0.012
R-squared	0.938			
Adjusted R-squared	0.929			
F-statistic	106.786			
Prob(F-statistic)	0.000			
Durbin-Watson stat	1.953			

Source: Author's Computation, (2019).

The result of the long-run estimates indicates that exchange rate volatility and interest rate are the major long-run determinants of oil and gas sector stock prices. External reserves, broad money supply and inflation rate are not long-run determinants of stock prices of oil and gas sector. Exchange rate volatility shows positive sign, indicating it influences oil and gas sector stock prices positively while interest rate shows negative sign, indicating it influences oil and gas sector stock prices negatively. The significant positive coefficient of exchange rate volatility

indicates that a percentage point increase in exchange rate volatility will lead to a long-run increase in oil and gas sector stock prices by about 4.58%, and vice versa. On the contrary, the significant negative coefficient of interest rate indicates that a percentage point increase in the rate of interest will lead to a long-run decline in oil and gas sector stock prices by about 0.13%, and vice versa.

The reported R-squared for this model shows a value of 0.938, indicating that the model explains about 93.8% of variations in oil and gas sector stock prices. F-statistic has a value of 106.79 and p-value of 0.000, indicating that the overall model is statistically significant. These jointly imply this model is in good fit. Durbin-Watson statistic indicates that the model is free from the problem of serial correlation as its reported statistic value can be approximated to 2.

4.4.2.5 Effects of Foreign Exchange Rate Dynamics on the Nigerian Stock Market.

In order to assess the homogeneity of the market, this section present the short run and long run effects of foreign exchange rate, interest rate, inflation rate, foreign external reserves and money supply on the aggregate market of the Nigerian stock exchange. The result of short run error correction model and long run co-integrating regression for aggregate stock market is presented in table 4.11.

Table 4.11: ARDL Short Run Error Correction and Long Run Estimates – Aggregate ASI

Short Run Error Correction				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGASI(-1))	0.410	0.083	4.930	0.000
D(EXVOL)	0.176	3.225	0.054	0.956
D(LOGEXRES)	0.339	0.152	2.223	0.028
D(LOGM2)	-0.037	0.132	-0.279	0.780
D(INTRATE)	-0.001	0.003	-0.531	0.595
D(INFLATION)	0.001	0.006	0.247	0.805
D(INFLATION(-1))	-0.014	0.008	-1.717	0.088
D(INFLATION(-2))	-0.003	0.008	-0.384	0.701
D(INFLATION(-3))	0.013	0.006	2.086	0.039
D(@TREND())	0.001	0.001	0.828	0.409
CointEq(-1)	-0.119	0.032	-3.677	0.000
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOL	1.478	26.949	0.054	0.956
LOGEXRES	0.694	0.289	2.394	0.018
LOGM2	-0.309	1.078	-0.287	0.774
INTRATE	-0.016	0.031	-0.525	0.599
INFLATION	-0.026	0.016	-1.667	0.098
C	8.015	18.016	0.444	0.657
@TREND	0.008	0.009	0.908	0.365
R-squared	0.957			
Adjusted R-squared	0.952			
F-statistic	191.220			
Prob(F-statistic)	0.000			
Durbin-Watson stat	1.937			

Source: Author's Computation, (2019).

Table 4.11 shows that external reserve and inflation rate are the major short-run and long run determinant of aggregate stock prices. Exchange rate volatility, broad money supply, and interest rate are not short-run and long run determinant of aggregate stock prices.

External reserves and inflation rate (in the first period lag) show negative signs, indicating they influence aggregate stock prices negatively while inflation rate (in the third period lag) shows a positive sign indicating it influences aggregate stock prices positively. The significant negative coefficient of external reserves indicates that a percentage increase in external reserves will lead

to a decline in aggregate stock market by about 0.34% and 0.69% for the short run and long run respectively, and vice versa. Similarly, the significant negative coefficient of inflation rate (in the first period lag) indicates that a percentage point increase in the rate of inflation in the current period will lead to a decline in aggregate stock prices in the next period by about 0.014% and 0.026% in the short run and long run, and vice versa.

The reported R-squared for this model shows a value of 0.957, indicating that the model explains about 95.7% of variations in aggregate stock prices. F-statistic has a value of 191.2 and p-value of 0.000, indicating that the overall model is statistically significant. These jointly imply this model is in good fit. Durbin-Watson statistic indicates that the model is free from the problem of serial correlation as its reported statistic value can be approximated to 2.

4.4.3 Volatility Spill over Effect of Foreign Exchange Rate on Sector Stock Returns in Nigeria: The (EGARCH) Model

This sub-section presents the results of EGARCH model employed to investigate the volatility spill over effects of exchange rate volatility on stock return volatility of each of the selected sectors and the aggregate market. An examination of an ARCH test was conducted through the major information criteria among the leading GARCH-family methods namely, GARCH, TGARCH, and EGARCH. The method with the least information criteria is considered to be the best method among the GARCH family, the result of the ARCH test is presented in table 4.12 while the information criteria model selection will be presented in table 4.13.

Table 4.12: Result of the ARCH Test

Sector	Statistic	Value	p-value
Aggregate	F-statistic	13.674	0.000
	Obs*R-squared	13.366	0.000
Banking	F-statistic	106.961	0.000
	Obs*R-squared	88.645	0.000
Consumer Goods	F-statistic	14.776	0.000
	Obs*R-squared	14.413	0.000
Insurance	F-statistic	49.682	0.000
	Obs*R-squared	45.418	0.000
Oil and Gas	F-statistic	134.004	0.000
	Obs*R-squared	106.365	0.000

Source: Author's Computation, (2019).

The ARCH test results presented in Table 4.12 indicates that there is evidence of ARCH effect in aggregate stock prices and stock prices of each of the selected sectors. This is evident from the statistics and their respective p-values.

The F-statistic and Obs*R-squared values of each sectors and the aggregate market revealed that they are statistically significant. This is evident through their respectively p-value providing sufficient evidence to reject the null hypothesis of no ARCH effect. This implies that estimating the models with an ARCH/GARCH-family models will provide the most appropriate results.

The Information Criteria for Model Selection

Presented in Table 4.13is the information criteria for model selection which shows the Akaike, Schwarz, and Hannan-Quinn information criteria for each of the sectors and the aggregate market on models such as GARCH, TGARCH, and EGARCH. The result revealed that EGARCH is the most appropriate model to extract volatility of the data series of stock returns for aggregate and each of the selected sectors. This is evident from the fact that all information criteria have least values for EGARCH than the values for TGARCH and GARCH.

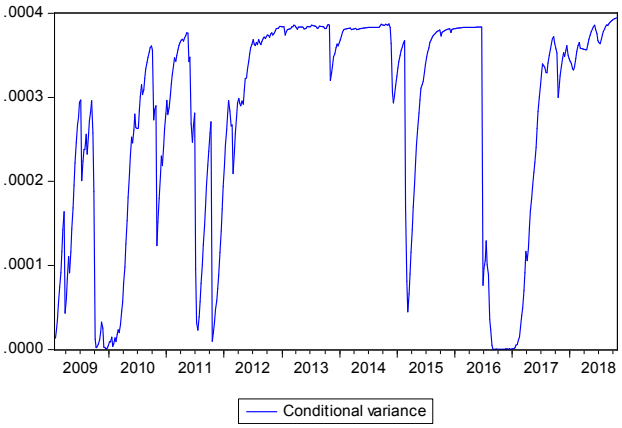
Table 4.13: Information Criteria for Model Selection

Sector	Info Criterion	GARCH	TGARCH	EGARCH
Aggregate	Akaike	-4.416	-4.413	-4.404
	Schwarz	-4.375	-4.363	-4.354
	Hannan-Quinn	-4.400	-4.393	-4.384
Banking	Akaike	-3.102	-2.455	-2.199
	Schwarz	-3.060	-2.405	-2.149
	Hannan-Quinn	-3.085	-2.435	-2.179
Consumer Goods	Akaike	-4.066	-4.066	-4.056
	Schwarz	-4.025	-4.016	-4.006
	Hannan-Quinn	-4.050	-4.046	-4.036
Insurance	Akaike	-1.929	-1.919	-1.184
	Schwarz	-1.887	-1.869	-1.134
	Hannan-Quinn	-1.912	-1.900	-1.164
Oil and Gas	Akaike	-3.386	-3.337	-3.323
	Schwarz	-3.345	-3.287	-3.273
	Hannan-Quinn	-3.370	-3.317	-3.303

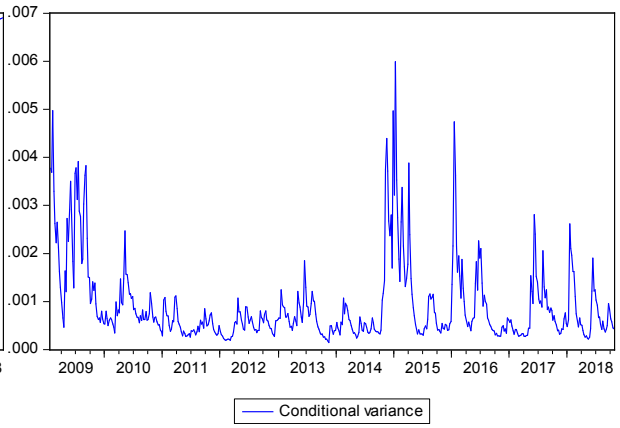
Source: Author's Computation, (2019).

The results in Tables 4.12 and 4.13 are suggestive of extracting the volatility series of stock returns and carrying out volatility model estimation through the exponential GARCH model in order to assess the volatility spill over effects of exchange rate on stock returns in Nigeria. The volatility series generated for exchange rate and stock returns of each of the sectors as well as the aggregate market is presented in Figure 4.2 to reveal the existence of persistent volatility in each of the variables.

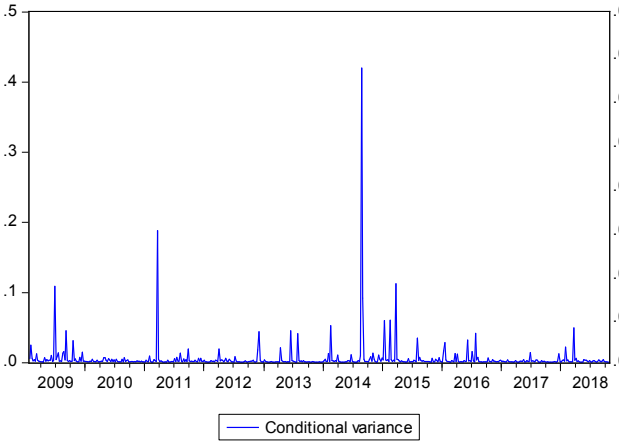
Exchange Rate



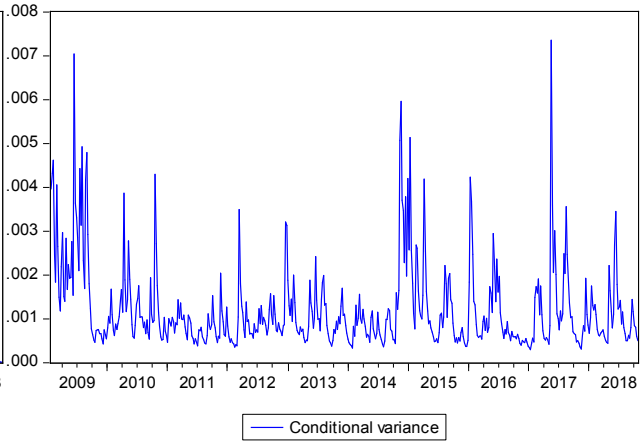
Aggregate Market Returns



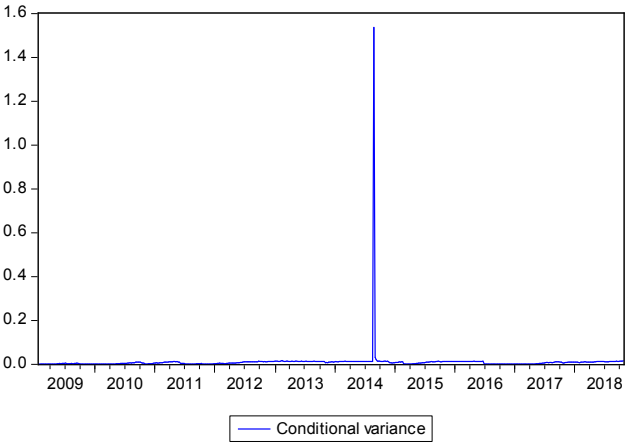
Banking Sector Stock Returns



Consumer Goods Sector Stock Returns



Insurance Sector Stock Returns



Oil & Gas Sector Stock Returns

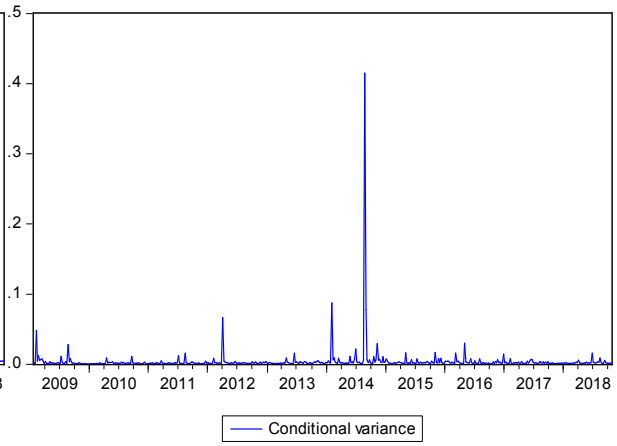


Fig 4.2:Volatility Series of Exchange Rate and Sector Stock Returns in Nigeria.

Source: Author's Computations, (2019).

The volatility series presented in Figure 4.2 showed that there is evidence of volatility in each of the sector stock returns within the periods. Also, volatility in exchange rate and the aggregate market are more pronounced over the period of concerns which indicated that, there is an evidence of volatility persistence in each of the variables.

Haven confirmed the existence of volatility in exchange rate and the sector returns, the results of the volatility models are presented in Tables 4.14, 4.15, 4.16, 4.17, and 4.18 for banking sector, consumer goods sector, insurance sector, oil and gas sector and the aggregate market respectively.

4.4.3.1 Volatility Spill over Effects of Foreign Exchange Rate on the Banking Sector Stock Returns

Table 4.14: EGARCH (1,1) Model Results – Banking Sector

Mean Equation				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
Constant	0.000	0.001	0.305	0.760
GRBANKING(-1)	0.197	0.043	4.588	0.000
Variance Equation				
Constant	-4.725	0.399	-11.815	0.000
Innovation	1.191	0.071	16.615	0.000
Asymmetry	-0.558	0.045	-12.378	0.000
Leverage	0.341	0.064	5.332	0.000
Exch. Volatility	-308.772	395.960	-0.779	0.435

Source: Author's Computation, (2019).

The mean equation of the banking sector stock returnspresented in Table 4.14 showed a statistically significant influence of lagged banking sector stock returns on the present banking sector stock returns. This is shown by its very low p-value, implying that past banking sector stock price returns matter for current banking sector stock price returns.

The variance equation result revealed that the effects of innovation, information asymmetry and leverage are statistically significant with p-values of 0.000 each. This further buttress the fact that there is ARCH effect in the banking sector stock returns and also indicates that there is

presence of information asymmetry and past volatilities influence current volatilities. The significance and positive coefficient of innovation is consistent with the outcome of the ARCH effect conducted earlier. The significant negative coefficient of information asymmetry indicates that there is evidence of information asymmetry, i.e. the effect of good news is significantly different from the effect of bad news, and that bad news exert greater influence on the volatility of banking sector stock prices than good news does. The significance and positive of the effect of leverage indicates that past volatilities affect future volatilities and increase in current volatilities also increases future volatilities.

However, the result shows that exchange rate volatility is not statistically significant in influencing banking sector stock returns volatility, this implies that, depreciation or appreciation in the value of the naira, does not affect the banking sector stock returns This is evident from its p-value being 0.435 which is greater than the conventional levels of significance. Hence, failure to reject the null hypothesis that there is no volatility spill over effects of exchange rateon banking sector stock returns volatility in Nigeria.

4.4.3.2 Volatility Spill over Effects of Foreign Exchange Rate on the Consumer Goods Sector Stock Returns

Table 4.15: EGARCH (1,1) Model Results – Consumer Goods Sector

Mean Equation				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
Constant	-0.000	0.001	-0.355	0.722
GRCG(-1)	0.157	0.047	3.342	0.000
Variance Equation				
Constant	-2.178	0.270	-8.062	0.000
Innovation	0.571	0.067	8.457	0.000
Asymmetry	0.038	0.041	0.922	0.356
Leverage	0.747	0.035	21.150	0.000
Exch. Volatility	38.108	184.912	0.206	0.836

Source: Author's Computation, (2019).

The mean equation in Table 4.15 shows a statistically significant influence of lagged consumer goods sector stock returns on current consumer goods sector stock returns. This is shown by its

very low p-value, implying that past consumer goods sector stock returns matter for current consumer goods sector stock price returns.

The result further revealed that both the innovation and leverage effects are statistically significant with p-values of 0.000 each. This implies that, the presence of innovation in the consumer goods sector (such as re-branding of goods, new line of product) have positive influence on the stock returns. Likewise, the positive effect of leverage indicates that past volatilities affect future volatilities and increase in current volatilities also increases future volatilities. However, information asymmetry and exchange rate are not statistically significant with p-value of 0.356 and 0.836, which implies the effect of good news is not significantly different from the effect of bad news and does not affects consumer goods sector return. In the same vein, volatility spill over of exchange rate does not influence the consumer goods sector stock returns on the Nigeria stock market, hence the study accept the null hypothesis which states that volatility spill over effects of exchange rate does not affect the consumer goods sector stock returns in Nigeria.

4.4.3.3 Volatility Spill over Effects of Foreign Exchange Rate on the Insurance Sector Stock Returns

The mean equation shows a statistically significant influence of lagged insurance sector stock price returns on current insurance sector stock returns. This is shown by its very low p-value, implying that past insurance sector stock returns matter for current insurance sector stock returns in Nigeria.

Table 4.16: EGARCH (1,1) Model Results – Insurance Sector

Mean Equation				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
Constant	-0.006	0.002	-3.674	0.000
GRINSURANCE(-1)	0.118	0.052	2.283	0.022
Variance Equation				
Constant	-6.678	1.132	-5.899	0.000
Innovation	0.112	0.084	1.332	0.182
Asymmetry	0.166	0.076	2.182	0.029
Leverage	0.206	0.138	1.493	0.135
Exch. Volatility	8357.126	1383.373	6.041	0.000

Source: Author's Computation, (2019).

In the variance equation, the result shows that both the innovation and leverage effects are not statistically significant with p-values of 0.182 and 0.135 respectively. The effect of information asymmetry is positive and statistically significant with p-value of 0.029. This indicates that the effect of good news is significantly different from the effect of bad news, and good news has greater influence on the volatility of insurance sector stock prices than bad news. Exchange rate volatility moves in the same direction as the information asymmetry, as the result shows that exchange rate volatility is statistically significant in influencing the volatility of insurance sector stock prices. This is evident from its p-value being 0.000 which is less than all conventional levels of significance, which implies that exchange rate volatility have spill over effects on the insurance sector stock returns. Therefore, the study rejects the null hypothesis that there is no volatility spill over effects of exchange rate on the insurance sector stock returns in Nigeria.

4.4.3.4 Volatility Spill over Effects of Foreign Exchange Rate on the Oil and Gas Sector Stock Returns

The mean equation shows a statistically significant influence of lagged oil and gas sector stock price returns on current oil and gas sector stock price returns. This is shown by its very low p-value, implying that past oil and gas sector stock price returns matter for current oil and gas sector stock price returns.

Table 4.17: EGARCH (1,1) Model Results – Oil and Gas Sector

Mean Equation				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
Constant	-0.000	0.001	-0.220	0.825
GROILNGAS(-1)	0.215	0.045	4.716	0.000
Variance Equation				
Constant	-4.662	0.570	-8.175	0.000
Innovation	1.037	0.067	15.434	0.000
Asymmetry	-0.464	0.045	-10.168	0.000
Leverage	0.403	0.087	4.626	0.000
Exch. Volatility	973.658	351.933	2.766	0.005

Source: Author's Computation, (2019).

The result further indicates that, effects of innovation, information asymmetry and leverage are statistically significant with p-values of 0.000 each. The significant negative coefficient of information asymmetry indicates that there is evidence of information asymmetry, i.e. the effect of good news is significantly different from the effect of bad news, and that bad news exert greater influence on the volatility of oil and gas sector stock returns than good news does, for example the effect of the price of oil in the international oil market. The positive significant effect of leverage indicates that past volatilities affect future volatilities and increase in current volatilities also increases future volatilities.

Lastly, the result shows that exchange rate volatility is statistically significant in influencing the volatility of oil and gas sector stock returns. This is evident from its p-value being 0.0057 which is less than the conventional levels of significance, which implies that volatility spill over effects

of exchange rate affects the oil and gas sector returnsin Nigeria. Hence, the alternative hypothesis that volatility spill over of exchange rate affects the oil and gas sector stock returns.

4.4.3.5 Volatility Spill over Effects of Foreign Exchange Rate on the Aggregate MarketReturns

The result of the aggregate market is also presented in Table 4.18 in order to make appropriate comparism between the sectors and the market as a whole

Table 4.18: EGARCH (1,1) Model Results – Aggregate

Mean Equation				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
Constant	0.000	0.001	0.308	0.758
GRASI(-1)	0.204	0.049	4.093	0.000
Variance Equation				
Constant	-1.161	0.156	-7.436	0.000
Innovation	0.469	0.052	9.047	0.000
Asymmetry	0.011	0.036	0.327	0.743
Leverage	0.891	0.020	43.476	0.000
Exch. Volatility	57.748	123.177	0.468	0.639

Source: Author's Computation, (2019).

Just like every other sector examined in this study, the mean equation of the aggregate market shows a statistically significant influence of lagged aggregate stockreturns on present aggregate stock returns. Also result shows that innovation and leverage effects are statistically significant with p-values of 0.000 each, while information asymmetry and exchange rate are not statistically significant. This indicates that the effect of good news is not significantly different from the effect of bad news and that volatility spill over of exchange rate does not affects the Nigerian stock market returns.

4.4.4 Volatility Transmission among Sectors Stock Returns in Nigeria.

Lastly, this study examined the volatility transmission among the selected sectors on the Nigerian stock exchange, in order to determine whether sudden changes in one sector can be transmitted concurrently to other sector. This is carried out using two of the MGARCH models

which are BEKK GARCH model and the Dynamic Conditional Correlation (DCC). The result of the BEKK GARCH model is presented in Table 4.19.

Table 4.19: Transformed Variance Coefficients of Diagonal BEKK GARCH(1,1) Model

	Coefficient	Std. Error	z-Statistic	Prob.
M(B,B)	0.002	0.000	4.879	0.000
M(B,CG)	0.000	0.000	2.097	0.036
M(B, I)	0.002	0.000	5.436	0.000
M(B,OG)	0.001	0.000	4.954	0.000
M(CG,CG)	0.000	0.000	5.559	0.000
M(CG,I)	0.000	0.000	0.142	0.886
M(CG,OG)	0.000	0.000	1.342	0.179
M(I,I)	0.006	0.000	8.247	0.000
M(I,OG)	0.002	0.000	5.529	0.000
M(OG,OG)	0.001	0.000	5.439	0.000
A1(B,B)	0.260	0.030	8.678	0.000
A1(B,CG)	0.204	0.026	7.688	0.000
A1(B,I)	0.260	0.036	7.094	0.000
A1(B,OG)	0.253	0.036	6.912	0.000
A1(CG,CG)	0.161	0.034	4.654	0.000
A1(CG,I)	0.204	0.031	6.587	0.000
A1(CG,OG)	0.199	0.032	6.170	0.000
A1(I,I)	0.260	0.053	4.910	0.000
A1(I,OG)	0.253	0.036	6.943	0.000
A1(OG,OG)	0.246	0.052	4.707	0.000
B1(B,B)	0.262	0.060	4.349	0.000
B1(B,CG)	0.384	0.054	7.062	0.000
B1(B,I)	0.232	0.064	3.603	0.000
B1(B,OG)	0.282	0.049	5.747	0.000
B1(CG,CG)	0.562	0.067	8.402	0.000
B1(CG,I)	0.340	0.076	4.451	0.000
B1(CG,OG)	0.412	0.054	7.566	0.000
B1(I,I)	0.205	0.089	2.292	0.022
B1(I,OG)	0.249	0.067	3.720	0.000
B1(OG,OG)	0.302	0.064	4.686	0.000

Source: Author's Computations, (2019).

Table 4.19 presents the transformed variance coefficients of the diagonal BEKK multivariate GARCH model. The variance and covariance parameters labelled M indicate an indefinite matrix while the parameters labelled A1 and B1 are the rank one matrices. The result showed that the coefficients of all the diagonal parameters, A1(Banking, Banking), A1(Consumer Goods, Consumer Goods), A1(Insurance, Insurance), A1(Oil & Gas, Oil & Gas), B1(Banking, Banking),

B1(Consumer Goods, Consumer Goods), B1(Insurance, Insurance), and B1(Oil & Gas, Oil & Gas), are statistically significant at 1% level of significance. The diagonal parameters capture own-sector shock and volatility transmission, which indicates thatpast shock and volatility of individual sector affects current shock and volatility.

The result also showed that, the off-diagonal parameters A1(Banking, Consumer Goods), A1(Banking, Insurance), A1(Banking, Oil & Gas), A1(Consumer Goods, Insurance), A1(Consumer Goods, Oil & Gas), A1(Insurance, Oil & Gas), B1(Banking, Consumer Goods), B1(Banking, Insurance), B1(Banking, Oil & Gas), B1(Consumer Goods, Insurance), B1(Consumer Goods, Oil & Gas), and B1(Insurance, Oil & Gas) are statistically significant at 1% level of significance. The off-diagonal parameters capture cross-sector shock and volatility transmission between the banking, consumer goods, insurance and oil and gas sector, implying that, shock and volatility of one sector affects shock and volatility of the other. For instance, from the off-diagonal elements of matrix A, shock from the banking sector spills over to the consumer goods, insurance and oil and gas sectors at 1% level of significance, and there is shock transmission from each of the latter sectors to the banking sector as well. This suggests that information flow and any sudden change in the banking sector stock impact the consumer goods, insurance and oil and gas sectors and vice versa. This evidence implies bi-directional shock transmission among all the selected sectors of the Nigerian stock market.

Furthermore, the off-diagonal elements of matrix B, showed clear evidences of volatility transmission among the sectors. For instance, there is volatility transmission from the banking sector to the consumer goods, insurance and oil and gas sectors at 1% level of significance, and there is volatility transmission from each of the latter sectors to the banking sector as well. The results also showed that volatility from the consumer goods sector transmits to all other sectors at

1% level of significance, and there is volatility transmission back to consumer goods sector from each of the other sectors as well. This result is also evident for each of the other two sectors. Hence, there is cross-sectional volatility transmission among all the selected sectors of the Nigerian stock market. These volatility transmissions are however positive, evident from each of their positive coefficients which indicates that the volatility in each of the sectors positively affects all other sectors of the NSE.

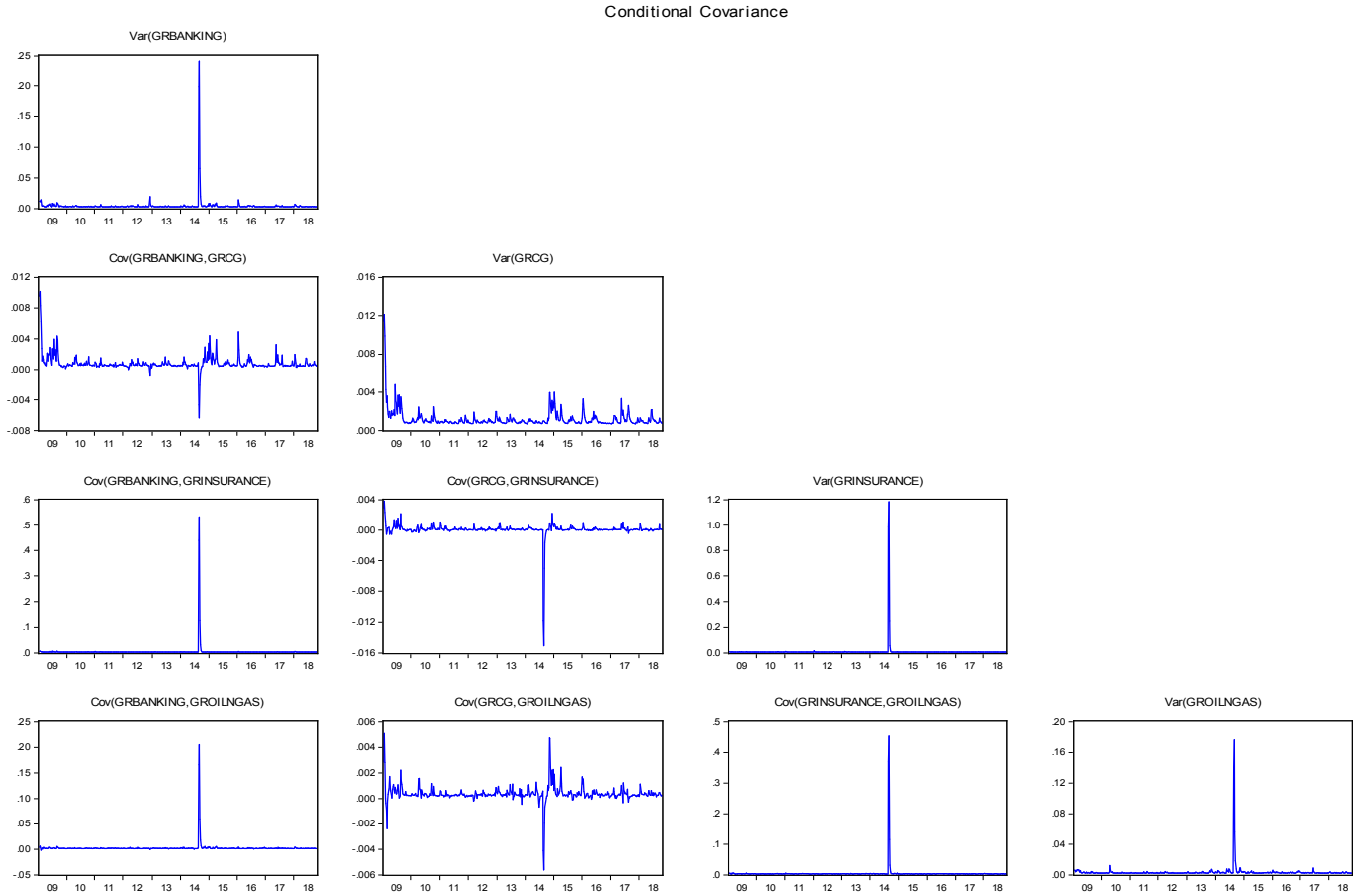


Figure 4.3: BEKK MGARCH Conditional Covariance Plot

Source: Author's Computations, (2019).

Figure 4.3 presents the conditional covariance plot showing the co-movement in the variance of the returns of selected sectors of Nigerian stock exchange. The figure revealed that the variance of these sectors returns have slightly weak average relationship throughout the period of concern. However, one thing is common for the sectors, each sector's return exhibit high surge during the weeks of 2014, indicating there was an event to which all these sectors simultaneously responded to.

Finally, **the Dynamic Conditional Correlation (DCC) MGARCH model** was also conducted to examine the volatility transmission among the selected sectors. The DCC MGARCH model employs a nonlinear combination of univariate GARCH models with time-varying cross-equation weights to model the conditional covariance matrix of the errors. Estimates of the MGARCH DCC parameters are generated in a process by which the conditional variances are modelled as univariate GARCH models and the conditional co-variances are modelled as nonlinear functions of the conditional variances. The DCC MGARCH model is about as flexible as the closely related varying conditional correlation (VCC) MGARCH model, more flexible than the constant conditional correlation (CCC) MGARCH model, and more parsimonious than the diagonal vech MGARCH model (Kroner & Ng, 1998).

However, a test of dynamic correlation was carried out to confirm if a dynamic conditional correlation MGARCH model is more appropriate for the case at hand or the constant conditional correlation fits it well. The DCC MGARCH model reduces to the CCC MGARCH model when Lambda1=Lambda2 = 0. However, result presented in table 4.19 revealed that conditional correlation are not constant, therefore, the assumption of time-invariant conditional correlations maintained in the CCC MGARCH model is seen to be too restrictive for these data. Therefore, DCC is more suitable than CCC for the series at hand.

Table 4.20: Multivariate GARCH Model Results – Dynamic Conditional Correlation

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Banking, Consumer goods	0.418	0.043	9.71	0.000
Banking, Insurance	0.749	0.026	28.76	0.000
Banking, Oil & Gas	0.654	0.034	19.37	0.000
Consumer goods, Insurance	0.063	0.054	1.16	0.245
Consumer goods, Oil & Gas	0.218	0.050	4.38	0.000
Insurance, Oil & Gas	0.691	0.031	22.30	0.000
Lambda 1	0.130	0.031	4.15	0.000
Lambda 2	0.231	0.089	2.60	0.009
Wald Chi-squared	**39.01**			**0.001**

Source: Author's Computation, (2019).

The DCC result showed very close evidence generated in BEKK-MGARCH model which showed positive significant volatility transmission among all the sectors of the Nigerian stock exchange except in the case of the volatility transmission between consumer goods and insurance sectors.Although, result showed that the magnitude of volatility transmission among the sectors are much higher compare to the result obtained in the BEKK model particularly transmission in the banking sector and insurance sector with 75%, insurance sector to oil and gas sector with 69% and banking and the oil and gas sector with 65%. This implies that, the contagion effects of the banking sector stock to other sector is relatively high and more pronounced than the effects from the consumer goods sector to other sector.

The DCC MGARCH model is statistically significant at 1% level of significance with Wald Chi-squared value of 39.01 and p-value of 0.0001. The results of adjusted parameters, Lambda 1 and Lambda 2 presented in Table 4.19 shows that both are statistically significant, with coefficient of 13% and 23% respectively, this implies that correlations between these sectors depend on shocks and own lag.

4.5 Post Estimation Test

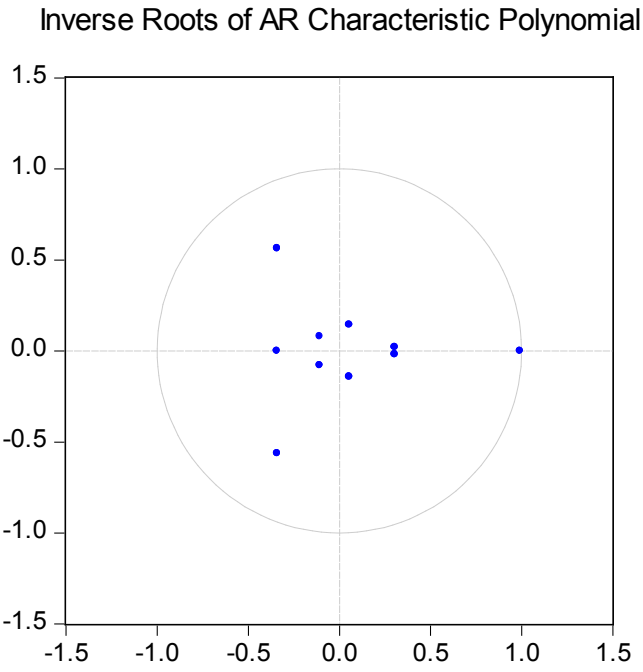


Figure 4.4: Stability Test for Augmented Granger Causality
Source: Author's Computations, (2019).

The Roots of Characteristic Polynomial graph presented in Fig. 4.4 revealed that no root lies outside the unit circle, indicating that the model satisfies the stability condition and exhibits good fit. The Roots of Characteristic Polynomial table (see appendix) also supports the conclusion.

Table 4.21: Autocorrelation and Heteroscedasticity Tests – ARDL

Model	Autocorrelation		Heteroscedasticity	
	Obs*R-squared	p-value	Obs*R-squared	p-value
Aggregate ASI	0.175	0.916	18.17	0.111
Banking	1.135	0.567	5.590	0.588
Consumer gds	0.715	0.699	15.97	0.193
Insurance	2.575	0.276	20.67	0.191
Oil and Gas	2.884	0.236	14.51	0.413

Source: Author's Computations, (2019).

The autocorrelation and heteroscedasticity tests are tests to determine if the models are free from the problems of serial correlation and unequal variance respectively. These tests are conducted

following the Breusch-Godfrey serial correlation LM test and Breusch-Pagan-Godfrey heteroscedasticity test respectively. The autocorrelation test states a null hypothesis that there is no serial correlation in the model while the heteroscedasticity test states a null hypothesis that there is equal variance. The results in Table 4.21 showed that there is absence of both autocorrelation and heteroscedasticity in all the models has there is insufficient evidence to reject the respective null hypotheses. This is evident from each of their observation times R-squared (i.e. Obs*R-squared) values being relatively small and their respective p-values being greater than all conventional p-values. This suggests that the models are free from serial correlation and heteroscedasticity problems.

Table 4.22: Correlogram Squared Residual for Autocorrelation – EGARCH

	Aggregate		**Banking**		**Consumer Gds**		**Insurance**		**Oil & Gas**	
Lag	Q-Stat	Prob*	Q-Stat	Prob*	Q-Stat	Prob*	Q-Stat	Prob*	Q-Stat	Prob*
1	0.121	0.728	0.025	0.873	0.044	0.834	0.022	0.882	0.043	0.835
2	1.017	0.601	0.037	0.982	0.593	0.743	0.026	0.987	0.054	0.973
3	1.093	0.779	0.043	0.998	0.652	0.884	0.031	0.999	0.287	0.962
4	1.155	0.885	0.365	0.985	0.652	0.957	0.038	1.000	0.506	0.973
5	1.245	0.940	0.366	0.996	4.983	0.418	0.042	1.000	0.558	0.990
6	3.158	0.789	0.562	0.997	7.345	0.290	0.046	1.000	0.609	0.996
7	6.613	0.470	0.563	0.999	10.454	0.164	0.052	1.000	0.689	0.998
8	6.614	0.579	0.587	1.000	10.939	0.205	0.058	1.000	1.316	0.995
9	7.565	0.578	0.956	1.000	11.497	0.243	0.065	1.000	5.670	0.772
10	7.569	0.671	1.099	1.000	11.628	0.311	0.072	1.000	5.681	0.841

Source: Author's Computations, (2019).

Table 4.22 presents the correlogram squared residual result to test for autocorrelation in the residuals of the EGARCH models. The Q-statistics and respective p-values for different lag periods up to 10 lags are reported for each of aggregate, banking sector, consumer goods sector, insurance sector, and oil and gas sector models respectively. Results show that none of the Q-statistics reported is statistically significant. This is shown by their low statistic values and high p-values. This indicates non-rejection of null hypothesis which states that there is no serial

correlation in the residuals for each lag period. Therefore, there is absence of serial correlation in the models.

Table 4.23: System Residual Portmanteau Tests for Autocorrelation – BEKK

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	30.972	0.013	31.032	0.013	16
2	49.758	0.023	49.893	0.022	32
3	58.1520	0.149	58.336	0.145	48
4	74.127	0.181	74.437	0.174	64
5	83.533	0.371	83.937	0.359	80
6	98.842	0.400	99.428	0.384	96
7	122.161	0.240	123.072	0.223	112
8	140.017	0.220	141.213	0.200	128
9	161.780	0.147	163.366	0.128	144
10	174.423	0.206	176.262	0.179	160

*The test is valid only for lags larger than the System lag order.
df is degrees of freedom for (approximate) chi-square distribution
Source: Author's Computations, (2019).

The system residual Portmanteau tests are presented in Table 4.23 to check the presence of autocorrelation in the BEKK MGARCH model. The result presents both the Q and adjusted Q-statistics. Both statistics showed a rejection of null hypothesis of no serial correlation in the first and second lags but show non-rejection of null hypothesis from the third lag up to the tenth lag. It can be concluded safely that there is absence of serial correlation in the model because the test result indicates that it is only valid for lags larger than the system lag order which is given at 2 lags while estimating the model. This simply implies the model is free from serial correlation problem.

4.6 Discussion of Findings

This section presents the discussions of major findings in relation to the research objectives of the study. The discussions are presented in the order of research questions set for the study.

4.6.1 Causal Relationship between Foreign Exchange Rate and Sectoral Stock Prices in Nigeria

The first research question was used to investigate the first objective, which examined the causal relationship between foreign exchange rate and stock prices of different sectors in Nigeria. The result revealed that causality between foreign exchange rate and stock price differs across sectors on the Nigerian stock market.

The result in Table 4.6 revealed a significant causal relationship between exchange rate and stock price of the aggregate market, with causality running from market index to foreign exchange rate volatility and not the other way round. This implies that increase or decrease in market index of the Nigerian stock market, granger causes foreign exchange rate changes. This could perhaps be as a result of the fact that, the Nigerian stock market is one of the fastest and largest growing markets in the African continent, with high foreign and local investors' participation (NSE, 2017). Hence, increase or decrease in the market performance can increase or decrease the inflow or outflow of foreign investors in the country, which may invariably increase or decrease the demand for domestic currency and consequently causes exchange rate movement in Nigeria. This submission is in line with the findings and assertions of Lin (2012) and Salisu and Ndako (2017) who argued that stock prices granger causes exchange rate and support the portfolio balanced theory.

However, in order to affirm the heterogeneity of the market, the panel result from Table 4.5, showed differing position for each of the selected sectors. The result showed a unidirectional

causality running from exchange rate to stock price of the banking sector, and consumer goods sector to exchange rate, while no causality was found between foreign exchange rate and the insurance and the oil and gas sector. Notably, only the banking sector stock price is caused by foreign exchange rate changes, this could be as a result of the banks more involvement in forex trading due to the closure of the official foreign exchange window and also bank balances outside Nigeria (CBN, 2016). Furthermore, the study found unidirectional causality from the consumer goods sector to foreign exchange rate in Nigeria. This may be ascribed to the fact that, the consumer goods sector is one of the fastest growing sector on the Nigerian stock market, that attracts investors for growth of wealth and investment (NSE, 2014).

Therefore, this study found significant causal relationship between foreign exchange rate and stock price of the banking sector, consumer goods sector and the aggregate market, but no causal relationship between foreign exchange, insurance sector and the oil and gas sector. However, causal direction between exchange rate and each of the selected sectors differs across sectors, the banking sector support the flow oriented theory, which asserted that changes in the exchange rate affects stock price. Whereas, the consumer goods sector and aggregate market follows the portfolio balanced theory which states that movements in stock price can affect exchange rate dynamic. This study is in line with the findings of Tahir and Wong (2005) who found stock prices to cause exchange rate for the aggregate market, however, found differing causality between exchange rate and the sectoral stock prices

4.6.2 Sectoral Response to Foreign Exchange Rate Dynamics in Nigeria.

The second research question sought to investigate the short run and long run effects of foreign exchange rate dynamics, interest rate, foreign reserve, inflation rate and money supply on stock price behavior of each of the selected sector on the Nigerian stock market, aimed at achieving the second objective of the study.

The outcome of each of the variables varies across sectors due to individual sector peculiarities, policies, structure and regulations as proposed by Narayan and Sharma (2011), hence this section will be discussed base on each sector and lastly the result of the aggregate market is also discussed to affirm that market are not homogenous.

4.6.2.1 Foreign Exchange Rate Dynamics and the Banking Sector Stock Price Behavior in Nigeria

The result of the ARDL short run and Long run co-integration of the banking sector showed that only foreign external reserve, interest rate and inflation have significant impact on banking sector stock price both in the short run and long run, foreign exchange rate and money supply have no short run and long run significant impact on the banking sector stock price on the Nigerian stock market.

The findings revealed that foreign external reserves have negative significant effects on banking sector stock price behavior, this may be due to sudden and persistent withdrawal of foreign investors from the market for safety of investment to other countries, which the banking sector are mostly affected by the volume of withdrawal. The banking sector has the largest and most traded equity on the Nigerian stock market with over 60% total market capitalization (Ajayi, 2013), Nigeria foreign reserves are mainly source from crude oil proceeds and according to CBN is expected to prevent capital flight in the country which are often jeopardized due to lack of

proper management and challenges (such as, youth restiveness, oil bunkering, kidnapping) faced in the oil producing region of the country.

In addition, according to CBN act 2007, bank balances outside Nigeria where currency are freely convertible are part of the composition of foreign external reserves, however, currency risk exposure of banks often affects banks profitability, earnings and also reduces return on investment and in the long run affects banking sector stock price. This assertion is in line with the Arbitrage Pricing Theory which argues that, only systematic risk cannot determine the price or return of an asset, theory support that, risk factor arise from changes in fundamental economic and financial variables which can influence the price of an assets.

It is adduced from the study that interest rate have significant negative effects on stock price of the banking sector this could perhaps due to the fact that the Central Bank of Nigeria in a bit to control inflation and also to preserve the foreign reserve increases the MPR by 8%. However, increased cost of borrowing result to liquidity challenges, reduces corporate earnings, firms profitability and curtail investment. This view is supported by Otieno *et.al* (2017), Khalid and Khan (2017) and Geert and Campbell, (1997) who stated that an economy faced with liquidity problem translate to negative effect on investment both from the local and foreign investors and also have adverse effect on stock price behavior, but in contrast to the findings of Lei (2017).

Furthermore, against the findings of Omankhalen *et al.* (2016), but in line with the evidence put forth by Charles and Richard (2018), inflation rate have positive significant impact on stock price of the banking sector, this might be ascribe to the fact that, stock market investment are good hedge against inflation in Nigeria. However, it is not surprising that both interest rate and inflation have significant impact on stock price of the banking sector though in opposite direction. These two variables are key macroeconomic determinant that changes inversely to one

another, while trying to curtail one, the other will rise and interest rate are sometimes used as a control measure by the CBN to control inflation in the country.

4.6.2.2 Foreign Exchange Rate Dynamics andConsumer Goods Sector Stock Price Behavior in Nigeria

The result presented in Table 4.8 revealed that foreign external reserves, interest rate, money supply and inflation are the major determinant of stock price behavior of the consumer goods sector in Nigeria. Findings showed that foreign reserves have positive short and long run significant impact on consumer goods sector stock price, this could be ascribe to high dominance of local investors in this sector, who are to a large extent mirrors consumer behavior and depends largely on the growth of the economic. This finding is in tandem with the work of Akinlo (2015) who asserted that foreign reserve are strong macroeconomic variables that are often use to maintain liquidity and shore up confidence among domestic investor, and hence impact positively on the economic growth.

In contrast to the findings of Omankhanlen *et al.* (2016), and compatible with the evidence put forth by Adeniji (2015) who asserted that interest rate possess liquidity challenges that affect consumer goods sector price. This study found that interest rate has negative significant impact on stock price of the consumer goods sector both in the long run and short run. This may be ascribed to the liquidity challenges which dampen the purchasing power in any economy due to high cost of borrowings; hence earnings and liquidity are major drivers of consumer goods sector growth in Nigeria.

It can also be deduced from the study that inflation rate have long run significant positive impacton the consumer goods sector in Nigeria. This position is in accordance with Khalid and Khan (2017) who found inflation rate as an important determinant of stock price. This may

perhaps be due to the fact that consumer goods sector consist of companies that produce daily needs of individual households, which are goods (such as: food, beverages, hygiene products and certain household items) people tends to buy out of necessity regardless of the economic conditions. These companies generate steady cash flow and predictable earnings during strong and weak economies due to constant demand for these products. This finding contradicts the work of Zakir (2013) who found negative significant impact of inflation on the consumer goods sector in Nigeria.

Furthermore, the study found that exchange rate does not have significant impact on stock price behavior of the consumer goods sectors in Nigeria. This may be reasoned along the diverse and dynamic nature of the consumer goods sector which is extremely susceptible to changes in consumer tastes. Consumer goods sector are usually non-cyclical and can serve as a means of hedging for investors during inflation and exchange rate changes in Nigeria. This findings support the view of Hutchet and Korinek (2011) and also in line with the Arbitrage pricing theory of multi factor variables influencing stock price behavior, however, against the work of Amin and Janor (2016) who found positive impact of exchange rate on the consumer goods sector.

4.6.2.3 Foreign Exchange Rate Dynamics and the Insurance Sector Stock Price Behavior in Nigeria.

The result of the short run and long run estimates of the insurance sector in Table 4.9 showed that foreign exchange rate, foreign reserves, money supply and interest rate have short and long run significant influence on stock price behavior of the insurance sector in Nigeria. Inflation rate have no significant impact either in short and long run estimates.

Against the findings of Chimaobi, Afamefuna and Ebere, (2015), this study revealed that foreign external reserve have negative short run significant impact on the insurance sector stock price, while positive and significant effect was found in the long run of the insurance sector in Nigeria. This may be due to huge and continuous capital flight for safety of investment by foreign investor due to lack of adequate and effective insurance system for life and property in Nigeria, especially with rising issues of kidnapping and terrorism (Adeyele and Maiturare, 2012).

In consistent with the findings of Choi and Kronlound (2017), Becker and Ivashina (2015) and Czaja, Scholz and Wilkens (2010), who asserted that, insurance sector returns are significantly sensitive to interest rate changes. This study found negative and significant impact of interest rate on the insurance sector stock price behavior in Nigeria both in short run and long run. This may be reasoned along the fact that, insurance company are the largest institutional holders of corporate and foreign bond who often tilt their portfolios towards higher duration assets in an effort to minimize interest rate risk, hence reaching- for-yield when interest rate is low, as a result of long duration, particularly for life assurance policy (Ali and Wang, 2018). Also, Beirne *et al.* (2009) argues that interest rate often affects the financing costs and the value of financial assets and liabilities held by the insurance firms. This study contradicts the findings of Mouna and Anis, (2016) who found positive significant impact of interest rate on the insurance sector stock returns in Germany.

Furthermore, monetary theory postulates that, increase in money supply implies higher demand for money due to increase in economic activities which are expected to drive investment and increase stock price. However, this study found contrasting evidence and revealed that money supply has short and long run negative significant impact on insurance sector stock price in Nigeria. This may be ascribed to the level of insurance penetration (measuring as a proportion of

the GDP) in Nigeria which stood at 0.3% compare to other notable African countries like; South Africa with 14.7%, Kenya with 2.8%, Angola(0.8%) and Egypt (0.6%). Similarly, despite large population density of about 196.1million, the level of insurance awareness in Nigeria is very low, which is one of the factor that influence patronage and growth. The insurance sector density (a measure of the industry gross premium to per capital income) in Nigeria is still one of the lowest when compared to other African countries like South Africa ($762.5), Kenya ($40.5), Angola ($30.5), Egypt ($22.8) and Nigeria ($6.92), (Proshareng, 2017). Therefore, economic activities may rise, but not in terms of equity investment in insurance sector, other productive sector like the Agricultural sector and service sector, as investors considered insurance sector to be weak. This study is in line with the view of Saizal and Sarma (2015) who found negative significant impact of money supply on the insurance sector stock price in Malaysia

Foreign exchange rate in the short and long run have high significant negative effects on the insurance sector stock price in Nigeria. This could perhaps be due to the fact that, solvency of the insurance firm are often affected by exchange rate fluctuations because of the impact on profitability and more importantly assets valuation and liabilities (Laing, 2008). Despite the insurance company being a risk mitigating sector, hedging against foreign exchange risk has been very challenging for the sector, thus, when the value of the naira depreciates, insurance sector stock price will drop. This finding supports the assertion of Papadamou and Siripoulous, (2014), who found negative significant influence of foreign exchange rate on the insurance sector stock price, but against the study of Mouna and Anis, (2016) who found positive significant impact of foreign exchange rate on insurance sector stock price in Spain.

4.6.2.4. Foreign Exchange Rate Dynamics and the Oil and Gas Sector Stock Price Behaviorin Nigeria.

The result presented in Table 4.10 revealed that oil and gas sector stock price is not influenced by foreign external reserve, money supply and inflation rate in the short run and long run estimates, foreign exchange rate and interest rate are the major short and long run determinant of the oil and gas sector of the Nigerian stock exchange market.

The study showed that the oil and gas sector stock price respond positively and negatively in the short and long run to foreign exchange rate dynamics, this may be due to drop in the price of crude oil in the international market, which often affects the oil and gas firms profitability and as such low dividend payout or even in some cases outright dividend cut-off which dampens investor's expectations on return. Bhattacharya (1979) argues that low or total cut-off of dividend payout have a negative signal on the wellbeing of the firm, hence reduces investor's appetite and thus the value of the share is also reduced. This assertions support the findings of Asaolu and Ilo (2012) who found significant effects of foreign exchange rate on the oil and gas sector in Nigeria.

In addition, the study revealed that the oil and gas sector stock respond negatively to interest rate in the short and long run estimates, this may be ascribed to the increase in monetary policy rate by the CBN in an effort to stabilize the value of the naira which lead to liquidity challenges in the country as a result of high cost of borrowing. Otieno *et al*. (2017) argued that stock returns are inversely sensitive to interest rate changes in Kenya and South Africa. This study supports the findings of Zakri (2013) who asserted that interest rate have significant negative impact for oil and non-oil sector in US stock market and also Khalid and Khan (2017) who found negative significant effect of interest rate on stock prices in Malaysia. However, in contrast to Lei (2017),

who found no significant influence of interest rate both in the short and long run estimates in their study.

In sum, the banking sector, insurance sector, consumer goods sector and the oil and gas sector stock price responds differently to foreign exchange rate dynamics, interest rate, money supply, foreign external reserve and inflation rate, based on the peculiarities of each of these sectors. However, it is interesting to note that interest rate is a major determinant of stock price behavior for each of these sectors both in the short and long run, and the coefficient for each of these sectors remain the same throughout the period understudy. This implies that, each of these sectors stock price respond negatively to interest rate changes, Geert and Campbell, (1997), stated that an economy faced with liquidity problem translate to negative effect on investment both from the local and foreign investors and also have adverse effect on the performance of the market, hence liquidity is an important factor that drives investment in Nigeria.

In addition, foreign external reserves and inflation rate are also major determinants to individual sector stock price behavior in Nigeria. As the study revealed that three of these sectors namely, the banking sector, consumer goods sector and the insurance sector responds positively and negatively to foreign reserves and inflation in the Nigerian stock exchange market both in the short and long run.

Furthermore, sectoral response to foreign exchange rate dynamics is quite selective on the Nigerian stock market, this can be deduced from the study that only two sectors namely, the insurance sector and the oil and gas sector respond positively and negatively in the short and long run to foreign exchange rate dynamics in Nigeria. This may be due to sectoral policies and the level of involvement in foreign exchange rate in their operations. In addition, money supply is also found to be selective as the study revealed that, while money supply have negative

significant impact on the consumer goods sector only in the short run, the insurance sector respond negatively to money supply both in the short run and long run.

Finally, it is important to note that only the insurance sector stock price responds to four of these macroeconomic determinant of stock price namely, foreign exchange rate, foreign external reserves, interest rate and money supply both in the short run estimates and long run co-integration. This implies that, the insurance sector stock price are more sensitive and respond promptly to changes in the determinants of stock price behavior and foreign exchange rate dynamics in Nigeria. Therefore, it can be deduced from the study that, individual sector respond or react differently to foreign exchange rate dynamics and other macroeconomic determinant namely (foreign external reserve, interest rate, inflation rate and money supply), hence the heterogeneity of the market is supported. This study lean on the arbitrage pricing theory which holds that, expected return of an asset cannot be modeled on just one beta factor, expected return of an asset are sensitive to several macroeconomic factors. Also, this study supports the assertions of wooldridge (2006) who argued that, the effects of one variable on the other, cannot be established unless other relevant variables are held constant.

In view of this, this study is in line with the findings of Ahmed and Naguib (2018), Akanni and Isah (2018), Mouna and Anis (2016), Amin and Janor (2016), Zakri (2013), Aloui and Jarboui (2013), Huchet and Korinek (2011) and Tahir and Wong (2005), these studies asserted that, aggregate stock market may hide significant differences of sectoral sensitivity to foreign exchange rate dynamics, foreign external reserves, interest rate, inflation rate and money supply.

However, looking at the aggregate market result presented in Table 4.11, the result showed that only foreign external reserves and inflation rate are the major determinant of stock market behavior in Nigeria. Foreign exchange rate, interest rate and money supply have no significant

impact on stock market behavior both in the short run and long run estimates. Foreign external reserves have positive significant impact on stock market behavior in Nigeria, this may be due to high inflow of foreign direct investment in Nigeria which is aimed at boosting economic activities and capital market growth. Chimaobi *et al.* argued that, increase in foreign direct investment drives economic activities and hence increases capital market development. This findings support the view of Haughton and Iglesias (2017) who found significant positive influence of foreign reserve on stock market return, but contrary to the submission of Adeniji (2015).

On the flip side, and against the findings of Charles and Richard (2018) and Khalid and Khan (2017) found positive significant impact of inflation on the aggregate market, this study revealed that inflation rate have negative significant effects on the aggregate stock price in Nigeria. This finding is in tandem with Omakhanlen *et al*. (2016) who found negative significant influence of inflation rate on the aggregate market in Nigeria.

4.6.3 Volatility Spillover Effect of Foreign Exchange Rate on Sectoral Stock Returns in Nigeria

The third research question was used to investigate the third objective which seeks to examine volatility spillover effects of foreign exchange rate on stock returns of each of the selected sector on the Nigerian stock market. The study provide evidence of strong volatility spillover effects from exchange rate to insurance sector and the oil and gas sector stock return and found no significant evidence of volatility spillover effects of foreign exchange rate on the banking sector and the consumer goods sector in Nigeria.

For the insurance sector, the study revealed strong evidence of volatility spillover effects from foreign exchange rate to insurance sector stock return, this may be due the effects on assets

valuation and liabilities which are often exposed to foreign exchange rate risk. This assertion support the view put forth by Mouna and Anis (2016) who found volatility spillover between foreign exchange rate and insurance sector stock returns. In the same vein, the study found volatility spillover from exchange rate to the oil and gas sector stock return, this may be due to negative shock in the price of crude oil in the international oil market, which is the major determinant of the value of the Naira. Asaolu and Ilo (2012) and Erygit (2009) argued that, volatility spillover effects of foreign exchange rate are more pronounced for oil dependent economies, and have direct influence on stock market return. This submission contradicts the findings of Lorna (2018) who found insignificant volatility spillover effects from exchange rate to crude oil price index return in Uganda.

On the flip side, and contrary to the findings of Kasman, Vardar and Tunc (2011), who posited that, exchange rate movements exert a significance impact on the common stocks of financial institutions, particularly the banking sector. This study found no significant volatility spillover effects from foreign exchange rate to the banking sector stock, despite the involvement of banks operations in forex trading and also net balance of foreign bank branches. This phenomenon may be caused by various off balance sheet activities of the banks such as loan securitization, brokerage service, foreign exchange swaps and also implementation of effective risk management techniques put in place to mitigate currency risk exposure. Kasman *et al*. (2011) argued that banks are directly affected by unexpected changes in exchange rate by generating gains or losses based on the net foreign positions.

In addition, despite the increase in production cost witnessed by the consumer goods sector as a result of the supply of foreign exchange challenge in Nigeria. The study showed no volatility spillover effects from foreign exchange rate to the consumer goods sector, this may be due to the

dynamic nature of the sector which are extremely prone to variations in consumer tastes and want. This contradicts the work of Amin and Janor (2016) who asserted that consumer goods sector are mostly affected by foreign exchange rate changes. Hence, it can be posited that, there are other factors (such as inflation rate, interest rate and foreign reserve) aside from exchange rate volatility that affects the banking sector and the consumer goods sector stock return in Nigeria, as volatility spillover effects from exchange rate to these two sectors are insignificant.

4.6.4 Volatility Transmission among Sector Stock Returns in Nigeria.

Finally, the fourth research objective was used to proffer answer to research question four that seeks to examine the volatility transmission among the selected sectors on the NSE market. The result presented in Table 4.19 showed that past shock and volatility of individual sector affects present shock and volatility of each sector in Nigeria. This may perhaps be due to regulations and prudential guidelines for each of these sectors and also the nature of business peculiar to these sectors, this finding agrees with Emenike and Peter (2014) and Worthington and Higgs (2004) who found evidence of own sector stock/ market stock volatility transmission more pronounced than cross-sector/ cross-market volatility transmission.

Furthermore, the off-diagonal matrix revealed a bidirectional shock transmission between the banking sector, consumer goods sector, insurance sector and oil and gas sector stock return. This implies that shock of one sector, induced shock in other sector, however, it is interesting to note that, the magnitude of the banking sector shock, transmitted to other sectors are more pronounced for the insurance and the oil and gas sector compared to the magnitude of shock, transmitted from the consumer goods sector to the insurance and the oil and gas sector stock return. This may not be far from the position of the banking sector as the leading financial institution in Nigeria. Ajayi (2013) reported that the banking sector is the most active traded

equities on the Nigerian stock exchange market and erodes almost 60% total market capitalization. This position is in line with Kouki *et al*. (2011) who found that the magnitude of the banking sector shock transmission to other sector higher compared to other sector for the emerging markets.

In addition, the study revealed positive volatility transmission between the banking sector, consumer goods sector, insurance sector and the oil and gas sector in Nigeria. The study found evidence of strong volatility transmission between the consumer goods sector and the oil and gas sector and also between banking sector and the consumer goods sector. However, the volatility transmission from the insurance sector to other three sectors is quite low compared to the banking sector and that of the consumer goods sector to oil and gas sector. This may be ascribed to the fact that, investors often perceived the insurance sector to be weak, perhaps due to very low insurance density in Nigeria which is one of the lowest compared to other African countries like South Africa, Kenya, Angola and Egypt. This submission contradicts the findings of Emenike and Peter (2014) who found negative volatility transmission between the banking sector and the consumer goods sector in Nigeria, however, supports the assertions of Kouki *et al.* (2011) and Hassan and Malik (2007) who showed evidence of bidirectional shock and volatility transmission among different sectors for the developed and emerging market.

Finally, the study revealed an average stock returns in the variance and co-variance of the selected sector within the period understudy, however, study showed high surge of volatility in the variance and co-variance of these sectors in the second quarter of 2014 and lasted through to the first quarter of 2015. This period coincided with the period in which the price of crude oil dropped from $101.66/ barrel to $59.30/barrel in the international oil market as a result of very low demand from China. The contagion effects cut across most oil exporting countries including

Nigeria; this period was characterized with lowering government revenue, exchange rate depreciation, high inflation rate and also reduces inward investment that cut across all the sectors of the economy on the Nigerian stock exchange.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS.

This chapter presents the summary, conclusion and recommendations based on the findings. This chapter further presents the policy implication of the study, contributions to knowledge as well as suggestions for further studies.

5.1. Summary

The interdependence between foreign exchange rates and stock price behavior has been a debatable phenomenon among researchers and has been an area of great interest to foreign and local investors, portfolio managers and financial analyst in building an efficient hedging strategies and portfolio diversification across the globe. Despite the bulk of studies in this topic area, very few studies have examined the interdependence between foreign exchange rate and stock price behavior on a disintegrated sectoral level in Nigeria. In view of the aforementioned background, this study examined the effects of foreign exchange rate dynamics on the banking sector, consumer goods sector, insurance sector and the oil and gas sector stock price behavior in Nigeria. The study further investigated the volatility spillover effects of foreign exchange rate on stock returns of each of the selected sectors. Finally, the study examined the volatility transmission among the banking sector, consumer goods sector, insurance sector and the oil and gas sector stock returns in Nigeria.

The study was subjected to preliminary tests such as unit root test, to determine the order of integration among all the variables using Augmented Dickey-Fuller Breakpoint unit root test which is capable of accessing structural breaks in financial time series data. The study found mixed order of integration of I(0) and I(1) among all the variables, a reason to conduct an ARDL bounds test in line with Pesearan *et al.* (2001) approach to co-integration. The study therefore,

used Augmented Granger Causality suggested by Toda and Yamamoto (1995) to determine the causal relationship between foreign exchange rate and stock prices of each of these sectors. Haven discovered that the Autoregressive Distributed Lag models were stable and devoid of serial correlation, the study proceeded to estimate the short run error correction model and the long run co-integration estimates between foreign exchange rate, interest rate, foreign reserve, inflation rate and money supply on each of the selected sectors on the Nigeria stock exchange market.

The study further examined the volatility spillover effects of foreign exchange rate and stock returns of these sectors using Exponential Generalized Autoregressive Conditional Heteroskedacity (EGARCH) Model subject to an ARCH test and information criteria for model selection to determine which of the GARCH model family is appropriate for volatility spillover. Finally, the study investigated volatility transmission among the selected sector stock returns using BEKK- MGARCH and the Dynamic Conditional Correlation (DCC) to examine the contagion effects among the banking sector, consumer goods sector, insurance sector and the oil and gas sector stock returns in Nigeria within the observed period.

The major findings from the investigations in the study were discussed in line with the stated objectives in chapter one.

The first objective examined the causal relationship between foreign exchange rate stock prices of the banking sector, consumer goods sector, insurance sector and the oil and gas sector on the Nigeria stock exchange market. The result showed significant causal relationship between foreign exchange rate and the banking sector and the oil and gas sector stock price, but the study found no causal relationship between foreign exchange rate and the remaining two sectors. However, the result of the aggregate market revealed significant causality between foreign

exchange rate and stock market price with causality running from the stock market to exchange rate following the portfolio balanced theory.

The second objective examined the effects of foreign exchange rate on sectoral stock price behavior in Nigeria. The study found that foreign external reserves, interest rate and inflation rate are the major determinant of the banking sector and the consumer goods sector both in the short run and long run. Study found that interest rate and foreign external reserves have negative impact on the banking sector stock price both in the short and long run, while inflation rate influenced the banking sector positively. Also, the consumer goods sector responded negatively to interest rate in the short run and long run, however, foreign external reserves have positive impact on the consumer goods sector both in the short run and long run. The study further revealed that inflation rate has positive significant impact only in the long run, while money supply has negative effects on the consumer goods sector in the short run. Hence, foreign exchange rate have no significant impact on stock prices of the banking sector and the consumer goods sector.

Furthermore, the study showed negative significant impact of foreign external reserves, interest rate and money supply on the insurance sector stock price, but positive significant effects of foreign exchange rate was found in the insurance sector both in the short run and long run. Lastly, for the second objective, the study found only foreign exchange rate and interest rate to be the major determinants of oil and gas sector stock price. however, interest have negative significant impact both in the short run and long run while foreign exchange have negative effects in the short run and positive significant influence in the long run.

The third objective of the study investigated volatility spillover effects of foreign exchange rate on stock returns of the banking sector, consumer goods sector, insurance sector and the oil and

gas sector in Nigeria. The findings show evidence of strong volatility spillover effects from exchange rate to insurance and the oil and gas sector stock return. However, volatility spillover effects of exchange rate on the banking sector and the consumer goods sector stock return are not significant for the observed period.

Finally, the fourth objective of the study investigated volatility transmission within the banking sector, consumer goods sector, insurance sector and the oil and gas sector stock returns of the Nigerian stock market. The result showed that past shock and volatility of individual sector affects present stock returns of each sector in Nigeria, for instance, past shock and volatility of the banking sector affects present banking sector stock returns. The study further revealed a bidirectional shock and positive volatility transmission between the banking sector, consumer goods sector, insurance sector and the oil and gas sector stock return. However, the magnitude of shock and volatility transmission between the banking sector, the consumer goods sector and the oil and gas sector return are more pronounced with 41%, 38% and 28% respectively compared to the magnitude of volatility transmission from the insurance sector to other sectors in Nigeria. Similarly, the result of the DCC revealed positive volatility transmission among the pairs of each sector on the Nigerian stock market,except for the consumer goods sector and the insurance sector. However, the magnitudes of volatility transmission in the DCC model are higher when compared to the BEKK model, which further affirms that volatility transmission in one sector have positive significant effects on the other sectors on the Nigerian stock market.

Similarly, the result of the Dynamic Conditional Correlation revealed positive volatility transmission among pairs of each sector on the Nigerian stock market, except for the consumer goods and insurance sector. However, the magnitudes of volatility transmission for the DCC results are much higher when compared to the BEKK result. This further affirms that volatility

transmission in one of these sectors have positive effects on the other sectors on the Nigerian stock market.

5.2. Conclusion

The study reported that only the insurance sector stock price and the oil and gas sector stock price respond to changes in foreign exchange rate dynamics in Nigeria. In addition, the study identified that, interest rate, foreign external reserves and inflation are the major determinants of stock prices behavior of each of these sectors. The study further posited that, the magnitude of shock and volatility transmission between the banking sector, consumer goods sector and the oil and gas sector are more pronounced compare to the magnitude of shock and volatility transmission from insurance sector to the other sectors.

Consequently, the following major conclusion were drawn from the study in line with the stated objectives in Chapter one.

(i) The study concluded that, there is unidirectional causality from foreign exchange rate to the banking sector stock prices, which validates the flow oriented theory. Also, unidirectional causality from consumer goods sector stock price to exchange rate in line with the portfolio balanced theory in Nigeria.

The study therefore, affirms the heterogeneity of the market and concluded that the market is not homogeneous; hence the direction of causality differs across sectors in Nigeria.

(ii) (a) The study concluded that, insurance sector and oil and gas sector stock price respond promptly to foreign exchange rate dynamics in Nigeria. Also, the study concluded that, the banking sector and the consumer goods sector stock price do not respond to foreign exchange rate dynamics in Nigeria.

(b) The study concluded that, interest rate is a major determinant of stock price behavior in Nigeria. The study revealed a negative impact of interest rate on all the four sectors both in the short run and long run. This indicates that, increase in the MPR done in an attempt to stabilize the economic situation in the country, lead to decrease in stock prices in Nigeria. Therefore, study concluded that, banking sector, consumer goods sector, insurance sector and the oil and gas sector, respond negatively to interest rate changes on the Nigerian Stock Market.

(c) Furthermore, findings revealed that, foreign external reserves and inflation rate have positive and negative significant impact on stock price behavior of the banking sector and the consumer goods sector both in the short run and long run. The study further revealed that insurance sector stock price respond promptly to changes in foreign external reserves, foreign exchange rate dynamics, interest rate and money supply in Nigeria. The study therefore, concluded that, insurance sector is more sensitive to foreign exchange rate dynamics and other macroeconomic determinants of stock price among other sectors on the Nigerian stock market.

(iii) The study concluded that volatility spillover effect of exchange rate is prominent for only the insurance and the oil and gas sector stock returns in Nigeria. The study further concludes that banking and the consumer goods sector are not affected by exchange rate volatility spillover in Nigeria.

(iv) Finally, this study concluded that, there is positive and bidirectional shock and volatility transmission among the four sectors. This indicates that, sudden change and volatility in one particular sector is transmitted to the other three sectors. Although, the study reported that the magnitude of shock and volatility transmission of the banking sector, consumer

goods sector and the oil and gas sector is higher when compared to the shock and volatility transmission from the insurance sector to the other three sectors. The study therefore concluded that, cross sector volatility transmission is prominent in Nigeria, particularly from the banking sector to the other sectors.

5.3 Recommendations

Based on the findings and conclusions, the following recommendations were provided:

i. Findings suggest that the banking sector, the consumer goods sector and even the aggregate market do not respond to foreign exchange rate dynamics in Nigeria. The study recommends that, the Security and Exchange Commission should look beyond exchange rate risk when accessing sectoral and market performance. Hence, other factors such as interest rate, inflation and foreign reserve which are peculiar to changes to each of the sectors should be well monitored. For instance inflation rate for the banking sector, consumer goods sector and the market as a whole. It is believed that, when inflation is well managed, sectoral stock prices will increase and thus lead to better market performance.

ii. The Nigerian government should be more intensive and focus in her diversification strategies.Finding suggest that, the banking sector which is the spine of the Nigerian capital market, respond negatively to foreign external reserves both in the short run and long run. Therefore, study recommends that attention should be more focus on the consumer goods sector. This in the long run will increase productivity of local goods, attracts foreign investors, increase exportations and hence multiple sources of foreign earnings in the country will be achieved.

iii. Based on the negative effect of interest rate on all the selected sectors, the study recommends that, the Central Bank of Nigeria should stabilize the Monetary Policy Rate (MPR) to a single digit in order to reduce the cost of borrowing in the country, this will increases liquidity and drive investor's appetite. In addition, the CBN should be more proactive when controlling for inflation and also to stabilize the foreign exchange rate, so that interest rate will not be pushed up when controlling for variations in exchange rate and inflation rate.

iv. Study further suggest that investors in the insurance and the oil and gas sector can diversify their portfolio by including more of the banking sector and the consumer goods sector stock in their asset. This will reduce foreign exchange risk inherent in the insurance sector and the oil and gas sector. This will enable investors achieve wealth maximization objective without taking unnecessary risk.

v. Based on the conclusion reached on the insurance sector which is the most sensitive sector among the four sectors, due to its response to all the variables. Study therefore recommends that the government and the financial regulators should make extant laws and regulations that will increase insurance density in Nigeria. For instance, just like the financial inclusion that drives the use of financial system, an insurance inclusive system that will increase insurance awareness and patronage in the country should be facilitated. This will reduce risk inherent in other sector like fire and theft in the consumer goods sector, robbery in the banking sector, bunkery in the oil and gas sector and subsequently prevent loss of capital resource in the country.

5.4 Contributions to Knowledge

This section presents the areas in which the study contributes to stock price behavior and exchange rate dynamics in literature.

i. The study for the first time, to the best of the researcher's knowledge, examined the volatility spillover effects of exchange rate on a disintegrated sectoral level in Nigeria. Studies on volatility spillover of exchange rate on sectoral stock price are mostly found from the developed countries like the US, Australia. No study has been carried out comprehensively on volatility spillover effects of exchange rate on the banking, consumer goods, insurance and the oil and gas sector stock returns in Nigeria. Previous studies in Nigeria, examined the spillover effects on the aggregate market of which the result cannot be generalized.

ii. The study for the first time to best of the researcher's knowledge, examined interest rate, inflation rate and money supply on each of the selected sector on the Nigerian stock exchange market. Previous studies evaluated these determinants on the aggregate market, which the response of each sectors to each of these variables differs across sectors on the Nigerian stock exchange and hence cannot be generalized. Furthermore, the study included for the first time foreign external reserves not only on the aggregate market but on each of the selected sectors which is found to be a major determinant for the banking, consumer goods and the insurance sector as well as the aggregate market. Prior studies on foreign external reserve on the market are scarce even in the developed market.

iii. Most studies that investigate foreign exchange dynamics and stock price behavior have used OLS, ECM and GARCH model. This may, however, lead to spurious result due to fact that, the OLS and ECM cannot adjust for structural breaks in financial time series

data, also the GARCH model does not allow for an explicit testing of volatility spillover without imposing additional restriction on the outcome. Therefore, the study used ARDL model, EGARCH and MGARCH of BEKK and Dynamic Conditional Correlation which can assess shock and volatility transmission among sectors based on the argument of Engle (2002), Nelson and Cao (1992) and Engle and Kroner (1995).

5.5 Policy Implications of the Study

In addition to the theoretical implications presented in chapter four, the results of the study also have policy implications to various stakeholders such as the researchers, investors, policy makers and portfolio managers.

This study provides empirical literature for researchers examining the interdependence between foreign exchange rate, interest rate, inflation rate, money supply and foreign external reserves on stock price behavior of the banking sector, insurance sector, consumer goods sector and the oil and gas sector to rely on due to scanty empirical literature in this research area in Nigeria. This study can be relied on because it allows for generalization of findings on a particular sector and also on the market. The study also revealed variables that matter for stock price behavior for each of the sectors on the Nigerian stock exchange. The implication of this study to the researcher is that, without this study, researchers might not be able to identify which of the macroeconomic variables affects stock price behavior of individual sector as well as firms within these sectors in Nigeria.

In addition, investors on the Nigerian stock exchange market should take cognizant of the sector that are affected by foreign exchange rate dynamics and also focus on other factors that are peculiar to each sectors when taking long term investment decisions. This will help them to determine what combination of asset can be pooled together that will give them optimum return

and reduce risk. Furthermore, portfolio managers should be mindful of sectoral sensitivity of stock price to each of these variables when giving advice on investment portfolio of their clients. Therefore, outside this study, investors might find it difficult to take best investment decision that will help in wealth maximization. Also, the financial analyst and portfolio managers may not know which among these sectors can serve as a means of hedging against foreign exchange rate risk in Nigeria.

Lastly, the Central Bank of Nigeria and the Security and Exchange Commission should pay attention to macroeconomic variables as it affects each of the sectors performance on the Nigerian stock market. This will guide them in making favourable economic policies and regulations that will better the performance of the market taking into consideration long term effects of all the variables on each of the sector particularly interest rate.

5.6 Suggestions for Further Studies

i. Future studies may also examine foreign exchange rate on other sector of the economy in Nigeria such as the industrial sector and the Shariah complaint stock on the Nigeria stock market.

ii. Further studies may also be carried out on foreign exchange rate and firms within each of these sectors to compare the findings of the firms with their sectors in Nigeria.

iii. Related studies may also be carried out on sectoral response to exchange rate and other variables of concern particularly foreign reserve which is yet to receive much attention in literature in other emerging markets in Africa like Ghana, Togo and Kenya.

5.7 Limitations of the Study

The study excluded other sectors on the Nigerian stock market due to availability of data, only five sectors out of the twelve sectors on the Nigerian stock market have sectoral indices,

however, the industrial sector index is not available until 2011. Also, the study could not capture the crisis period for each of the sectors, this is because data on sectoral indices were not available in Nigeria until after the global financial crisis, therefore, findings may not be applicable to crisis period.

Similarly, Gross Domestic Product could not be included in the macroeconomic determinant of sector stock price due to non -availability of data of GDP on a monthly basis, GDP data available in CBN is on quarterly basis. Hence, this study however, takes comfort in other macroeconomic variables to investigate the response of each sector on the Nigeria stock market. Nevertheless, the results of this study are professionally adequate, comprehensive, reliable and fit for economic policy formulation and implementation.

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APPENDIX

Unit Root Test

Null Hypothesis: ASI has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2015M04
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 1 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.281492	0.3468
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(ASI) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2010M04
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.781766	< 0.01
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: BANKING has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2015M10
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 1 (Automatic - based on Schwarz information criterion, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.118156	0.4452

Test critical values:	1% level	-5.719131
	5% level	-5.175710
	10% level	-4.893950

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(BANKING) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2017M04
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.04455	< 0.01
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: CG has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2015M05
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.435265	0.8424
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(CG) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2017M04
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.836770	< 0.01
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.
Null Hypothesis: INSURANCE has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2010M10
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.634076	< 0.01
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: OILNGAS has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2013M10
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.914180	0.0949
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(OILNGAS) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2014M08
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.41650	< 0.01
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.
Null Hypothesis: M2 has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2015M02
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.555141	0.0177
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: EXRES has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2015M07
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 3 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.457471	0.8331
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(EXRES) has a unit root

Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2017M10
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.223456	< 0.01
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: INTRATE has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2011M02
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.985432	0.5315
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(INTRATE) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2011M10
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.26249	< 0.01
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: INFLATION has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2016M01
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.640957	0.0137
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: EXCH has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2015M12
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 4 (Automatic - based on Schwarz information criterion, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.655992	0.1717
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(EXCH) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2017M01
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-10.60003	< 0.01

Test critical values:	1% level	-5.719131
	5% level	-5.175710
	10% level	-4.893950

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Granger Causality

VAR Lag Order Selection Criteria
Endogenous variables: BANKINGVOL CGVOL INSURANCEVOL OILNGASVOL EXVOL
Exogenous variables: C
Date: 12/21/18 Time: 17:51
Sample: 1/12/2009 10/22/2018
Included observations: 497

Lag	LogL	LR	FPE	AIC	SC	HQ
0	10580.95	NA	2.26e-25	-42.55917	-42.51683	-42.54255
1	11507.57	1830.868	6.01e-27	-46.18742	-45.93338	-46.08771
2	11596.48	173.8715	4.65e-27*	-46.44458*	-45.97884*	-46.26178*
3	11608.50	23.26799	4.89e-27	-46.39235	-45.71491	-46.12645
4	11620.74	23.45639	5.15e-27	-46.34102	-45.45188	-45.99204
5	11667.90	89.37532	4.71e-27	-46.43018	-45.32934	-45.99810
6	11695.35	51.47233*	4.67e-27	-46.44003	-45.12749	-45.92486
7	11704.26	16.54114	4.98e-27	-46.37531	-44.85107	-45.77704
8	11717.48	24.26017	5.23e-27	-46.32790	-44.59197	-45.64655
9	11722.56	9.218507	5.67e-27	-46.24774	-44.30010	-45.48329
10	11732.79	18.35597	6.02e-27	-46.18829	-44.02896	-45.34076
11	11753.13	36.09106	6.15e-27	-46.16953	-43.79849	-45.23890
12	11758.36	9.172928	6.66e-27	-46.08996	-43.50723	-45.07624

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

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 12/16/18 Time: 09:35
Sample: 1/12/2009 10/22/2018
Included observations: 501

Dependent variable: ASIVOL

Excluded	Chi-sq	Df	Prob.
EXVOL	1.780200	7	0.9710
All	1.780200	7	0.9710

Dependent variable: EXVOL

Excluded	Chi-sq	Df	Prob.
ASIVOL	20.37280	7	0.0048
All	20.37280	7	0.0048

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 12/21/18 Time: 17:54
Sample: 1/12/2009 10/22/2018
Included observations: 502

Dependent variable: BANKINGVOL

Excluded	Chi-sq	Df	Prob.
CGVOL	7.322770	6	0.2920
INSURANCEVOL	77.62335	6	0.0000
OILNGASVOL	11.87967	6	0.0647
EXVOL	16.25397	6	0.0125
All	93.80168	24	0.0000

Dependent variable: CGVOL

Excluded	Chi-sq	Df	Prob.
BANKINGVOL	2.683627	6	0.8474
INSURANCEVOL	2.491249	6	0.8694
OILNGASVOL	0.529761	6	0.9975
EXVOL	1.661957	6	0.9480
All	8.804937	24	0.9980

Dependent variable: INSURANCEVOL

Excluded	Chi-sq	Df	Prob.
BANKINGVOL	5.691356	6	0.4586
CGVOL	3.709671	6	0.7159
OILNGASVOL	10.31615	6	0.1120
EXVOL	8.154262	6	0.2270
All	51.50124	24	0.0009

Dependent variable: OILNGASVOL

Excluded	Chi-sq	Df	Prob.
BANKINGVOL	7.472061	6	0.2794
CGVOL	0.720313	6	0.9940
INSURANCEVOL	80.60721	6	0.0000
EXVOL	7.289524	6	0.2949

All	83.16285	24	0.0000

Dependent variable: EXVOL

Excluded	Chi-sq	Df	Prob.
BANKINGVOL	3.600191	6	0.7306
CGVOL	12.02030	6	0.0615
INSURANCEVOL	4.647832	6	0.5897
OILNGASVOL	1.906225	6	0.9281
All	19.97900	24	0.6980

ARDL Models

ARDL Cointegrating And Long Run Form
Dependent Variable: LOGBANKING
Selected Model: ARDL(2, 0, 0, 0, 0, 0)
Date: 12/18/18 Time: 08:27
Sample: 2008M01 2018M09
Included observations: 115

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGBANKING(-1))	-0.118586	0.100670	-1.177960	0.2415
D(EXVOLA)	-0.245365	22.013422	-0.011146	0.9911
D(LOGEXRES)	-6.082568	0.072538	-83.853570	0.0000
D(LOGM2)	0.100688	0.199053	0.505832	0.6140
D(INTRATE)	-0.144079	0.006636	-21.712584	0.0000
D(INFLATION)	0.325384	0.003217	101.150768	0.0000
D(@TREND())	-0.000344	0.001842	-0.186498	0.8524
CointEq(-1)	-0.675511	0.066714	-10.125413	0.0000

Cointeq = LOGBANKING - (-0.3632*EXVOLA -9.0044*LOGEXRES + 0.1491 *LOGM2 -0.2133*INTRATE + 0.4817*INFLATION -0.0107 -0.0005 *@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOLA	-0.363229	32.588782	-0.011146	0.9911
LOGEXRES	-9.004397	0.965376	-9.327345	0.0000
LOGM2	0.149054	0.298092	0.500027	0.6181
INTRATE	-0.213289	0.018544	-11.501900	0.0000
INFLATION	0.481685	0.049188	9.792707	0.0000
C	-0.010672	4.937094	-0.002162	0.9983
@TREND	-0.000509	0.002747	-0.185191	0.8534

ARDL Bounds Test
Date: 12/12/18 Time: 09:24
Sample: 2009M03 2018M09
Included observations: 115
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	4.455866	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound

10%	2.75	3.79
5%	3.12	4.25
2.5%	3.49	4.67
1%	3.93	5.23

Dependent Variable: LOGBANKING
Method: ARDL
Date: 12/15/18 Time: 21:00
Sample (adjusted): 2009M03 2018M09
Included observations: 115 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): EXVOLA LOGEXRES LOGM2 INTRATE INFLATION
Fixed regressors: C @TREND
Number of models evalulated: 12500
Selected Model: ARDL(2, 0, 0, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOGBANKING(-1)	0.987705	0.096107	10.27717	0.0000
LOGBANKING(-2)	-0.225738	0.100670	-2.242350	0.0270
EXVOLA	-22.35542	22.01342	-1.015536	0.3122
LOGEXRES	0.175539	0.072538	2.419959	0.0172
LOGM2	-0.190960	0.199053	-0.959343	0.3396
INTRATE	-0.003563	0.006636	-0.536937	0.5924
INFLATION	0.002420	0.003217	0.752426	0.4535
C	2.590730	3.334940	0.776844	0.4390
@TREND	0.002211	0.001842	1.199976	0.2328

R-squared	0.848141	Mean dependent var	5.897358
Adjusted R-squared	0.836680	S.D. dependent var	0.204953
S.E. of regression	0.082828	Akaike info criterion	-2.069082
Sum squared resid	0.727204	Schwarz criterion	-1.854261
Log likelihood	127.9722	Hannan-Quinn criter.	-1.981887
F-statistic	74.00180	Durbin-Watson stat	1.952327
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Cointegrating And Long Run Form
Dependent Variable: LOGCG
Selected Model: ARDL(2, 0, 0, 0, 0, 4)
Date: 12/18/18 Time: 08:52
Sample: 2008M01 2018M09
Included observations: 115

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGCG(-1))	0.410091	0.097645	4.199831	0.0001
D(EXVOLA)	0.176488	16.118963	0.010949	0.9913
D(LOGEXRES)	0.339745	0.039153	8.677282	0.0000
D(LOGM2)	-0.256880	0.145065	-1.770794	0.0796
D(INTRATE)	-0.037004	0.004201	-8.808862	0.0000
D(INFLATION)	-0.001978	0.008296	-0.238442	0.8120
D(INFLATION(-1))	0.009552	0.010354	0.922560	0.3584
D(INFLATION(-2))	-0.014748	0.010185	-1.448066	0.1507
D(INFLATION(-3))	-0.003310	0.007746	-0.427344	0.6700
D(@TREND())	0.956850	0.001264	757.140062	0.0000
CointEq(-1)	-0.119376	0.034479	-3.462302	0.0008

Cointeq = LOGCG - (1.4784*EXVOLA + 2.8460*LOGEXRES -2.1518
*LOGM2 -0.3100*INTRATE + 0.0676*INFLATION -0.1110 + 8.0154
*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOLA	1.478418	135.000103	0.010951	0.9913
LOGEXRES	2.845995	0.849093	3.351807	0.0011
LOGM2	-2.151848	1.476590	-1.457308	0.1481
INTRATE	-0.309974	0.089070	-3.480138	0.0007
INFLATION	0.067563	0.036815	1.835210	0.0694
C	-0.110953	19.928353	-0.005568	0.9956
@TREND	8.015398	2.315541	3.461565	0.0008

ARDL Bounds Test
Date: 12/18/18 Time: 08:53
Sample: 2009M03 2018M09
Included observations: 115
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	6.038592	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound

10%	2.75	3.79
5%	3.12	4.25
2.5%	3.49	4.67
1%	3.93	5.23

Dependent Variable: LOGCG
Method: ARDL
Date: 12/18/18 Time: 08:41
Sample (adjusted): 2009M03 2018M09
Included observations: 115 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): EXVOLA LOGEXRES LOGM2 INTRATE INFLATION
Fixed regressors: C @TREND
Number of models evalulated: 12500
Selected Model: ARDL(2, 0, 0, 0, 0, 4)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOGCG(-1)	1.114994	0.096067	11.60643	0.0000
LOGCG(-2)	-0.168075	0.097645	-1.721298	0.0882
EXVOLA	-24.67487	16.11896	-1.530797	0.1289
LOGEXRES	0.081711	0.039153	2.086939	0.0394
LOGM2	0.116603	0.145065	0.803800	0.4234
INTRATE	-0.000742	0.004201	-0.176698	0.8601
INFLATION	0.004026	0.008296	0.485261	0.6285
INFLATION(-1)	-0.008493	0.010475	-0.810775	0.4194
INFLATION(-2)	0.017550	0.010354	1.694982	0.0931
INFLATION(-3)	0.008893	0.010185	0.873182	0.3846
INFLATION(-4)	-0.020375	0.007746	-2.630475	0.0098
C	-2.362674	2.379444	-0.992952	0.3231
@TREND	-0.000977	0.001264	-0.773090	0.4413

R-squared	0.944116	Mean dependent var	6.642645
Adjusted R-squared	0.937542	S.D. dependent var	0.230101
S.E. of regression	0.057506	Akaike info criterion	-2.767725
Sum squared resid	0.337309	Schwarz criterion	-2.457429
Log likelihood	172.1442	Hannan-Quinn criter.	-2.641778
F-statistic	143.6014	Durbin-Watson stat	2.000205
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Cointegrating And Long Run Form
Dependent Variable: LOGINSURANCE
Selected Model: ARDL(2, 4, 4, 0, 0, 0)
Date: 12/18/18 Time: 08:33
Sample: 2008M01 2018M09
Included observations: 115

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGINSURANCE(-1))	-0.257008	0.088310	-2.910295	0.0045
D(EXVOLA)	-0.357826	3.147375	-0.113690	0.9097
D(EXVOLA(-1))	1.627777	3.632738	0.448086	0.6551
D(EXVOLA(-2))	0.947287	3.402113	0.278441	0.7813
D(EXVOLA(-3))	-7.629771	3.081277	-2.476171	0.0150
D(LOGEXRES)	0.432476	0.318663	1.357158	0.1778
D(LOGEXRES(-1))	-0.284270	0.496059	-0.573057	0.5679
D(LOGEXRES(-2))	1.239687	0.491847	2.520472	0.0133
D(LOGEXRES(-3))	-0.679117	0.331197	-2.050490	0.0430
D(LOGM2)	-0.530116	0.273828	-1.935945	0.0558
D(INTRATE)	-0.017690	0.008337	-2.121924	0.0364
D(INFLATION)	0.001937	0.004280	0.452507	0.6519
D(@TREND())	0.005430	0.002421	2.242884	0.0272
CointEq(-1)	-0.272464	0.061456	-4.433473	0.0000

Cointeq = LOGINSURANCE - (3.507843*EXVOLA + 0.7207*LOGEXRES
-1.9456*LOGM2 -0.0649*INTRATE + 0.0071*INFLATION + 28.7595 +
0.0199*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOLA	3.507843	172.493910	2.033604	0.0447
LOGEXRES	0.720657	0.267478	2.694269	0.0083
LOGM2	-1.945636	0.873377	-2.227717	0.0282
INTRATE	-0.064926	0.026976	-2.406850	0.0180
INFLATION	0.007109	0.015064	0.471914	0.6380
C	28.759516	14.854673	1.936059	0.0557
@TREND	0.019930	0.007658	2.602520	0.0107

ARDL Bounds Test
Date: 12/18/18 Time: 08:34
Sample: 2009M03 2018M09
Included observations: 115
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	4.497531	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.75	3.79
5%	3.12	4.25
2.5%	3.49	4.67
1%	3.93	5.23

Dependent Variable: LOGINSURANCE
Method: ARDL
Date: 12/18/18 Time: 08:32
Sample (adjusted): 2009M03 2018M09
Included observations: 115 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): EXVOLA LOGEXRES LOGM2 INTRATE INFLATION
Fixed regressors: C @TREND
Number of models evalulated: 12500
Selected Model: ARDL(2, 4, 4, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOGINSURANCE(-1)	0.470528	0.090113	5.221523	0.0000
LOGINSURANCE(-2)	0.257008	0.088310	2.910295	0.0045
EXVOLA	-0.357826	3.14737	-0.113690	0.9097
EXVOLA(-1)	4.86073	3.49897	1.389189	0.1679
EXVOLA(-2)	-1.62778	3.63274	-0.448086	0.6551
EXVOLA(-3)	-0.94728	3.40211	-0.278441	0.7813
EXVOLA(-4)	7.62977	3.08128	2.476171	0.0150
LOGEXRES	0.432476	0.318663	1.357158	0.1778
LOGEXRES(-1)	0.040177	0.491310	0.081775	0.9350
LOGEXRES(-2)	0.284270	0.496059	0.573057	0.5679
LOGEXRES(-3)	-1.239687	0.491847	-2.520472	0.0133
LOGEXRES(-4)	0.679117	0.331197	2.050490	0.0430
LOGM2	-0.530116	0.273828	-1.935945	0.0558
INTRATE	-0.017690	0.008337	-2.121924	0.0364
INFLATION	0.001937	0.004280	0.452507	0.6519
C	7.835933	4.478168	1.749808	0.0833
@TREND	0.005430	0.002421	2.242884	0.0272

R-squared	0.901977	Mean dependent var	5.045887
Adjusted R-squared	0.885973	S.D. dependent var	0.289245
S.E. of regression	0.097672	Akaike info criterion	-1.678720
Sum squared resid	0.934899	Schwarz criterion	-1.272947
Log likelihood	113.5264	Hannan-Quinn criter.	-1.514019
F-statistic	56.36021	Durbin-Watson stat	2.119252

Prob(F-statistic)	0.000000

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Cointegrating And Long Run Form
Dependent Variable: LOGOILNGAS
Selected Model: ARDL(4, 4, 0, 0, 0, 0)
Date: 12/18/18 Time: 08:35
Sample: 2008M01 2018M09
Included observations: 113

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGOILNGAS(-1))	0.245906	0.095863	2.565175	0.0118
D(LOGOILNGAS(-2))	0.189080	0.087442	2.162348	0.0330
D(LOGOILNGAS(-3))	-0.198445	0.087321	-2.272587	0.0252
D(EXVOLA)	-3.174880	2.325501	-1.365245	0.1753
D(EXVOLA(-1))	-2.506900	2.707519	-0.925903	0.3568
D(EXVOLA(-2))	2.422063	2.532893	0.956243	0.3413
D(EXVOLA(-3))	-5.023399	2.224719	-2.257992	0.0262
D(LOGEXRES)	0.057707	0.059452	0.970662	0.3341
D(LOGM2)	-0.247179	0.208238	-1.187001	0.2381
D(INTRATE)	-0.018300	0.007790	-2.349332	0.0208
D(INFLATION)	-0.001171	0.003132	-0.373880	0.7093
D(@TREND())	0.003959	0.002040	1.941138	0.0551
CointEq(-1)	-0.142796	0.050019	-2.854850	0.0053

Cointeq = LOGOILNGAS - (4.58667*EXVOLA + 0.4041*LOGEXRES
-1.7310*LOGM2 -0.1282*INTRATE -0.0082*INFLATION + 29.4868 +
0.0277*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOLA	4.586675	2.195153	2.089456	0.0393
LOGEXRES	0.404126	0.459745	0.879023	0.3815
LOGM2	-1.730997	1.287312	-1.344660	0.1818
INTRATE	-0.128157	0.040234	-3.185285	0.0019
INFLATION	-0.008202	0.022085	-0.371362	0.7112
C	29.486844	21.635627	1.362884	0.1760
@TREND	0.027725	0.010908	2.541657	0.0126

ARDL Bounds Test
Date: 12/18/18 Time: 08:36
Sample: 2009M05 2018M09
Included observations: 113
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	5.701441	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.75	3.79
5%	3.12	4.25
2.5%	3.49	4.67
1%	3.93	5.23

Dependent Variable: LOGOILNGAS
Method: ARDL
Date: 12/18/18 Time: 08:35
Sample (adjusted): 2009M05 2018M09
Included observations: 113 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): EXVOLA LOGEXRES LOGM2 INTRATE INFLATION
Fixed regressors: C @TREND
Number of models evalulated: 12500
Selected Model: ARDL(4, 4, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOGOILNGAS(-1)	1.103110	0.096014	11.48911	0.0000
LOGOILNGAS(-2)	-0.056825	0.134142	-0.423620	0.6728
LOGOILNGAS(-3)	-0.387525	0.129158	-3.000404	0.0034
LOGOILNGAS(-4)	0.198445	0.087321	2.272587	0.0252
EXVOLA	-3.17488	2.32550	-1.365245	0.1753
EXVOLA(-1)	4.61621	2.65357	1.739620	0.0851
EXVOLA(-2)	2.50690	2.70752	0.925903	0.3568
EXVOLA(-3)	-2.42206	2.53289	-0.956243	0.3413
EXVOLA(-4)	5.02340	2.22472	2.257992	0.0262
LOGEXRES	0.057707	0.059452	0.970662	0.3341
LOGM2	-0.247179	0.208238	-1.187001	0.2381
INTRATE	-0.018300	0.007790	-2.349332	0.0208
INFLATION	-0.001171	0.003132	-0.373880	0.7093
C	4.210589	3.631193	1.159561	0.2490
@TREND	0.003959	0.002040	1.941138	0.0551

R-squared	0.938481	Mean dependent var	5.689559
Adjusted R-squared	0.929693	S.D. dependent var	0.276338
S.E. of regression	0.073272	Akaike info criterion	-2.266201
Sum squared resid	0.526146	Schwarz criterion	-1.904159
Log likelihood	143.0404	Hannan-Quinn criter.	-2.119288
F-statistic	106.7865	Durbin-Watson stat	1.953447
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Cointegrating And Long Run Form
Dependent Variable: LOGASI
Selected Model: ARDL(2, 0, 1, 0, 0, 4)
Date: 12/18/18 Time: 08:49
Sample: 2008M01 2018M09
Included observations: 125

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGASI(-1))	0.410091	0.083174	4.930498	0.0000
D(EXVOL)	0.176488	3.225449	0.054717	0.9565
D(LOGEXRES)	0.339745	0.152805	2.223388	0.0282
D(LOGM2)	-0.037004	0.132470	-0.279337	0.7805
D(INTRATE)	-0.001978	0.003719	-0.531862	0.5959
D(INFLATION)	0.001538	0.006218	0.247302	0.8051
D(INFLATION(-1))	-0.014748	0.008586	-1.717767	0.0886
D(INFLATION(-2))	-0.003310	0.008616	-0.384196	0.7016
D(INFLATION(-3))	0.013245	0.006348	2.086587	0.0392
D(@TREND())	0.001062	0.001281	0.828436	0.4092
CointEq(-1)	-0.119376	0.032465	-3.677063	0.0004

Cointeq = LOGASI - (1.4784*EXVOL + 0.6941*LOGEXRES -0.3100*LOGM2
-0.0166*INTRATE -0.0268*INFLATION + 8.0154 + 0.0089*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXVOL	1.478418	26.949375	0.054859	0.9563
LOGEXRES	0.694147	0.289947	2.394045	0.0183
LOGM2	-0.309974	1.078195	-0.287494	0.7743
INTRATE	-0.016570	0.031503	-0.525988	0.5999
INFLATION	-0.026820	0.016083	-1.667682	0.0982
C	8.015398	18.016157	0.444901	0.6573
@TREND	0.008892	0.009783	0.908912	0.3654

ARDL Bounds Test
Date: 12/18/18 Time: 08:50
Sample: 2008M05 2018M09
Included observations: 125
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	5.035411	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound

10%	2.75	3.79
5%	3.12	4.25
2.5%	3.49	4.67
1%	3.93	5.23

Dependent Variable: LOGASI
Method: ARDL
Date: 12/18/18 Time: 08:47
Sample (adjusted): 2008M05 2018M09
Included observations: 125 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): EXVOL LOGEXRES LOGM2 INTRATE INFLATION
Fixed regressors: C @TREND
Number of models evalulated: 12500
Selected Model: ARDL(2, 0, 1, 0, 0, 4)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOGASI(-1)	1.290714	0.084745	15.23059	0.0000
LOGASI(-2)	-0.410091	0.083174	-4.930498	0.0000
EXVOL	0.176488	3.225449	0.054717	0.9565
LOGEXRES	0.339745	0.152805	2.223388	0.0282
LOGEXRES(-1)	-0.256880	0.149985	-1.712705	0.0896
LOGM2	-0.037004	0.132470	-0.279337	0.7805
INTRATE	-0.001978	0.003719	-0.531862	0.5959
INFLATION	0.001538	0.006218	0.247302	0.8051
INFLATION(-1)	-0.009552	0.008627	-1.107305	0.2706
INFLATION(-2)	0.014748	0.008586	1.717767	0.0886
INFLATION(-3)	0.003310	0.008616	0.384196	0.7016
INFLATION(-4)	-0.013245	0.006348	-2.086587	0.0392
C	0.956850	2.241653	0.426850	0.6703
@TREND	0.001062	0.001281	0.828436	0.4092

R-squared	0.957256	Mean dependent var	10.30118
Adjusted R-squared	0.952250	S.D. dependent var	0.248175
S.E. of regression	0.054231	Akaike info criterion	-2.885926
Sum squared resid	0.326447	Schwarz criterion	-2.569155
Log likelihood	194.3704	Hannan-Quinn criter.	-2.757238
F-statistic	191.2208	Durbin-Watson stat	1.937382
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARCH Tests and EGARCH Models

Heteroskedasticity Test: ARCH

F-statistic	13.67417	Prob. F(1,506)	0.0002
Obs*R-squared	13.36699	Prob. Chi-Square(1)	0.0003

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/15/18 Time: 22:11
Sample (adjusted): 2/02/2009 10/22/2018
Included observations: 508 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000760	0.000104	7.317620	0.0000
RESID^2(-1)	0.160989	0.043536	3.697860	0.0002

R-squared	0.026313	Mean dependent var	0.000909
Adjusted R-squared	0.024389	S.D. dependent var	0.002186
S.E. of regression	0.002159	Akaike info criterion	-9.434255
Sum squared resid	0.002359	Schwarz criterion	-9.417599
Log likelihood	2398.301	Hannan-Quinn criter.	-9.427723
F-statistic	13.67417	Durbin-Watson stat	2.091381
Prob(F-statistic)	0.000241		

Dependent Variable: GRASI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 12/15/18 Time: 22:14
Sample (adjusted): 1/26/2009 10/22/2018
Included observations: 509 after adjustments
Convergence achieved after 35 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1)) + C(7)
*EXGARCH

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000364	0.001181	0.308244	0.7579
GRASI(-1)	0.204577	0.049973	4.093757	0.0000
Variance Equation				
C(3)	-1.161111	0.156143	-7.436182	0.0000
C(4)	0.469967	0.051948	9.046910	0.0000
C(5)	0.011845	0.036156	0.327617	0.7432
C(6)	0.891311	0.020501	43.47589	0.0000
C(7)	57.74823	123.1775	0.468821	0.6392

R-squared	-0.001428	Mean dependent var	0.000620
Adjusted R-squared	-0.003404	S.D. dependent var	0.030528

S.E. of regression	0.030580	Akaike info criterion	-4.400534
Sum squared resid	0.474121	Schwarz criterion	-4.342328
Log likelihood	1126.936	Hannan-Quinn criter.	-4.377712
Durbin-Watson stat	2.216828		

Heteroskedasticity Test: ARCH

F-statistic	148.7418	Prob. F(1,507)	0.0000
Obs*R-squared	115.4564	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/15/18 Time: 22:17
Sample (adjusted): 1/26/2009 10/22/2018
Included observations: 509 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.52E-35	3.10E-35	1.777440	0.0761
RESID^2(-1)	0.475943	0.039025	12.19597	0.0000

R-squared	0.226830	Mean dependent var	1.07E-34
Adjusted R-squared	0.225305	S.D. dependent var	7.88E-34
S.E. of regression	6.94E-34	Sum squared resid	2.44E-64
F-statistic	148.7418	Durbin-Watson stat	1.718596
Prob(F-statistic)	0.000000		

Dependent Variable: GRBANKING
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 12/15/18 Time: 22:20
Sample (adjusted): 1/26/2009 10/22/2018
Included observations: 509 after adjustments
Convergence achieved after 34 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1)) + C(7)
*EXGARCH

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000449	0.001472	0.304981	0.7604
GRBANKING(-1)	0.197267	0.042990	4.588626	0.0000
Variance Equation				
C(3)	-4.725284	0.399915	-11.81573	0.0000
C(4)	1.191779	0.071729	16.61511	0.0000
C(5)	-0.558972	0.045158	-12.37822	0.0000
C(6)	0.341632	0.064072	5.331986	0.0000
C(7)	-308.7725	395.9606	-0.779806	0.4355

R-squared	-0.153388	Mean dependent var	0.000384
Adjusted R-squared	-0.155662	S.D. dependent var	0.070352
S.E. of regression	0.075630	Akaike info criterion	-3.196383
Sum squared resid	2.899972	Schwarz criterion	-3.138176
Log likelihood	820.4794	Hannan-Quinn criter.	-3.173560
Durbin-Watson stat	2.879663		

Dependent Variable: GRCG
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 12/16/18 Time: 07:54
Sample (adjusted): 1/26/2009 10/22/2018
Included observations: 509 after adjustments
Convergence achieved after 46 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1)) + C(7)
*EXGARCH

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000464	0.001306	-0.355555	0.7222
GRCG(-1)	0.157604	0.047152	3.342471	0.0008
Variance Equation				
C(3)	-2.177785	0.270117	-8.062374	0.0000
C(4)	0.571449	0.067569	8.457243	0.0000
C(5)	0.038378	0.041616	0.922195	0.3564
C(6)	0.747285	0.035332	21.15009	0.0000
C(7)	38.10839	184.9126	0.206089	0.8367

R-squared	0.003395	Mean dependent var	0.001175
Adjusted R-squared	0.001429	S.D. dependent var	0.034619
S.E. of regression	0.034594	Akaike info criterion	-4.052606
Sum squared resid	0.606754	Schwarz criterion	-3.994399
Log likelihood	1038.388	Hannan-Quinn criter.	-4.029783
Durbin-Watson stat	2.162964		

Heteroskedasticity Test: ARCH

F-statistic	14.77613	Prob. F(1,506)	0.0001
Obs*R-squared	14.41363	Prob. Chi-Square(1)	0.0001

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/16/18 Time: 09:19
Sample (adjusted): 2/02/2009 10/22/2018
Included observations: 508 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000965	0.000122	7.918986	0.0000
RESID^2(-1)	0.164781	0.042867	3.843974	0.0001

R-squared	0.028373	Mean dependent var	0.001161
Adjusted R-squared	0.026453	S.D. dependent var	0.002530
S.E. of regression	0.002497	Akaike info criterion	-9.143688
Sum squared resid	0.003154	Schwarz criterion	-9.127033
Log likelihood	2324.497	Hannan-Quinn criter.	-9.137157
F-statistic	14.77613	Durbin-Watson stat	2.078444
Prob(F-statistic)	0.000136		

Heteroskedasticity Test: ARCH

F-statistic	49.68205	Prob. F(1,506)	0.0000
Obs*R-squared	45.41893	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/16/18 Time: 09:21
Sample (adjusted): 2/02/2009 10/22/2018
Included observations: 508 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008505	0.007527	1.129935	0.2590
RESID^2(-1)	0.299011	0.042422	7.048550	0.0000

R-squared	0.089407	Mean dependent var	0.012137
Adjusted R-squared	0.087608	S.D. dependent var	0.177201
S.E. of regression	0.169261	Akaike info criterion	-0.710823
Sum squared resid	14.49650	Schwarz criterion	-0.694168
Log likelihood	182.5491	Hannan-Quinn criter.	-0.704292
F-statistic	49.68205	Durbin-Watson stat	2.068401
Prob(F-statistic)	0.000000		

Dependent Variable: GRINSURANCE
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 12/16/18 Time: 09:22
Sample (adjusted): 1/26/2009 10/22/2018
Included observations: 509 after adjustments
Convergence achieved after 39 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1)) + C(7)
*EXGARCH

Variable	Coefficient	Std. Error	z-Statistic	Prob.

C	-0.006632	0.001805	-3.673719	0.0002
GRINSURANCE(-1)	0.118131	0.051730	2.283599	0.0224

Variance Equation

C(3)	-6.678640	1.132045	-5.899623	0.0000
C(4)	0.111760	0.083875	1.332463	0.1827
C(5)	0.166830	0.076460	2.181933	0.0291
C(6)	0.206987	0.138574	1.493694	0.1353
C(7)	8357.126	1383.373	6.041122	0.0000

R-squared	-0.125499	Mean dependent var	-0.002856
Adjusted R-squared	-0.127719	S.D. dependent var	0.124654
S.E. of regression	0.132375	Akaike info criterion	-2.595263
Sum squared resid	8.884226	Schwarz criterion	-2.537056
Log likelihood	667.4944	Hannan-Quinn criter.	-2.572440
Durbin-Watson stat	3.048704		

Heteroskedasticity Test: ARCH

F-statistic	134.0042	Prob. F(1,506)	0.0000
Obs*R-squared	106.3651	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/16/18 Time: 09:23
Sample (adjusted): 2/02/2009 10/22/2018
Included observations: 508 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001962	0.001127	1.740303	0.0824
RESID^2(-1)	0.457582	0.039528	11.57602	0.0000

R-squared	0.209380	Mean dependent var	0.003618
Adjusted R-squared	0.207818	S.D. dependent var	0.028316
S.E. of regression	0.025203	Akaike info criterion	-4.519779
Sum squared resid	0.321407	Schwarz criterion	-4.503123
Log likelihood	1150.024	Hannan-Quinn criter.	-4.513248
F-statistic	134.0042	Durbin-Watson stat	1.820508
Prob(F-statistic)	0.000000		

Dependent Variable: GROILNGAS
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 12/16/18 Time: 09:24
Sample (adjusted): 1/26/2009 10/22/2018
Included observations: 509 after adjustments
Failure to improve likelihood (singular hessian) after 55 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)

*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1)) + C(7)
*EXGARCH

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000361	0.001641	-0.220154	0.8258
GROILNGAS(-1)	0.214907	0.045567	4.716283	0.0000
Variance Equation				
C(3)	-4.662885	0.570348	-8.175510	0.0000
C(4)	1.037331	0.067209	15.43433	0.0000
C(5)	-0.464579	0.045688	-10.16844	0.0000
C(6)	0.403336	0.087180	4.626491	0.0000
C(7)	973.6585	351.9334	2.766598	0.0057

R-squared	-0.143361	Mean dependent var	-0.001504
Adjusted R-squared	-0.145616	S.D. dependent var	0.061761
S.E. of regression	0.066105	Akaike info criterion	-3.326118
Sum squared resid	2.215492	Schwarz criterion	-3.267912
Log likelihood	853.4971	Hannan-Quinn criter.	-3.303296
Durbin-Watson stat	2.812909		

Diagonal BEKK

System: UNTITLED
Estimation Method: ARCH Maximum Likelihood (BFGS / Marquardt steps)
Covariance specification: Diagonal BEKK
Date: 12/16/18 Time: 13:35
Sample: 1/19/2009 10/22/2018
Included observations: 510
Total system (balanced) observations 2040
Presample covariance: backcast (parameter =0.7)
Convergence achieved after 101 iterations
Coefficient covariance computed using outer product of gradients

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.001423	0.006352	0.223953	0.8228
C(2)	-0.000425	0.001426	-0.297780	0.7659
C(3)	0.000655	0.013567	0.048263	0.9615
C(4)	-0.001570	0.005610	-0.279922	0.7795
Variance Equation Coefficients				
C(5)	0.002055	0.000421	4.879606	0.0000
C(6)	0.000292	0.000139	2.097777	0.0359
C(7)	0.002870	0.000528	5.436185	0.0000
C(8)	0.001246	0.000252	4.954301	0.0000
C(9)	0.000305	5.48E-05	5.559957	0.0000
C(10)	4.11E-05	0.000288	0.142674	0.8865
C(11)	0.000139	0.000104	1.342136	0.1796
C(12)	0.006542	0.000793	8.247893	0.0000
C(13)	0.002369	0.000429	5.529365	0.0000
C(14)	0.001590	0.000292	5.439396	0.0000
C(15)	0.510247	0.029398	17.35665	0.0000
C(16)	0.401060	0.043088	9.307977	0.0000

C(17)	0.510189	0.051946	9.821465	0.0000
C(18)	0.496736	0.052757	9.415485	0.0000
C(19)	0.512408	0.058910	8.698180	0.0000
C(20)	0.750185	0.044640	16.80507	0.0000
C(21)	0.453526	0.098916	4.584946	0.0000
C(22)	0.550198	0.058707	9.371869	0.0000

Log likelihood	3496.875	Schwarz criterion	-13.44430
Avg. log likelihood	1.714154	Hannan-Quinn criter.	-13.55535
Akaike info criterion	-13.62696		

Equation: GRBANKING = C(1)

R-squared	-0.000371	Mean dependent var	6.24E-05
Adjusted R-squared	-0.000371	S.D. dependent var	0.070657
S.E. of regression	0.070670	Sum squared resid	2.542091
Durbin-Watson stat	2.560549		

Equation: GRCG = C(2)

R-squared	-0.001215	Mean dependent var	0.000813
Adjusted R-squared	-0.001215	S.D. dependent var	0.035541
S.E. of regression	0.035563	Sum squared resid	0.643738
Durbin-Watson stat	1.755293		

Equation: GRINSURANCE = C(3)

R-squared	-0.000861	Mean dependent var	-0.002996
Adjusted R-squared	-0.000861	S.D. dependent var	0.124571
S.E. of regression	0.124625	Sum squared resid	7.905423
Durbin-Watson stat	2.931088		

Equation: GROILNGAS = C(4)

R-squared	-0.000005	Mean dependent var	-0.001707
Adjusted R-squared	-0.000005	S.D. dependent var	0.061869
S.E. of regression	0.061869	Sum squared resid	1.948352
Durbin-Watson stat	2.441666		

Covariance specification: Diagonal BEKK
GARCH = M + A1*RESID(-1)*RESID(-1)'*A1 + B1*GARCH(-1)*B1
M is an indefinite matrix
A1 is a diagonal matrix
B1 is a diagonal matrix

Transformed Variance Coefficients

	Coefficient	Std. Error	z-Statistic	Prob.
M(1,1)	0.002055	0.000421	4.879606	0.0000
M(1,2)	0.000292	0.000139	2.097777	0.0359
M(1,3)	0.002870	0.000528	5.436185	0.0000
M(1,4)	0.001246	0.000252	4.954301	0.0000
M(2,2)	0.000305	5.48E-05	5.559957	0.0000
M(2,3)	4.11E-05	0.000288	0.142674	0.8865
M(2,4)	0.000139	0.000104	1.342136	0.1796
M(3,3)	0.006542	0.000793	8.247893	0.0000
M(3,4)	0.002369	0.000429	5.529365	0.0000
M(4,4)	0.001590	0.000292	5.439396	0.0000

A1(1,1)	0.510247	0.029398	17.35665	0.0000
A1(2,2)	0.401060	0.043088	9.307977	0.0000
A1(3,3)	0.510189	0.051946	9.821465	0.0000
A1(4,4)	0.496736	0.052757	9.415485	0.0000
B1(1,1)	0.512408	0.058910	8.698180	0.0000
B1(2,2)	0.750185	0.044640	16.80507	0.0000
B1(3,3)	0.453526	0.098916	4.584946	0.0000
B1(4,4)	0.550198	0.058707	9.371869	0.0000

DCC MGARCH Model

Dynamic conditional correlation MGARCH model

Sample: 2009w3 - 2018w44 — Number of obs = 509
Distribution: Gaussian — Wald chi2(16) = 39.01
Log likelihood = 3493.282 — Prob > chi2 = 0.0011

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dbanking						
dbanking						
L1.	-.0213082	.076039	-0.28	0.779	-.170342	.1277256
dcg						
L1.	.0536075	.0781885	0.69	0.493	-.0996392	.2068542
dins						
L1.	-.0003983	.0617049	-0.01	0.995	-.1213377	.1205411
doilngas						
L1.	.0043871	.0616466	0.07	0.943	-.116438	.1252122
ARCH_dbanking						
arch						
L1.	.4400642	.0888063	4.96	0.000	.2660071	.6141213
_cons	.0026127	.0002593	10.08	0.000	.0021046	.0031209
dcg						
dbanking						
L1.	.1180459	.041627	2.84	0.005	.0364585	.1996333
dcg						
L1.	.1106832	.0610278	1.81	0.070	-.008929	.2302954
dins						
L1.	-.0315041	.0237656	-1.33	0.185	-.0780838	.0150756
doilngas						
L1.	-.0193035	.0356485	-0.54	0.588	-.0891731	.0505662
ARCH_dcg						
arch						
L1.	.3392909	.100696	3.37	0.001	.1419304	.5366514
_cons	.0008181	.0000827	9.89	0.000	.000656	.0009802
dins						
dbanking						
L1.	.0446694	.115296	0.39	0.698	-.1813066	.2706453
dcg						
L1.	-.082128	.1268539	-0.65	0.517	-.3307572	.1665012
dins						
L1.	-.056127	.1247818	-0.45	0.653	-.3006949	.1884409
doilngas						
L1.	-.0117102	.1157013	-0.10	0.919	-.2384805	.2150602
ARCH_dins						
arch						
L1.	.4039758	.0852676	4.74	0.000	.2368545	.5710972
_cons	.0083816	.0005314	15.77	0.000	.00734	.0094232
doilngas						
dbanking						
L1.	.0798601	.0578588	1.38	0.168	-.033541	.1932612
dcg						
L1.	-.0377139	.0732116	-0.52	0.606	-.1812061	.1057782
dins						
L1.	-.0024369	.051335	-0.05	0.962	-.1030515	.0981778
doilngas						
L1.	.0035986	.0694199	0.05	0.959	-.1324619	.139659
ARCH_doilngas						
arch						
L1.	.5274091	.1144258	4.61	0.000	.3031387	.7516796
_cons	.0019883	.0002112	9.42	0.000	.0015744	.0024022
corr(dbanking,dcg)	.4184488	.043094	9.71	0.000	.3339861	.5029115
corr(dbanking,dins)	.7487158	.0260352	28.76	0.000	.6976878	.7997438
corr(dbanking,doilngas)	.6540075	.0337611	19.37	0.000	.5878369	.7201781
corr(dcg,dins)	.0632303	.0543439	1.16	0.245	-.0432819	.1697424
corr(dcg,doilngas)	.2178914	.0497313	4.38	0.000	.1204198	.315363
corr(dins,doilngas)	.6907012	.0309765	22.30	0.000	.6299883	.751414
Adjustment						
lambda1	.1299529	.0313045	4.15	0.000	.0685973	.1913085
lambda2	.2308508	.088716	2.60	0.009	.0569707	.4047309

CCC MGARCH Model

Constant conditional correlation MGARCH model

Sample: 2009w3 - 2018w44 Number of obs = 509
Distribution: Gaussian Wald chi2(16) = 36.05
Log likelihood = 3480.684 Prob > chi2 = 0.0028

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dbanking						
dbanking						
L1.	-.0422136	.0706796	-0.60	0.550	-.180743	.0963158
dcg						
L1.	.0550291	.0771075	0.71	0.475	-.0960987	.2061569
dins						
L1.	-.0077957	.0535929	-0.15	0.884	-.1128357	.0972444
doilngas						
L1.	.0020916	.0491749	0.04	0.966	-.0942895	.0984727
ARCH_dbanking						
arch						
L1.	.5729344	.1119694	5.12	0.000	.3534784	.7923903
_cons	.0023104	.0002284	10.11	0.000	.0018627	.0027581
dcg						
dbanking						
L1.	.1065176	.0405439	2.63	0.009	.0270531	.1859821
dcg						
L1.	.117423	.0582886	2.01	0.044	.0031795	.2316666
dins						
L1.	-.0288083	.0225516	-1.28	0.201	-.0730086	.0153921
doilngas						
L1.	-.0085273	.0356364	-0.24	0.811	-.0783734	.0613188
ARCH_dcg						
arch						
L1.	.3359614	.0988108	3.40	0.001	.1422957	.5296271
_cons	.0008159	.0000794	10.28	0.000	.0006603	.0009716
dins						
dbanking						
L1.	-.0040405	.0997658	-0.04	0.968	-.1995778	.1914968
dcg						
L1.	-.1007069	.1270711	-0.79	0.428	-.3497616	.1483478
dins						
L1.	-.0235473	.1059911	-0.22	0.824	-.231286	.1841915
doilngas						
L1.	-.0332877	.0900703	-0.37	0.712	-.2098223	.1432469
ARCH_dins						
arch						
L1.	.1583831	.058976	2.69	0.007	.0427922	.273974
_cons	.0082561	.0005195	15.89	0.000	.0072379	.0092744
doilngas						
dbanking						
L1.	.063753	.0512837	1.24	0.214	-.0367611	.1642671
dcg						
L1.	-.0575184	.0698215	-0.82	0.410	-.194366	.0793292
dins						
L1.	.0102501	.038761	0.26	0.791	-.0657201	.0862204
doilngas						
L1.	-.0285466	.0601523	-0.47	0.635	-.1464429	.0893497
ARCH_doilngas						
arch						
L1.	.6757015	.1559205	4.33	0.000	.3701029	.9813001
_cons	.0017012	.0001882	9.04	0.000	.0013324	.00207
corr(dbanking,dcg)	.4464881	.0360593	12.38	0.000	.3758133	.517163
corr(dbanking,dins)	.6965575	.0253924	27.43	0.000	.6467893	.7463257
corr(dbanking,doilngas)	.5902309	.0318191	18.55	0.000	.5278666	.6525951
corr(dcg,dins)	.0635499	.0442335	1.44	0.151	-.0231461	.150246
corr(dcg,doilngas)	.2218348	.0425257	5.22	0.000	.138486	.3051836
corr(dins,doilngas)	.642919	.0300951	21.36	0.000	.5839336	.7019044

Diagnostic Tests

Roots of Characteristic Polynomial
Endogenous variables: EXGARCH GRBANKING GRCG GRINSURANCE GROILNGAS
Exogenous variables: C EXGARCH(-3) GRBANKING(-3) GRCG(-3) GRINSURANCE(-3) GROILNGAS(-3)
Lag specification: 1 2
Date: 03/20/19 Time: 13:57

Root	Modulus
0.991958	0.991958
-0.340110 - 0.564258i	0.658834
-0.340110 + 0.564258i	0.658834
-0.341457	0.341457
0.304955 - 0.019067i	0.305550
0.304955 + 0.019067i	0.305550
0.055016 - 0.141923i	0.152213
0.055016 + 0.141923i	0.152213
-0.107473 - 0.079603i	0.133742
-0.107473 + 0.079603i	0.133742

No root lies outside the unit circle.
VAR satisfies the stability condition.

Autocorrelation and Heteroskedasiticity test- the ARDL model

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.077065	Prob. F(2,110)	0.9259
Obs*R-squared	0.174902	Prob. Chi-Square(2)	0.9163

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.587969	Prob. F(12,112)	0.1050
Obs*R-squared	18.17513	Prob. Chi-Square(12)	0.1105
Scaled explained SS	27.25241	Prob. Chi-Square(12)	0.0071

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.528149	Prob. F(2,106)	0.5912
Obs*R-squared	1.134657	Prob. Chi-Square(2)	0.5670

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.780977	Prob. F(7,107)	0.6046
Obs*R-squared	5.589974	Prob. Chi-Square(7)	0.5884
Scaled explained SS	9.432584	Prob. Chi-Square(7)	0.2231

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.313075	Prob. F(2,100)	0.7319
Obs*R-squared	0.715592	Prob. Chi-Square(2)	0.6992

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.370368	Prob. F(12,102)	0.1923
Obs*R-squared	15.96620	Prob. Chi-Square(12)	0.1928
Scaled explained SS	21.83958	Prob. Chi-Square(12)	0.0394

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.099286	Prob. F(2,96)	0.3373
Obs*R-squared	2.574740	Prob. Chi-Square(2)	0.2760

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.342440	Prob. F(16,98)	0.1877
Obs*R-squared	20.67383	Prob. Chi-Square(16)	0.1914
Scaled explained SS	157.5109	Prob. Chi-Square(16)	0.0000

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.257281	Prob. F(2,96)	0.2891
Obs*R-squared	2.884299	Prob. Chi-Square(2)	0.2364

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.031002	Prob. F(14,98)	0.4298
Obs*R-squared	14.50669	Prob. Chi-Square(14)	0.4127
Scaled explained SS	23.98980	Prob. Chi-Square(14)	0.0460

Corrologram Squared Residual for Autocorrelation- EGARCH

Banking sector
Date: 03/20/19 Time: 14:24
Sample: 1/12/2009 10/22/2018
Included observations: 509

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	-0.015	-0.015	0.1213	0.728
.|. |	.|. |	2	0.042	0.042	1.0176	0.601
.|. |	.|. |	3	0.012	0.013	1.0936	0.779
.|. |	.|. |	4	-0.011	-0.012	1.1554	0.885
.|. |	.|. |	5	-0.013	-0.015	1.2451	0.940
.|. |	.|. |	6	-0.061	-0.061	3.1581	0.789
.|* |	.|* |	7	0.082	0.082	6.6134	0.470
.|. |	.|. |	8	0.001	0.009	6.6141	0.579
.|. |	.|. |	9	0.043	0.038	7.5652	0.578
.|. |	.|. |	10	-0.003	-0.006	7.5694	0.671
.|. |	.|. |	11	-0.047	-0.052	8.7472	0.645
.|. |	.|. |	12	0.007	0.005	8.7764	0.722
.|. |	.|. |	13	-0.049	-0.035	10.056	0.689
.|. |	.|. |	14	-0.012	-0.017	10.133	0.752
.|. |	.|. |	15	-0.020	-0.015	10.349	0.797
.|. |	.|. |	16	-0.032	-0.039	10.884	0.817
.|. |	.|. |	17	-0.019	-0.024	11.067	0.853
.|. |	.|. |	18	-0.059	-0.052	12.931	0.796
.|. |	.|. |	19	-0.006	-0.011	12.948	0.841
.|. |	.|. |	20	0.047	0.061	14.137	0.823
.|. |	.|. |	21	0.067	0.071	16.556	0.738
.|. |	.|. |	22	-0.052	-0.057	18.008	0.706
.|. |	.|. |	23	0.004	-0.004	18.014	0.757
.|* |	.|* |	24	0.098	0.098	23.155	0.511
.|. |	.|. |	25	-0.040	-0.023	24.009	0.519
.|. |	.|. |	26	-0.027	-0.029	24.401	0.553
.|. |	.|. |	27	-0.002	-0.005	24.403	0.608
.|. |	.|. |	28	-0.047	-0.065	25.581	0.596
.|. |	.|. |	29	-0.025	-0.030	25.931	0.629
.|. |	.|. |	30	-0.012	-0.007	26.006	0.675
.|. |	.|. |	31	-0.033	-0.048	26.590	0.693
.|. |	.|. |	32	0.029	0.032	27.059	0.715
.|. |	.|. |	33	-0.022	-0.029	27.316	0.746
.|. |	.|. |	34	-0.051	-0.057	28.718	0.724
.|* |	.|* |	35	0.075	0.094	31.811	0.623
.|. |	.|. |	36	-0.040	-0.033	32.704	0.626

*Probabilities may not be valid for this equation specification.

Consumer Goods Sector
Date: 03/20/19 Time: 14:26
Sample: 1/12/2009 10/22/2018
Included observations: 509

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	0.007	0.007	0.0255	0.873
.|. |	.|. |	2	0.005	0.005	0.0370	0.982
.|. |	.|. |	3	-0.003	-0.003	0.0430	0.998
.|. |	.|. |	4	-0.025	-0.025	0.3652	0.985
.|. |	.|. |	5	-0.002	-0.001	0.3666	0.996
.|. |	.|. |	6	-0.019	-0.019	0.5625	0.997
.|. |	.|. |	7	-0.001	-0.001	0.5631	0.999
.|. |	.|. |	8	-0.007	-0.007	0.5871	1.000
.|. |	.|. |	9	0.027	0.027	0.9565	1.000
.|. |	.|. |	10	0.016	0.015	1.0936	1.000
.|. |	.|. |	11	-0.014	-0.015	1.1961	1.000
.|. |	.|. |	12	0.034	0.033	1.7846	1.000
.|. |	.|. |	13	-0.023	-0.022	2.0571	1.000
.|. |	.|. |	14	0.000	0.001	2.0571	1.000
.|. |	.|. |	15	-0.008	-0.008	2.0928	1.000
.|. |	.|. |	16	-0.024	-0.021	2.3842	1.000
.|. |	.|. |	17	-0.021	-0.022	2.6270	1.000
.|. |	.|* |	18	0.073	0.074	5.4419	0.998
.|. |	.|. |	19	-0.010	-0.014	5.4956	0.999
.|. |	.|. |	20	0.035	0.035	6.1471	0.999
.|. |	.|. |	21	0.007	0.004	6.1734	0.999
.|. |	.|. |	22	-0.003	-0.001	6.1785	1.000
.|. |	.|. |	23	-0.005	-0.005	6.1939	1.000
.|. |	.|. |	24	-0.013	-0.011	6.2907	1.000
.|. |	.|. |	25	0.049	0.052	7.5632	1.000
.|. |	.|. |	26	-0.011	-0.009	7.6334	1.000
.|. |	.|. |	27	0.039	0.036	8.4423	1.000
.|. |	.|. |	28	0.016	0.015	8.5889	1.000
.|. |	.|. |	29	0.014	0.017	8.6880	1.000
.|. |	.|. |	30	0.054	0.046	10.271	1.000
.|. |	.|. |	31	-0.007	0.000	10.300	1.000
.|. |	.|. |	32	0.024	0.021	10.602	1.000
.|. |	.|. |	33	0.013	0.018	10.691	1.000
.|. |	.|. |	34	-0.016	-0.013	10.838	1.000
.|. |	.|. |	35	-0.009	-0.005	10.884	1.000
.|. |	.|. |	36	-0.027	-0.028	11.299	1.000

*Probabilities may not be valid for this equation specification.

Insurance sector
Date: 03/20/19 Time: 14:27
Sample: 1/12/2009 10/22/2018
Included observations: 509

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	-0.009	-0.009	0.0441	0.834
.|. |	.|. |	2	-0.033	-0.033	0.5936	0.743
.|. |	.|. |	3	0.011	0.010	0.6526	0.884
.|. |	.|. |	4	-0.000	-0.001	0.6526	0.957
.|* |	.|* |	5	0.092	0.092	4.9834	0.418
*|. |	*|. |	6	-0.068	-0.067	7.3455	0.290
.|* |	.|* |	7	0.077	0.084	10.454	0.164
.|. |	.|. |	8	-0.031	-0.038	10.939	0.205
.|. |	.|. |	9	-0.033	-0.025	11.497	0.243
.|. |	.|. |	10	0.016	0.002	11.628	0.311
.|. |	.|. |	11	0.031	0.044	12.144	0.353
.|. |	.|. |	12	0.035	0.018	12.801	0.384
.|. |	.|. |	13	-0.012	0.008	12.881	0.457
.|. |	.|. |	14	0.037	0.033	13.590	0.481
.|. |	.|. |	15	-0.002	-0.004	13.593	0.557
.|. |	.|. |	16	-0.011	-0.011	13.658	0.624
.|. |	.|. |	17	0.010	0.006	13.715	0.687
.|. |	.|. |	18	-0.055	-0.059	15.339	0.639
.|. |	.|. |	19	-0.010	-0.018	15.397	0.697
.|. |	.|. |	20	0.020	0.026	15.610	0.740
.|. |	.|. |	21	0.024	0.022	15.929	0.774
.|. |	.|. |	22	-0.005	-0.005	15.942	0.819
.|. |	.|. |	23	-0.026	-0.011	16.294	0.842
.|. |	.|. |	24	-0.011	-0.021	16.357	0.875
.|. |	.|. |	25	-0.009	-0.011	16.398	0.902
.|. |	.|. |	26	0.001	-0.003	16.399	0.926
.|. |	.|. |	27	0.008	0.005	16.433	0.944
.|. |	.|. |	28	-0.031	-0.032	16.941	0.950
.|. |	.|. |	29	-0.060	-0.052	18.888	0.924
.|. |	.|. |	30	-0.010	-0.004	18.938	0.941
*|. |	*|. |	31	-0.073	-0.081	21.810	0.889
.|. |	.|. |	32	-0.044	-0.046	22.862	0.883
.|. |	.|. |	33	-0.002	-0.003	22.864	0.907
.|. |	.|. |	34	-0.026	-0.025	23.230	0.918
.|. |	.|. |	35	0.008	0.009	23.269	0.935
.|. |	.|. |	36	-0.043	-0.026	24.276	0.932

*Probabilities may not be valid for this equation specification.

Oil and Gas Sector
Date: 03/20/19 Time: 14:27
Sample: 1/12/2009 10/22/2018
Included observations: 509

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	0.007	0.007	0.0220	0.882
.|. |	.|. |	2	0.003	0.003	0.0263	0.987
.|. |	.|. |	3	-0.003	-0.003	0.0313	0.999
.|. |	.|. |	4	-0.004	-0.004	0.0382	1.000
.|. |	.|. |	5	-0.003	-0.003	0.0425	1.000
.|. |	.|. |	6	-0.003	-0.003	0.0460	1.000
.|. |	.|. |	7	-0.004	-0.004	0.0528	1.000
.|. |	.|. |	8	-0.003	-0.003	0.0582	1.000
.|. |	.|. |	9	-0.004	-0.004	0.0655	1.000
.|. |	.|. |	10	-0.004	-0.004	0.0721	1.000
.|. |	.|. |	11	-0.003	-0.003	0.0771	1.000
.|. |	.|. |	12	-0.004	-0.004	0.0839	1.000
.|. |	.|. |	13	-0.004	-0.004	0.0918	1.000
.|. |	.|. |	14	-0.003	-0.003	0.0978	1.000
.|. |	.|. |	15	-0.002	-0.002	0.0991	1.000
.|. |	.|. |	16	0.001	0.001	0.0999	1.000
.|. |	.|. |	17	-0.003	-0.003	0.1053	1.000
.|. |	.|. |	18	-0.004	-0.004	0.1126	1.000
.|. |	.|. |	19	-0.004	-0.004	0.1217	1.000
.|. |	.|. |	20	-0.004	-0.004	0.1284	1.000
.|. |	.|. |	21	-0.003	-0.003	0.1340	1.000
.|. |	.|. |	22	-0.003	-0.004	0.1402	1.000
.|. |	.|. |	23	-0.004	-0.005	0.1507	1.000
.|. |	.|. |	24	-0.004	-0.004	0.1607	1.000
.|. |	.|. |	25	-0.004	-0.004	0.1695	1.000
.|. |	.|. |	26	-0.004	-0.004	0.1780	1.000
.|. |	.|. |	27	-0.002	-0.002	0.1800	1.000
.|. |	.|. |	28	-0.004	-0.004	0.1896	1.000
.|. |	.|. |	29	-0.003	-0.004	0.1961	1.000
.|. |	.|. |	30	-0.004	-0.005	0.2067	1.000
.|. |	.|. |	31	-0.003	-0.003	0.2111	1.000
.|. |	.|. |	32	-0.001	-0.002	0.2121	1.000
.|. |	.|. |	33	-0.003	-0.003	0.2160	1.000
.|. |	.|. |	34	-0.004	-0.005	0.2257	1.000
.|. |	.|. |	35	-0.002	-0.003	0.2286	1.000
.|. |	.|. |	36	-0.004	-0.004	0.2361	1.000

*Probabilities may not be valid for this equation specification.

Aggregate Market
Date: 03/20/19 Time: 14:28
Sample: 1/12/2009 10/22/2018
Included observations: 509

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	0.009	0.009	0.0433	0.835
.|. |	.|. |	2	0.005	0.005	0.0544	0.973
.|. |	.|. |	3	-0.021	-0.021	0.2875	0.962
.|. |	.|. |	4	0.021	0.021	0.5065	0.973
.|. |	.|. |	5	-0.010	-0.010	0.5583	0.990
.|. |	.|. |	6	-0.010	-0.010	0.6097	0.996
.|. |	.|. |	7	-0.012	-0.011	0.6894	0.998
.|. |	.|. |	8	0.035	0.034	1.3162	0.995
.|* |	.|* |	9	0.091	0.091	5.6706	0.772
.|. |	.|. |	10	-0.004	-0.007	5.6809	0.841
.|. |	.|. |	11	0.047	0.049	6.8555	0.811
.|. |	.|. |	12	-0.006	-0.005	6.8773	0.866
.|* |	.|* |	13	0.177	0.175	23.241	0.039
.|. |	.|. |	14	-0.006	-0.005	23.260	0.056
.|. |	.|. |	15	-0.010	-0.009	23.313	0.078
.|. |	.|. |	16	0.014	0.025	23.424	0.103
.|. |	.|. |	17	-0.019	-0.032	23.623	0.130
.|. |	.|. |	18	0.020	0.019	23.836	0.160
.|. |	.|. |	19	-0.006	-0.006	23.856	0.202
.|. |	.|. |	20	0.009	0.004	23.903	0.247
.|. |	.|. |	21	-0.002	-0.012	23.906	0.298
.|. |	.|. |	22	-0.015	-0.053	24.034	0.345
.|. |	.|. |	23	-0.000	0.006	24.034	0.402
.|. |	.|. |	24	-0.013	-0.033	24.127	0.454
.|. |	.|. |	25	-0.003	-0.002	24.132	0.512
.|. |	.|. |	26	0.032	0.006	24.690	0.537
.|. |	.|. |	27	-0.001	-0.007	24.690	0.592
.|. |	.|. |	28	-0.000	0.008	24.690	0.645
.|. |	.|. |	29	0.074	0.066	27.633	0.538
.|. |	.|. |	30	-0.009	0.003	27.676	0.588
.|. |	.|. |	31	0.015	0.016	27.800	0.631
.|. |	.|. |	32	0.012	0.019	27.874	0.676
.|. |	.|. |	33	-0.001	0.004	27.875	0.720
.|. |	.|. |	34	0.030	0.035	28.368	0.740
.|. |	.|. |	35	-0.012	0.000	28.448	0.775
.|. |	.|. |	36	0.011	0.013	28.519	0.808

*Probabilities may not be valid for this equation specification.

System Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: no residual autocorrelations up to lag h
Orthogonalization: Cholesky (Lutkepohl)
Date: 03/20/19 Time: 16:50
Sample: 1/19/2009 10/22/2018
Included observations: 510

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	30.97194	0.0136	31.03279	0.0133	16
2	49.75871	0.0235	49.89353	0.0228	32
3	58.15208	0.1496	58.33655	0.1458	48
4	74.12712	0.1814	74.43789	0.1749	64
5	83.53313	0.3715	83.93702	0.3599	80
6	98.84208	0.4009	99.42822	0.3849	96
7	122.1615	0.2408	123.0721	0.2233	112
8	140.0177	0.2206	141.2130	0.2004	128
9	161.7802	0.1477	163.3664	0.1287	144
10	174.4237	0.2060	176.2627	0.1796	160

*The test is valid only for lags larger than the System lag order.
df is degrees of freedom for (approximate) chi-square distribution

```
( 1)  [Adjustment]lambda1 - [Adjustment]lambda2 = 0
( 2)  [Adjustment]lambda1 = 0

           chi2(  2) =   40.83
         Prob > chi2 =    0.0000
```