IMPACT OF OIL PRICE FLUCTUATIONS AND EXCHANGE RATE VOLATILITY ON ECONOMIC PERFORMANCE OF NIGERIA

BY

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Certification

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Dedication

This research work is dedication to Almighty God for His guidance, and to my family for their support.

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Abstract

It is not news that oil is the mainstay of the Nigerian economy, and it accounts for over 95 percent of its foreign earnings and more than 80 percent of its budgetary allocation. To this end, oil price shock and exchange rate volatility have impacts on the economic performance of Nigeria and, in particular. The latter is mostly important due to the double dilemma of being an oil exporting and oil-importing country, a situation that emerged in the last decade. The study examined the effects of oil price shock, exchange rate volatility, external reserves and interest rate on economic performance using annual data covering the period 1981 to 2015. The long run relationship among the variables was determined using the Johansen Co-integration technique while the vector correction mechanism was used to examine the speed of adjustment of the variables from the short run dynamics to the long run equilibrium. Variance decomposition was used to measure the proportion of forecast error variance in one variable explained by innovations in itself and the other variables. It was observed that a proportionate change in oil price leads to a more than proportionate change in GDP, and change in exchange rate volatility also leads to more than proportionate change in GDP of Nigeria. From the variance decomposition, it was gathered that the shock resulting from oil was more than the shock resulting from exchange rate volatility to GDP. The study therefore recommend that the Nigeria government should diversify from the oil sector to other sectors of the economy hereby dwindling the impact of crude oil as the mainstay of the economy and overcome the effect of incessant changes in crude oil prices which often culminate into macroeconomic instability and as well ensure that demand for foreign exchange should be closely monitored and exchange rate should move in tandem with the volatility in crude oil prices bearing in mind that Nigeria remains an oil–dependent economy.

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List of Acronyms

ADF - Augmented Dickey Fuller

BOP - Balance of Payment

CBN - Central Bank of Nigeria

DW - Durbin-Watson

ECM - Error Correction Model

EGARCH-Exponential Generalized Autoregressive Conditional Heteroskedasticity

ER_t - External Reserve

FOREX - Foreign Exchange

GARCH - Generalized Autoregressive Conditional Heteroskedasticity

GDI - Gross Domestic Investment

GDP - Gross Domestic Product

INT_t - Interest Rate Spread

IRF - Impulse Response Function

OILF - Oil Price Fluctuations

OLS - Ordinary Least Square

RGDP - Real Gross Domestic Product

RMS - Real Money Supply

R_v - Volatility of Exchange Rate

RV - Realized Volatility

SAP - Structural Adjustment Policies

VAR - Vector Autoregression

VDC - Variance Decomposition

VECM - Vector Error Correction Mechanism

CHAPTER ONE

INTRODUCTION

1.1   Background of the Study

The oil market has been and will continue to be an ever changing arena. This is because oil is so vital to the world economy, it is present in everyone's daily lives and its market is truly global. Since the discovery of oil in commercial quantity, Nigeria has been largely a mono-product economy. Nevertheless, Nigeria has been generating a lot of money from oil at an increasing rate or at a decreasing rate. In recent analysis, total federally collected revenue for the second quarter of 2014 stood at N2.602 trillion while the gross oil revenue receipts stood at N1.796 trillion accounted for 69 percent of the total revenue. It however fell by 0.7 percent below N1.809 trillion received in the preceding quarter (Premium Times Report, May 5, 2015). The country's gross external reserves in April 2014 showed a 0.8 percent decline to $37.11 billion (N6.07 trillion) from the previous level in March 2014 and about 22.5 percent below the levels in the corresponding period of 2013. Thus, the absolute dependence of oil export revenue has accentuated the level of Nigeria economy vulnerability to sudden oil price movements.

Factors such as periods of favorable oil price shocks triggered by conflict in oil-producing countries of the world, rise in the demand for the commodity by the consuming nations due seasonality factors, trading positions and so on; enhance Nigeria favorable terms of trade evidenced by her experiences of large current account surplus and exchange rate appreciation. On the converse, when crude oil prices are low,

occasioned by factors such as low demand, seasonality factors, excess supply, Nigeria experiences unfavourable terms of trade evidenced by budget deficit and slow economic growth (Englama, 2010). An example was a drop in the revenue from oil exports during the global financial crisis in 2009. According to OPEC statistical bulletin (2010/2011), oil export revenue dropped from US$74,033 million in 2008 to US$43,623 million in 2009 and the naira depreciated to N148.902 in 2009 from N118.546 in 2008.

In the same vein, oil prices have dropped by more than 60 percent between June 2014 and January 2015 and this has affected revenue and nominal exchange rate of naira negatively. If not for the effort of the government in promoting the economic diversification and for their macroeconomic response to collapsing export prices, the whole economy could have collapsed. However, vulnerabilities remain high in view of the uncertainties about oil price, security, and political situation.

This study however attempts to examine the extent to which oil price influences exchange rate and how both affect Nigerian economy. Oil price changes directly affects the inflow of foreign exchange into the country, therefore there is a need to investigate its impact on the naira exchange rate volatility; as crude oil is a key source of energy in Nigeria and in the world. Oil being an important part of the economy of Nigeria plays a strong role in influencing the economic and political fate of the country, crude oil has generated great wealth for Nigeria, but its effect on the growth of the Nigerian economy as regards returns and productivity is still questionable (Odularu 2007).

Oil price fluctuations have received important considerations for their presumed role on macroeconomic variables. Higher oil prices may reduce economic growth, generate stock

exchange panics and produce inflation which eventually leads to monetary and financial instability. It will also lead to high interest rates and even a plunge into recession (Mckillop, 2004). Sharp increases in the international oil prices and the violet fluctuations of the exchange rate are generally regarded as the factors discouraging economic growth (Jin, 2008).

Exchange rate is an important economy metric as it reflects underlying strength and competitiveness with world economies (Asinya and Takon, 2014). Whether fixed or floating, exchange rate affects macroeconomic variables such as import, export, output, interest rate, inflation rate etc. Chong and Tan (2008) empirical analysis revealed that the exchange rate is responsible for changes in macroeconomic fundamentals for the developing economies. Exchange rate fluctuations influence domestic prices through their effects on aggregate supply and demand. In general, when a currency depreciates it will result in higher import prices if the country is an international price taker, while lower import prices result from appreciation. The potentially higher cost of imported inputs associated with exchange rate depreciation increases marginal costs and leads to higher price of domestically produced goods (Kandil, 2004).

Thus, it is on this note that this study seeks to examine the effect of oil price on exchange rate volatility and its effects on the Nigerian economy, as well as suggest methods to minimize the adverse effects it can produce on the economy as a whole.

The study adopts econometric technique in ascertaining the impact of oil price and exchange rate on economic growth of Nigeria. The Johansen maximum likelihood test is used to determine the long run relationship between oil price and exchange rate volatility.

The crude oil price and exchange rates are key research subjects, and both variables generate considerable impacts on macroeconomic conditions such as economic growth, international trade, inflation, and energy management. The relationships between the two have been studied, mainly for guidelines of interaction and causality. In past decades, changes in the price of crude oil have been shown to be a key factor in explaining movements of foreign exchange rates, particularly those measured against the U.S. dollar.

1.2   Statement of the Problem

Oil price shocks are predominantly defined with respect to price fluctuations resulting from changes in either the demand or supply side of the international oil market (Wakeford, 2006). These changes have been traditionally traced to supply side disruptions such as OPEC supply quotas, political upheavals in the oil-rich Middle East and activities of militant groups in the Niger Delta region of Nigeria. The shocks could be positive (a rise) or negative (a fall). Two issues are identified regarding the shocks; first is the magnitude of the price increase which can be quantified in absolute terms or as percentage changes, second is the timing of the shock, that is, the speed and persistence of the price increase.

Going by the foregoing, five oil shocks can be observed in Nigeria. Each of the shocks had connections with some movements in key macroeconomic variables in Nigeria. For instance, the 1973-74, 1979-80, and 2003-2006 periods were associated with price increases while the oil market collapse of 1986 and 2015 are episodes of price decrease. During the first oil shock in Nigeria (1973-74), with respect to the rise of OPEC and the disruption in the supply of crude oil, OPEC first exercised its oil controlling power

during Yom Kippor War which started in 1973 by imposing an oil restriction on western countries as a result of U.S and the Europe support for Israel. Production of Oil was reduced by five million barrels a day, this cut back amounted to about seven percent of the world production and the price of oil increased 400 percent in six months, and consequently, the value of Nigeria's export measured in US dollars rose by about 600 per cent with the terms of trade rising from 18.9 in 1972 to 65.3 by 1974. Government revenue which stood at 8 per cent of GDP in 1972 rose to about 20 per cent in 1975. This resulted in increased government expenditure owing largely from the need to monetize the crude oil receipts. Investment was largely in favour of education, public health, transport, and import substituting industries (Nnanna and Masha, 2003).

During the oil price shock of 2003-2006, Nigeria recorded increases in the share of oil in GDP from about 80 per cent in 2003 to 82.6 per cent in 2005. The shock was gradual and persisted for a while. This could be regarded as a permanent shock. The result of the shock was a favourable investment climate, increased national income within the period although a slight decline was observed in the growth rate of the GDP. Despite this perceived benefit of oil price change, the macroeconomic environment in Nigeria during the booms was undesirable. For instance inflation was mostly double digit in the 1970s; money supply grew steeply, while huge fiscal deficits were also recorded.

Apart from the 1986 oil collapse, the present oil collapse took a downturn on the Nigeria's economy. The low crude oil price has started to take its toll on Nigeria's economy, triggering a huge decline in the country's foreign reserves and engendering a free fall of the naira, and a host of others. In the April 2015 Federation Account Allocation Committee (FAAC) meeting, it was stated that the country recorded a revenue

shortfall of N86.42 billion, due to N78.36 billion decline from oil revenue. Oil majors recently warned that the country risks losing up to $10billion (about N2 trillion) in revenue from oil and gas if oil traded around an average of $53 per barrel in 2015. As a result, oil and gas companies in the country are already considering cutting down on their investments in the country, some have begun to cut down on their staff strength as well as slashing salaries, while a number of oil and gas projects in the country have been suspended. This development portends a dangerous signal for the economy and are grave signs that financing the budget would pose a herculean task (Vanguard, 2015).

In the same vein, Nigeria's exchange rate has been more volatile in the post-SAP period due to its excessive exposure to external shocks. The effect of the recent global economic meltdown on Nigerian exchange rate was phenomenon as the Naira exchange rate vis-à-vis the Dollar rose astronomically from about N120/$ to more than N180/$ (about 50% increase) between 2008 and 2009, and presently to N199/$ between December 2014 and March 2015. This is attributable to the sharp drop in foreign earnings of Nigeria as a result of the persistent fall of crude oil price, which plunged from an all-time high of US$147 per barrel in July 2007 to a low of US$45 per barrel in December 2008 and from US$100 in January 2014 to a low of US$40 per barrel in December 2014.

Although various factors have been adduced to the poor economic performance of Nigeria, it is necessary to examine the growth process of Nigeria under various oil price fluctuations and exchange regimes that had been adopted in the country, which is the main thrust of this study.

1.3   Objectives of the Study

The broad objective of this study is to examine the effects of oil price fluctuations and exchange rate volatility on Nigeria's economic performance. The specific objectives of the study are as follows:

i.   To examine the impact of oil price fluctuations on the economic performance of Nigeria; and

ii.   To examine the impact of exchange rate volatility on the economic performance of Nigeria.

1.4   Research Questions

According to the objectives stated above, the research questions that would be examined in the course of the study are as follows:

i.   Is there any impact of oil price fluctuations on the economic performance of Nigeria?

ii.   Is there any impact of exchange rate volatility on economic performance of Nigeria?

1.5   Justification of the Study

The effects of the recent oil price fall on Nigeria's economic performance have reaffirmed the urgent need for protection of the economy from exchange rate risk and to diversify the economy. Although, no country is immune to such shock, the over-reliance on oil export revenue by Nigeria exposes her exchange rate and economy excessively to

external shocks. Therefore, there is the need to conduct a research of this nature to examine the effect of oil price fluctuations and exchange rate volatility under different periods on Nigeria's economic performance.

In light of this, this study would help the government and the Central bank of Nigeria (CBN) to identify the effects of oil price fluctuations, and also to identify the strength and weakness of foreign exchange system and hence adopt the policy that suits the economy - which would definitely enhance growth and development of the economy. The study will also make international trade and investment decision easier, and lastly, serve as a guide to future researchers on this subject.

1.6   Scope of the Study

This study focuses on the effect of oil price fluctuations and exchange rate volatility on the economic performance of Nigeria as necessitated by the inflationary pressure generated by recent oil price fall through the exchange rate sensitivity. Despite the liberalization of the exchange rate in Nigeria since the introduction Structural Adjustment Programme (SAP) in 1986, no meaningful progress has been made to improve economic performance of the country. Therefore, this study would examine the economic performance of Nigeria under various oil price shock periods and the exchange rate regimes with the view of identifying the real cause of growth instability in the country. The investigation will be done empirically with the data spanning from 1980 to 2014.

## 1.7	Organization of the Study

This research work is organized in five chapters. Chapter one focuses on the introduction of the topic where the background, statement of the problem, objectives, research questions, justification and the scope of the study are analysed. Chapter two focuses on review of literature where the conceptual, theoretical and empirical works of the past researchers in the related topic are reviewed. Chapter three focuses on the theoretical framework and methodology adopted to carry out the research study as it focuses on the specific theory that is germane to the study, research design, mode of collecting data and the sources of data. Chapter four focuses on the presentation of the results and its analysis, and also comparison is made between the results and the previous findings. Lastly, chapter five highlights the summary of the major findings of the study, followed by the conclusion and policy recommendations derived from the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual and Theoretical Review

To review the literature on the impact of oil price fluctuations and exchange rate volatility on Nigeria's economic performance, some concepts and theories have to be discussed. Many writers have analyzed the impact of oil price fluctuations and exchange rate volatility. However, most papers dealt only with the empirical analysis of the study. It is therefore imperative to look at the theoretical aspect of oil price fluctuations. This will be done by looking at the origin of oil in Nigeria, causes and consequences of oil price change, and how exchange rate affects trade balances (import and export).

2.1.1 Brief History of Oil in Nigeria

The search for oil began in 1908 by a German company named Nigeria Bitumen Corporation, but there was no success until 1955 when oil was discovered in Oloibiri in Niger delta by shell-BP. Nigeria started exporting crude oil in 1958 but in major quantity in 1965, after the establishment of the Bonny Island on the coast of Atlantic and the pipeline to link the terminal. The discovery of oil in the eastern and mid-eastern regions of Nigeria brought hope of a brighter future for Nigeria in terms of economic development as Nigeria became independent, but there were also grave consequences for the economy; as it fuelled already existing ethnic and political tension. The tension reached its peak with the civil war and reflected the impact and fate of the oil industry. Nigeria survived the war and was able to recover mainly from the huge revenue gained

from oil in the 1970s. In 1970, as the Biafra war ended, there was a rise in world oil price and Nigeria benefited immensely from this rise. Nigeria became a member of the organization of petroleum exporting countries (OPEC) in 1971 and the Nigerian National Petroleum company (NNPC) which is a government owned and controlled company was founded in 1977. By the late sixties and early seventies, Nigeria had attained a production level of over 2 million barrels of crude oil a day. Nigeria gained wholesomely from the nearly 36 months oil boom, the boom generates a lot of funds needed to meet all development need but the oil revenue which was supposed to be a blessing became a curse due to the corruption and the mismanagement of windfall gain from oil.

Although there was a drop in production of crude oil in the eighties due to economic downturn, by 2004 Nigeria bounced back producing 2.5 million barrels per day, but the Niger delta crisis and the global economy financial crises reduced Nigeria oil production and the world oil price.

The enormous impact of the oil shock on Nigeria grabbed the attention of scholars who tried to analyze the effect of oil price on economic growth in Nigeria. A set of radical oriented writers were interested in the nationalization that took place during the oil shock as well as the linkages between oil and an active foreign policy. Regarding the latter, the emphasis was on OPEC, Nigeria's strategic alliance formation within Africa, the vigorous efforts to establish the Economic Community of West African States (ECOWAS), and the country's attempts to use oil as a political weapon, especially in the liberation of South Africa from apartheid. Many people had hoped that Nigeria will become an industrial nation and a prosperous nation from the benefits of oil but they were greatly

disappointed when a major financial crisis hit, which led to the restructuring of the economy (Odularu, 2007).

2.1.2 Causes and Consequences of Oil Price Shock

There has been interest in understanding the causes and consequences of oil price shocks ever since the 1970s when Nigeria experienced oil boom and some years later when oil revenue was on the decreasing rate. According to Lutz Kilian (2014), oil price shocks have been blamed for U.S. recessions and for higher inflation, and for stagflation (a term coined to refer to the unprecedented coincidence of inflation and economic stagnation during the 1970s). They also have been held responsible for changes in monetary policy, for far-reaching labour market adjustments, and for changes in energy technologies. While the interest in oil price shocks waned in the 1990s, the fluctuations in the real price of oil since 2003 have led to a resurgence of research on oil markets.

According to Hamilton (2008), there are three ways of explaining changes in oil prices. One can first look at the statistical investigation of the basic correlations in the historical data. The second way is to look at the predictions of economic theory as to how oil prices should behave over time. While, the third way is to examine in detail the fundamental determinants and prospects for demand and supply. Reconciling the conclusions drawn from these different perspectives is an interesting intellectual challenge, and necessary if we are to claim to understand what is going on.

Citing U.S, Lutz Kilian (2014) argued that changes in the real price of oil (all else equal) affect the macroeconomic performance of oil-importing economies; and, changes in macroeconomic conditions in oil-importing economies (all else equal) affect the real

price of oil. This means that identifying cause and effect in the relationship between the real price of oil and macroeconomic conditions in oil-importing economies requires a structural model of the global economy including the global oil market.

Thus, an increase in the price of crude oil has a direct impact on the supply of goods that are produced using energy and on the production of crude oil. Hamilton (2008) shows that if the production function is assumed to be continuous and differentiable in energy use, it is unlikely to see large fluctuations in output without a great deal of variation in energy prices and firms' adjustment of inputs (both energy and other factors of production). Indeed, the elasticity of output with respect to changes in oil usage will be bounded by the share of energy expenditure in total output. In addition, ceteris paribus, assuming a smooth production function implies a symmetric response of output to changes in the energy input.

As for oil exporting economies, the direct-supply effect is symmetric but its sign is ambiguous. On one hand, industries that use energy intensively in their production process will experience a contraction as capital and labor reallocate away from energy-intensive sectors. This effect, in turn, will lead to a downturn in aggregate production. On the other hand, an increase in oil prices will foster exploration and extraction of crude oil, yet production is likely to respond with a long lag (see for instance, Favero, Pesaran and Sharma, 1994). Furthermore, productivity spillovers between the oil sector and the rest of the economy might result in increased production across oil and non-oil industries in response to demand-driven oil price shocks (Bjørnland and Thorsrud 2013). Therefore, the sign of the effect will depend on: (a) the importance of the oil sector in the country's

aggregate GDP, (b) the lag in the response of oil production, and (c) productivity spillovers between oil and non-oil industries.

Oil price shocks can also be transmitted to macroeconomy via a direct demand-side channel. Hence, an increase in the price of crude oil leads to an income transfer from oil exporting countries to oil importing countries and, thus, to a change in consumers' purchasing power. Therefore, while oil exporting countries would experience an increase in production due to a demand push, oil importing countries would face a contraction (see Edelstein and Kilian 2007, 2009; Hamilton, 2011).

Exogenously, oil price shock has a direct effect on real GDP. According to Lutz Kilian (2014), the first effect is akin to an adverse aggregate demand shock in a macroeconomic model of aggregate demand and aggregate supply. The other immediate effect is to increase the cost of producing domestic output to the extent that oil is a factor of production along with capital and labor, which is akin to an adverse aggregate supply shock. These direct effects of an exogenous increase in the real price of oil imports are symmetric in oil price increases and decreases. An unexpected increase in the real price of oil will cause aggregate production and income to fall by as much as an unexpected decline in the real price of oil of the same magnitude will cause aggregate income and production to increase.

Kilian (2014) also argued that inflation is also one of the consequences of oil price shock. He argued that even though one expects an exogenous oil price shock, if it occurs in isolation, to be recessionary and deflationary, it is, of course, possible for an oil price shocks to shift both the aggregate demand and aggregate supply curves. This would

reinforce the decline in real GDP, but result in at least partially offsetting effects of the oil price shock on the price level.

2.1.3   Effects of Exchange Rate on Trade Balances

In this section, the effect of exchange rate volatility on macroeconomic variables, such as trade balances are emphasized. It was noted that the relegation of Agriculture to the background as a result of oil boom in 1970s was a result of inappropriate exchange rate policy which made the prices of agricultural output too low to give farmers the incentive to produce. During this period, the Nigerian exchange rate policy tended to encourage over-valuation of the *Naira* which in turn, encouraged imports, discouraged non-oil export and helped in sustaining the manufacturing sector's overdependence on imported inputs (Obadan, 1993).

Exchange rate policy during this period was not geared towards the attainment of long-run equilibrium rate that would equilibrate the BOP's in the medium and long term and facilitate the achievements of export diversification and discourage over-independence on imported manufacturing inputs; but rather the reverse was the case (Chukwuma, 2011).

Chukwuma (2011) analyzed the effect of exchange rate on trade balances using the elasticity approach of the Marshal-Learner condition (Marshall, 1923, Lerner, 1944). The ML condition studies situations under which exchange rate variations restore equilibrium in *BOP* by devaluing a country's currency. This approach is related to the price effect of devaluation. The theory states that when a country devalues its currency, the domestic prices of its import are raised and the foreign prices of its exports are reduced. Thus, devaluation helps to improve *BOP* deficits of a country by increasing its exports and

reducing its imports. But the extent to which it will succeed depends on the country's price elasticities of domestic demand for imports and foreign demand for exports. The Marshall-Learner condition states that: when the sum of price elasticities of demand for exports and imports in *absolute terms* is greater than unity, devaluation will improve the country's balance of payments, i.e,

$$\eta_x + \eta_m > 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

Where η_x is the demand elasticity of exports and η_m is the demand elasticity for imports.

On the contrary, if the sum of price elasticities of demand for exports and imports, in absolute terms, is less than unity,

$$\eta_x + \eta_m < 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(2)$$

Devaluation will worsen (increase the deficit) the *BOP*.

If the sum of these elasticities in absolute terms is equal to unity,

$$\eta_x + \eta_m = 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3)$$

Devaluation has no effect on the *BOP* situation which will remain unchanged.

The following is the process through which the Marshal-Learner condition operates in removing *BOP* deficits of a devaluing country. Devaluation reduces the domestic prices of exports in terms of the foreign currency. With low prices, exports increase.

The extent to which they increase depends on the demand elasticity for exports. It also depends on the nature of goods exported and the market conditions. If the country is the

sole supplier and exports raw materials or perishable goods, the demand elasticity for its exports will be low. If it exports machinery, tools and industrial products in competition with other countries, the elasticity of demand for its products will be high, and devaluation will be successful in correcting a deficit.

Devaluation has also the effect of increasing the domestic price of imports which will reduce the import of goods. By how much the volume of imports will decline depends on the demand elasticity of imports. The demand elasticity of imports, in turn, depends on the nature of goods imported by the devaluing country. If it imports consumer goods, raw materials and inputs for industries, its elasticity of demand for imports will be low. It is only when the import elasticity of demand for products is high that devaluation will help in correcting a deficit in the balance of payments.

Thus it is only when the sum of the elasticity of demand for exports and the elasticity of demand for imports is greater than one that devaluation will improve the balance of payments of a country devaluing its currency.

However, an attempt to over-stimulate the economy, by expansionary monetary policy or currency devaluation will result in higher rate of inflation, but no increase in real economic growth (Barro and Gordon, 1983). Hence, as a nominal variable, the exchange rate might not affect the long-run economic growth. There is no unambiguous theoretical evidence what impacts the exchange-rate target exhibits on growth.

2.2   Empirical Review

Since economic theory does not reveal clear foundations for the relationship between the exchange-rate target and oil prices, the issue becomes empirical. It should be noted that the key factors that influence economic activities in Nigeria are exchange rate, oil price and their volatilities.

2.2.1   Empirical Review on Other Countries

Beckmann and Czudaj (2012) stressed that diverse theoretical relationship between oil price and exchange rates have been established in literature. There have been significant considerations for the role played by oil price fluctuations in the dynamism of macroeconomic variables. There have been many suggestions that oil price might have a significant influence on exchange rate. The proposition that oil price might be adequate enough to explain all the long run movements in real exchange rate appears to be new.

Trung and Vinh (2011) postulated that there are two reasons why macroeconomic variables should be affected by oil shocks. First, oil increase leads to lower aggregate demand given that income is redistributed between net oil import and export countries. Oil price spikes could alter economic activity because household income is spent more on energy consumption, and firms reduce the amount of crude oil it purchases which then leads to underutilization of the factors of production like labor and capital. Second, the supply side effects are related to the fact that crude oil is considered as the basic input to production process. A rise in oil price will lead to a decline in supply of oil due to the fact that a rise in cost of crude oil production will lead to a decline in potential output.

According to Amano and Norden (1998), many researchers suggest that oil fluctuations has a significant consequence on economic activity and the effect differ for both oil exporting countries and oil importing countries. It benefits the oil exporting countries when the international oil price is high but it poses a problem for oil importing countries.

Using an extended version of the Balassa-Samuelson model, Kutan and Wyzan (2005) found evidence that changes in oil prices had a significant effect on the real exchange rate during 1996 to 2003 and that the Balassa-Samuelson working through productivity changes may be present though its economic significance may not be large.

According to Plante (2008), theoretically the immediate effect of positive oil price shocks is the increase in the cost of product for oil importing countries, this is likely to reduce output and the magnitude of this will depends on the demand curve for oil. Higher oil prices lower disposable income which then leads to a decrease in consumption. Once the increase in oil price is believed to be permanent, private investments will decrease. But if the shocks are perceived as transitory, oil is used less in production and the productivity of labor and capital will decline and potential output will fall.

In the words of Korhonen and Juurikkala (2007), increasing crude oil prices cause a real exchange rate appreciation in oil exporting countries and this is not shocking, since they earn a significant amount from oil exportation. A study carried out on the Russian economy by Spatafora and Stavrev (2003) confirm the sensitivity of Russia's equilibrium real exchange rate to long run oil prices. It was provided by Lizardo and Mollick (2010) that between the year 1970s to 2008, movements in the value of the U.S dollar against

major currencies was significantly explained by oil prices. They found that when oil prices increases, currencies of oil importers such as china suffer depreciation.

Using a panel of 16 developing countries, Choudhri and Khan (2004) provided strong evidence of the workings of the Balassa-Samuelson effects. Coudert (2004) survey provided evidence that the trend appreciation in the real exchange rate observed in countries of central and eastern Europe during the early 2000 stemmed, in fact, from the Balassa effect. The study concluded that even though other factors were just as responsible, the estimated Balassa effect goes some way in explaining the real appreciation.

In Bahrain, Johansen co-integration test is used to examine the co-integrating relationship among the real GDP, real effect exchange rate and real oil price of a country. Real GDP of Bahrain is more elastic to changes in international oil prices than real exchange rate (Al-Ezzee, 2011). Research conducted on Vietnam from the period of 1995 to 2009 using the vector autoregressive model (VAR) produce results that suggest that both oil prices and the real effective exchange rates have strong significant impact on economic activity.

Using the vector autoregressive (VAR) analysis along with the Granger causality test, generalized impulse response functions and generalized variance decompositions, Salim and Rafiq (2013) empirically investigated the impact of oil price volatility on six major emerging economies of Asia, namely China, India, Indonesia, Malaysia, Philippines and Thailand. Following Andersen et al. (2004), quarterly oil price volatility was measured by using the realized volatility (RV). For China, it was reported that oil price volatility impacts output growth in the short run. However, for India and the Philippines, oil price

volatility was found to impact both GDP growth and inflation before and after the Asian financial crisis.

2.2.2 Empirical Review on Nigeria

A fraction of the trade balance for energy-dependant economies is represented by oil imports. The variability in oil prices is expected to have a large impact on the relative value of the currency. This relationship between the price of oil and the exchange rate has been established by this literature for Nigeria as an oil-producing country.

Interestingly, Nigeria like other low income countries has adopted two main exchange rate regimes for the purpose of gaining balance both internally and externally. Umar and Soliu (2009) postulated that the purpose for this different practice is to maintain a stable exchange rate. A fluctuating real exchange rate stemming from volatile oil prices are damaging to non – oil sector, capital formation and per capita income.

The impact of oil price shocks on aggregate economic activity (output, inflation, the real exchange rate and money supply) in Nigeria was investigated by Olomola (2006) using quarterly data from 1970 to 2003. He found out that oil price shocks do not affect output and inflation in Nigeria significantly. However, oil price shocks were found to significantly influence the real exchange rate. The author argues that oil price shocks may give rise to wealth effect that appreciates the real exchange rate and may squeeze the tradable sector, giving rise to the "Dutch-Disease".

Okonju (2009), after a careful assessment of Nigeria's growth path in post oil discovery period, judged it as having been very rough. He explained that during the oil boom era

GDP grew positively by 6.2% annually, but the growth rate turned negative through the larger part of the 80's when oil prices crashed; this period also saw inflation rate jump to 11.8% on average, with a period peak of 41% in 1989; Gross Domestic Investment (GDI) as percentage of GDP fell from 16.3% to 14%. However GDP growth rate managed to turn positive (averaging about 4%) between 1988 and 1997 as a result of structural adjustment policies (SAP). Okonju concluded that oil price volatility has been a major contributory factor to instability in GDP growth pattern in Nigeria.

Akide (2007) investigated the impact of oil price volatility on economic growth indicators in Nigeria using quarterly data from 1970 to 2000. He found out that within the period of study oil price shocks did not affect output and inflation in Nigeria, but significantly influenced real exchange rate.

Olaokun (2000) arrived at some interesting conclusions by showing that oil price increases exerts a negative effect on the economies of Ghana and Nigeria, but has a positive effect on Russia, which like Nigeria is an oil producing country.

The impact of oil price volatility on macroeconomic activity in Nigeria has also been examined by Apere and Ijeoma (2013) using exponential generalized autoregressive conditional heteroskedasticity (EGARCH), impulse response function and lagaugmented VAR (LA-VAR) models. The paper finds a unidirectional relationship between interest rate, exchange rate and oil prices. However, a significant relationship between oil prices volatility and real GDP was not found. The paper concludes that that oil price volatility is an important determinant of real exchange rates and in the long run, while exchange rate rather than oil price volatility affects output growth in Nigeria.

Omisakin (2008) carried out a study on the impacts of oil price shocks on the macroeconomic performance in Nigeria using Vector Autoregression (VAR) approach. Forecast error variance decomposition is estimated using 7 key Nigerian macroeconomic variables, which are real gross domestic product, consumer price index, real oil revenue, real money supply, real government recurrent expenditure, real government capital expenditure and real oil price. The study found that oil price shocks significantly contribute to the variability of oil revenue and output. On the other hand, the result reveals that oil price shock does not have substantial effects on money supply, price level and government expenditure in Nigeria over the period covered by the study. This finding confirms, therefore, that oil price shock may not be necessarily inflationary especially, in the case of an open developing economy like Nigeria. The policy implication of this is that fiscal policy can be used more effectively to stabilize the domestic economy after an oil shock.

According to Aliyu (2009), analysis of the impact of asymmetric shocks caused by exchange rate and oil price variability on economic growth has been a major concern of both academics and policy makers for a long time now.

2.3   Implication of the Review for the Current Study

There have been few literatures on the impact of oil price fluctuations on oil producing countries who are still developing, their main focus of research has been on net oil importers and developed countries. Also few scholars have conducted studies on the effects of oil price changes on the macro-economy of developing countries, and most of the scholars looked at the long run relationship between oil price and exchange rate.

However, as it is known that five oil price shock periods have been experienced in Nigeria, each of which had connections with some movements in key macroeconomic variables in Nigeria, for instance, the 1973-74, 1979-80, and 2003-2006 periods were associated with price increases while the oil market collapse of 1986 and 2015 are episodes of price decrease.

This research work, thus, draws on relevant aspects of the foregoing studies but defines its scope somewhat differently as earlier stated that there is the need to conduct a research to examine the effect of oil price fluctuations and exchange rate volatility under different periods on Nigeria's economic performance.

CHAPTER THREE

THEORETICAL FRAMEWORK AND METHODOLOGY

3.1   Theoretical Framework

The standard growth theories focus on primary inputs such as; capital, labour & land, while failing to recognize the role of primary energy inputs such as; oil deposits. However, natural scientists and some ecological economists have made efforts at evolving some theories which capture the role of oil price volatility on economic growth, thus incorporating the linkage between energy resources; its availability and volatility and economic growth (Oriakhi and Iyoha, 2013). For the purpose of this study, the linear/symmetric relationship theory of growth and asymmetry-in-effects theory of economic growth are used.

3.1.1   The Linear/Symmetric Relationship Theory of Growth

The Linear/Symmetric relationship theory of growth which has as its proponents, Hamilton (1983), Gisser (1985), Goodwin (1985), Hooker (1986) and Laser (1987) postulated that volatility in GNP growth is driven by oil price volatility. They hinged their theory on the happenings in the oil market between 1948 and 1972 and its impact on the economies of oil-exporting and importing countries respectively. Hooker (2002), after rigorous empirical studies demonstrated that between 1948 and 1972 oil price level and its changes exerted influence on GDP growth significantly. Laser (1987), who was a late entrant into the symmetric school of thought, confirms the symmetric relationship between oil price volatility and economic growth. After an empirical study of her own,

she submitted that an increase in oil prices necessitates a decrease in GDP, while the effect of an oil price decrease on GDP is ambiguous, because its effects varied in different countries.

3.1.2 The Asymmetry-In-Effects Theory of Economic Growth

The Asymmetry-in-effects theory of economic growth used the U.S economy as a case study. The theory posits that the correlation between crude oil price decreases and economic activities in the U.S economy is significantly different and perhaps zero. Mark *et al.* (1994), members of this school in a study of some African countries, confirmed the asymmetry in effect of oil price volatility on economic growth. Ferderer (1996) another member of this school explained the asymmetric mechanism between the influence of oil price volatility and economic growth by focusing on three possible ways: Counter-inflationary monetary policy, sectoral shocks and uncertainty. He finds a significant relationship between oil price increases and counter-inflationary policy responses. Balke (1996) supports Federer's position/submission. He posited that monetary policy alone cannot sufficiently explain real effects of oil price volatility on real GDP.

There exist other theories on the oil price volatility effect on economic growth in the literature, such as; the Decoupling theory, Income transfer model of growth etc. The theories reviewed are still at their crude stage, this is vivid from the quality of their analysis, ambiguity in conclusions and submissions and a clear absence of an econometric face. This is not unconnected to the background of the proponents of these theories, many of whom are scientists, ecological and environmental economists. The

submissions of these theories however provide analytical foundations on which to compose our empirical investigations (Oriakhi and Iyoha, 2013).

.3.2   Methodology

To investigate the impact of oil price fluctuations and exchange rate volatility on economic performance of Nigeria, a restricted Vector Autoregressive model (VAR) or Vector Error Correction Mechanism is adopted. The VECM treats all variables as endogenous and does not impose *a priori* restrictions on structural relationships. The reason for the error correction term is the same as with the standard error correction model, it measures any movements away from the long run equilibrium and measures the speed of adjustment of the short run dynamics to the long run equilibrium time path. Once the VECM has been estimated, the relative importance of a variable in generating variations in its own value and in the value of other variables can be assessed (Forecast Error Variance Decomposition (VDC)). VDC assesses the relative importance of oil fluctuations and exchange rate volatility in the volatility of other variables in the system.

The dynamic response of macroeconomic variables to innovations in a particular variable can also be traced out using the simulated responses of the estimated VAR system (Impulse Response Functions (IRF)). Thus, the IRF enables the determination of the dynamic effects of oil price fluctuations on the Nigerian macro economy.

Johansen maximum likelihood estimation method is also used to test for cointegration. The choice of this cointegration is as a result of the fact that:

i. Most time series data are not stationary that is they do not have a constant mean, a constant variance and a constant auto variance for every successive lag, so the use of the OLS method of estimation would only yield unauthentic results.

ii. Cointegration view is a convenient approach for the estimation of long run parameters with unit root.

iii. The cointegration approach provides a direct test of the economic theory and enables utilization of the estimated long run parameters into the estimation of the short run disequilibrium relationships.

iv. The traditional approach is criticized for ignoring the problems caused by the presence of unit roots variables in the data generating process.

However both unit root and cointegration have important implications for the specification and estimation of dynamic models.

3.2.1 Model Specification

With reference to the theoretical model built by Oriakhi and Iyoha (2013), and in line with the main objective of the study, standard deviation from Microsoft EXCEL is adopted to determine the volatility of exchange rate and oil price fluctuations. This research study uses real GDP as the measure of economic growth. Other variables such as external reserve, real money supply and interest rate spread are also considered. Generally, the model is represented as follow:

$$RGDP = f(EXR_v, OIL_F, MSR, INT, ER)$$

$$logRGDP = \beta_0 + \beta_1 EXR_v + \beta_2 OIL_F + \beta_3 MSR + \beta_4 INT + \beta_5 ER + \mu_t$$

Where RGDP is the gross domestic product at 2010 constant basic prices, EXR_v is the volatility of exchange rate, OIL_F is oil price fluctuations, MSR is money supply ratio to GDP, INT_t is interest rate spread (lending rate minus deposit rate), ER_t is external reserve. β_0 is the constant term, $\beta_1 - \beta_5$ are elasticity coefficients, and μ_t is the stochastic random term.

3.2.2   Research Design

A research design is a systematic thinking strategy which involves a planned and formalized collection, analysis and interpretation of data for problem solving. A descriptive research design will be used to describe the exchange rate that is used is sourced from the CBN website and the Microsoft EXCEL is used to generate the conditional variance series that is subsequently used as the exchange rate volatility and oil price fluctuation time series data from 1981 to 2015. The variables for 2015 are determined using the average of the four quarters of the year.

3.2.3   Estimation Technique

It is imperative to note that each explanatory variable will be tested if they are good predictors of the model. There are various criteria used to test for the significance of the model. With the use of Eviews 7 software package for estimation, some of the analyses that would be carried out include:

(a) The Test for Stationarity (Unit Root)

The unit root test is conducted before the co-integration method of analyses can be carried out; this is because it is necessary to test for the presence of a unit root in a

variable. A unit root test tests whether time series variable is non-stationary using autoregressive model. A common test and valid for large samples is the Augmented Dickey Fuller (ADF) and Phillips Perron test. They are used to determine the order of integration of a variable. The test states that if a particular series say Y has to be differenced n times (number of times, 1, 2, 3… n) before it becomes stationary then Y is said to be integrated of order n (it is written as I(n)). If the series is stationary at level it is said to be integrated to order 0 (I(0)), that is there is no unit root. If a variable is differentiated once in order for it to be stationary it is said to be integrated to order 1 that is I(1).

The test statistics of the estimated coefficient of Y_t is then used to test the null hypothesis that the series is non-stationary (has unit root). If the absolute value of the test statistics is higher than the absolute value of the critical T value (which could be at 1, 5, or 10 percent) then he series is said to be stationary, therefore we reject the null hypothesis, otherwise it has to be differentiated until is stationary.

(b) Johansen Test for Co-integration

Co-integration is basically based on the idea that there is a long run co movement between trended economic time series so that there is a common equilibrium relation which the time series have a tendency to revert to, therefore even if certain time series, they are nonstationary, a linear combination of them may exist that is stationary. A lot of economic series behave like I(1) processes that is they seem to drift all over the place, but another thing to notice is that they seem to drift in such a way that they do not drift away

from each other. Formulating it statistically you will come up with a co integration model.

Johansen test named after Soren Johansen, is procedure, is a procedure for testing cointegration of several I(1) time series. This test permits more than one co integrating relationships, so it is more applicable than the Engle-Granger test which is OLS based. There are two types of Johansen test, Trace and Maximal Eigen value which are used to test for cointegration and they are also used to determine the number of co integrating vectors. Both tests do not always indicate the same number of co integrating vectors. The trace test is a joint test, the null hypothesis is that the number of co integrating vectors is less than or equal to r against a general alternative hypothesis that there are more than r. the Maximal Eigen value test conducts separate test on each Eigen value. The null hypothesis is that r cointegrating vectors present against the alternative that there are (r+1) present. If there are g variables in the system of equations, there can be a maximum of g-1 co integrating vectors.

(c) The Vector Error Correction Model

This is basic VAR, with an error correction term incorporated into the model. The reason for the error correction term is the same as with the standard error correction model, it measures any movements away from the long run equilibrium and measures the speed of adjustment of the short run dynamics to the long run equilibrium time path. The coefficient is expected to be negatively signed. The vector error correction model would be used to analyze the short run relationship between the world crude oil price and the Nigerian exchange rate.

3.2.4 Sources and Measurement of Data

Basically, data for this research work will be secondary data drawn from the Statistical Bulletin of the Central Bank of Nigeria (2015 Ed); CBN website; International Financial Statistics and Data Files of IMF; and World Development Indicators (2015 Ed) of World Bank. Due to the delicate nature of this stage in the research, the data collection would be handled such that biasness will be minimized. Descriptions and data sources of the variables are in the table below:

Table 3.1: Variables and Data sources

VARIABLE	DESCRIPTION	DATA SOURCE
REAL GROSS DOMESTIC PRODUCT (GDP)	This is the GDP at 2010 constant basic prices measured in billion naira.	CBN statistical bulletin
OIL PRICE (oilp)	The price of crude oil is stated in US dollars. Oil price is the price at which oil is sold per barrel each day in the international oil market. It is measured in US dollars	World Development Indicators (WDI), World Bank while volatility figures are conditional variances generated using Excel
EXTERNAL RESERVES (er)	This is the amount of revenue saved by country from trading with other nations. It is measured in US billion dollars.	World Development Indicators (WDI), World Bank
MONEY SUPPLY RATIO (msr)	Money supply ratio is defined, given the GDP, as the nominal money supply (M^S) divided by the GDP at current market price.	CBN statistical bulletin
Interest rate spread (int)	This is the interest rate charged by banks on loans to private sector customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits.	International Financial Statistics and Data Files, IMF
EXCHANGE RATE (exr)	It is the price of a country currency expressed in terms of one unit of another country's currency. It is measure as the exchange rate of the naira to the dollar.	Figures for exchange rate derived from CBN statistical bulletin while volatility figures are conditional variances generated using EViews 7.0

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF RESULT

4.1   Presentation of Results

4.1.1   Test for Unit Root

Unit root test is carried out to determine if the variables are stationary or otherwise; and if stationary, to determine their order of integration (i.e. number of times they are to be differenced to achieve stationarity). In standard econometric analysis using a time series data, it is expedient to conduct a stationary test; this is due to the fact that most time series data are non-stationary. The unit root tests were conducted using the Augmented Dickey Fuller test (ADF) and the Phillips Perron (PP) test; these two were conducted for the time series employed in the study. The Augmented Dickey Fuller (ADF) result and the Phillips Perron (PP) test show that all the variables are integrated series of order I(1).

This is represented in the table below:

Table 4.1: ADF Test and Phillips Perron Test for Unit Root

Variable	Augumted Dickey fuller test (ADF)			Phillips Perron (PP)		
	Level	First Difference	OI	Level	First Difference	OI
LOG(RGDP)	0.724410	3.378729*	I(1)	1.799207	3.220256*	I(1)
EXRV	2.085117	8.731785*	I(1)	2.081184	14.17200*	I(1)
OILF	2.367864	5.009812*	I(1)	2.224945	7.622421*	I(1)
MSR	2.074479	5.470143*	I(1)	2.091706	6.001202*	I(1)
INT	1.376617	5.712973*	I(1)	1.335965	9.256027*	I(1)
ER	1.521167	3.896148*	I(1)	1.101055	3.621287*	I(1)

   * Statistical significance at 5% level. OI signifies order of integration.

4.1.2 Johansen Maximum Likelihood Test of Co-Integration

The major aim of this test is to ascertain whether a linear combination of the integrated variable is becomes stationary over the long-run, if this hold sway, it means cointegration exists among the variables, this further implies that there exist a long run relationship among the variables. The Johansen cointegration test commenced with the test for the number of cointegrating relations or rank using Johansen's maximum Eigen value and the trace test. The results are shown in the table below:

Table 4.2: Unrestricted Cointegration Rank Tests

No. of co-integrating equation	Trace Statistic		Maximum Eigen value	
	Statistic	5% Critical Value	Statistic	5% Critical Value
None *	200.1733	95.75366	85.30328	40.07757
At most 1 *	114.8700	69.81889	42.90722	33.87687
At most 2 *	71.96279	47.85613	35.05017	27.58434
At most 3 *	36.91262	29.79707	27.08646	21.13162
At most 4	9.826161	15.49471	5.736085	14.26460
At most 5 *	4.090076	3.841466	4.090076	3.841466

The two tests produced the same result. The trace test rejected the null hypothesis (H_0) that there is no co-integrating relationship between the variables and the test based on the maximum Eigen value also rejected the null hypothesis. They both indicate evidence supporting four co-integrating equation at the 5 percent level of significance. The result of the co-integration test showed that LOG(RGDP), EXRV, OILF, MSR, ER and INT have equilibrium condition which keeps them in proportion to each other in the long run. The exactly identifying estimates of the Johansen Maximum likelihood estimates show the co-integrating coefficients normalized to LOG(RGDP) as below. They are very useful in understanding the long run relationships among co-integrating variables.

Table 4.3: Normalized Co-integrating coefficients

VARIABLES	LOG(GDP)	EXRV	OILF	MSR	INT	ER
Coefficients	1.000000	-0.055183	1.111885	-0.345489	-0.029683	-0.263189
Standard Error		(0.03013)	(0.08438)	(0.08121)	(0.04346)	(0.02025)

4.1.3 Vector Error-Correction Model

The ECM coefficient is known as the speed of adjustment factor, it tells how fast the system adjusts to restore equilibrium. It captures the reconciliation of the variables over time from the position of disequilibrium to the period of equilibrium. The result of the vector correction model (VECM) is shown on the table below. However, the basic criteria for analyzing VECM are that the VECM must lie between 0 and 1; it must be negative for it to be meaningful, if it's positive there is no error correction and therefore diverges; and lastly the t-statistic must be significant.

Table 4.4: Vector Error Correction Model

VARIABLES	ECM(-1)	T-STATISTIC
D(LOG(RGDP))	-0.014552	-0.453694
D(EXRV)	-0.000632	-0.858534
D(OILF)	-0.001587	-0.602580
D(MSR)	0.001906	0.749520
D(INT)	0.002539	1.197905
	0.000548	0.376908

R-squared = 0.419140, F-statistic = 0.999116, Durbin-Watson stat = 2.100338

The speed of adjustment co-efficient for LOG(RGDP) is -0.014552. The VECM is correctly signed and in terms of magnitude it lies between 0 and 1. Satisfying these criteria signifies that the model has the capacity to correct errors generated in the immediate periods at it approaches its long run equilibrium path. Precisely the error correction model in this equation means that about 1.5 percent of errors generated

between each period are correlated in subsequent periods. Since errors are short lived in our model, we can conclude that there is a long run causality running from exchange rate volatility, oil price fluctuations, external reserves and interest rate to GDP. This means that exchange rate, oil price, external reserve and interest rate have influence on the dependent variable, GDP. Hence, it implies that the long run relationship obtained is sustainable and our result is reliable.

4.1.4   Variance Decomposition Analysis

The tables below show the variance decomposition. The essence of the variance decomposition is that it measures the proportion of forecast error variance in one variable explained by innovations in itself and the other variables. But it should be noted that the VECM was estimated with the sets of contemporaneous structural restrictions specified in the equations.

The variance decomposition in table 4.5 shows that the response of RGDP to a one standard deviation, shock to positive oil price changes was significantly different from zero. This result confirms the huge monetization of crude oil receipts and subsequent increase in RGDP as explained earlier. However, with the introduction of an oil stabilization fund by the central bank to save some part of oil windfalls, the picture may differ in future as shown in the table. This result contradicts that of Farzanegan and Markwardt (2008) where positive oil shocks accounted for an insignificant variation in government revenue.

Table 4.5: Variance Decomposition of RGDP

T	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	0.035580	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.062679	97.55132	0.324682	1.161816	0.182061	0.762620	0.017503
3	0.089323	91.30209	1.674627	5.610384	0.129037	0.928582	0.355276
4	0.113000	87.26255	1.557407	8.657013	0.113328	0.837485	1.572218
5	0.133280	85.33556	1.247917	10.17067	0.183125	0.959817	2.102903
6	0.151012	85.00055	1.307779	10.10990	0.233737	0.933345	2.414687
7	0.167558	85.00169	1.412548	9.829843	0.192137	0.878888	2.684897
8	0.183408	84.40789	1.490057	10.01663	0.165891	0.825706	3.093826
9	0.198666	83.70501	1.519646	10.31697	0.142964	0.783955	3.531453
10	0.212459	83.39140	1.452972	10.49945	0.163496	0.760788	3.731891

The variance decomposition suggests that shocks to RGDP as presented in table 4.6 below accounted for about 76 percent of shocks to exchange rate in the first period and decreasing in effects to about 59.7 percent in the 10th period. The contribution of oil fluctuations to the volatility in the exchange rate is not very significant. The result shows a less than 1 per cent contribution over the first two periods but increases gradually to approximately 4 percent in the 10th period. Shocks to interest rate contributed an average of 1 percent to exchange rate volatility over the whole 10 periods. On the whole, a high oil price may have given rise to RGDP that appreciates the exchange rate, low oil price depreciates exchange rate.

Table 4.6: Variance Decomposition of Exchange Rate Volatility

T	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	13.48015	23.67173	76.32827	0.000000	0.000000	0.000000	0.000000
2	14.30293	25.52975	73.23839	0.000345	0.099769	0.262468	0.869278
3	15.92629	27.71988	62.83486	3.994298	1.474021	1.410009	2.566928
4	17.74707	26.63313	64.01542	3.318589	1.295110	1.140519	3.597236
5	19.03334	27.82547	62.87842	2.939982	1.139248	1.188644	4.028238
6	20.33000	26.59187	63.28605	3.269121	1.447089	1.198880	4.206989
7	21.76877	26.59645	62.93514	4.402242	1.304950	1.089636	3.671576
8	22.54226	26.79923	60.95630	5.044890	1.842787	1.177072	4.179722
9	23.52384	26.98840	59.48431	4.708028	2.410449	1.233318	5.175499
10	24.70884	26.73455	59.71212	4.315886	2.204699	1.177096	5.855653

The result of the variance decomposition in table 4.7 below indicates that oil price fluctuations significantly affect economic performance in Nigeria. This is in line with the expectations that oil price fluctuations tend to lower RGDP (Gordon, 1989); impacts significantly on industrial output growth Farzanegan and Markwardt, 2008) and confirms the findings of (Barsky and Kilian, 2004 and Olomola, 2006) and that oil price fluctuations had marginal impact on output. Specifically, about 2.8 percent of the shocks in the RGDP in the first period was as a result of variations in oil price fluctuations. Meanwhile, the money supply ratio increased significantly from the third period. It can be depicted from the table that there is a negative relationship between MSR and oil price.

Table 4.7: Variance Decomposition of Oil Price Fluctuations

T	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	4.362526	2.777270	23.16432	74.05841	0.000000	0.000000	0.000000
2	5.223021	2.123642	16.41721	58.32867	0.312670	2.319739	20.49806
3	5.660680	2.879264	14.44957	52.47027	7.625317	2.031239	20.54434
4	8.014651	1.447867	13.36751	26.70999	18.94105	3.857233	35.67634
5	9.169115	1.127786	10.95088	28.82942	15.13011	3.594393	40.36741
6	9.920640	0.963654	12.87479	26.28932	16.65525	3.645287	39.57170
7	10.21346	1.170204	12.40474	27.77269	17.03439	3.845913	37.77207
8	10.92227	1.158227	12.34127	27.09163	19.89061	4.317902	35.20035
9	12.50641	1.096445	11.86848	20.95145	24.91703	4.072612	37.09397
10	13.65770	0.923333	9.961352	22.37771	21.79126	3.834641	41.11170

From table 4.8 below, the response of MSR to volatility in oil price is positive and lasts until the end period. The positive response of MSR to positive shocks in external reserves acts as a built-in stabilizer, mitigating the inflationary effects of interest rate after positive oil price fluctuations.

Table 4.8: Variance Decomposition of Money Supply Ratio

T	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	3.427138	1.921070	4.878399	37.53928	55.66125	0.000000	0.000000
2	5.961417	0.662122	3.073890	26.78257	47.03042	0.481854	21.96914
3	7.079417	0.617080	2.339747	23.55452	43.01458	0.351801	30.12227
4	8.051450	0.671595	1.848431	27.11935	37.11350	0.397060	32.85006
5	8.719090	0.633034	1.826618	28.99412	33.21135	0.657501	34.67737
6	9.052458	0.619506	2.365020	29.06948	31.96451	0.738111	35.24338
7	9.539068	0.665966	2.420952	26.56265	33.58856	0.836413	35.92545
8	10.55187	0.590784	2.746851	23.69079	36.37561	0.900816	35.69516
9	11.67132	0.506704	2.275299	24.92755	34.26143	0.910204	37.11881
10	12.30562	0.468623	2.451597	27.13872	31.22114	0.886207	37.83372

The shock brought by interest rate to RGDP is not significant as shown in the table below. However, exchange rate volatility and money supply ratio have positive influence on interest rate.

Table 4.9: Variance Decomposition of Interest rate

T	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	4.124463	0.822813	14.93845	11.82927	41.26998	31.13948	0.000000
2	4.985559	2.517305	10.23046	18.93319	35.94884	30.27923	2.090967
3	5.848879	2.592530	7.973411	28.88326	30.29071	27.50064	2.759449
4	6.785271	2.172785	10.16365	29.01967	29.96636	26.59871	2.078818
5	7.444707	1.874281	8.594277	29.20088	31.56567	26.98860	1.776287
6	7.803519	1.707289	8.025482	29.51969	31.32979	27.79117	1.626570
7	8.391319	1.500360	7.572775	32.24587	29.55239	27.52401	1.604592
8	8.944232	1.335751	7.041082	33.52083	29.44278	27.02390	1.635655
9	9.514163	1.196348	7.014467	33.34199	30.34700	26.64197	1.458227
10	9.926591	1.112958	6.845559	32.99347	30.89320	26.81483	1.339983

From table 4.10 below, the response of external reserve to volatility in exchange rate is negative and lasts until the end period. The increasing response of external reserve for the first period after initial shock is significantly different from zero. The negative response

of external reserve to positive shocks acts as a built-in stabilizer, mitigating the inflationary effects of interest rate after positive oil price fluctuations. In essence, low oil price fluctuations have negative effect on the external reserve, while exchange rate volatility contributes to fluctuation in external reserve. However, external reserve has no significant contribution to RGDP but there exists a positive relationship between them.

Table 4.10: Variance Decomposition of External Reserves

T	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	4.124463	0.822813	14.93845	11.82927	41.26998	31.13948	0.000000
2	4.985559	2.517305	10.23046	18.93319	35.94884	30.27923	2.090967
3	5.848879	2.592530	7.973411	28.88326	30.29071	27.50064	2.759449
4	6.785271	2.172785	10.16365	29.01967	29.96636	26.59871	2.078818
5	7.444707	1.874281	8.594277	29.20088	31.56567	26.98860	1.776287
6	7.803519	1.707289	8.025482	29.51969	31.32979	27.79117	1.626570
7	8.391319	1.500360	7.572775	32.24587	29.55239	27.52401	1.604592
8	8.944232	1.335751	7.041082	33.52083	29.44278	27.02390	1.635655
9	9.514163	1.196348	7.014467	33.34199	30.34700	26.64197	1.458227
10	9.926591	1.112958	6.845559	32.99347	30.89320	26.81483	1.339983

4.2   Discussion of Results

The goodness of fit of the model result shown above is rather inefficient. Firstly, the R-squared result indicates that only about 30.65 percent of the short run systematic variation in RGDP is explained by the independent variables and the ECM. This shows that the pattern of movement in RGDP has not been effectively captured by the specified ECM representation. The overall fit of the model is also impressive, with an F-statistics value of 0.999. The F-statistic fails the significance test at the 5 percent level of significance. Wald test showed that there is no short run causality running from the independent variables to RGDP. None of the coefficient is significantly different from zero. This goes

to show that in the short run, none of these variables plays any significant role in predicting the RGDP. The DW-statistic reveals absence of autocorrelation in the model.

The error term is negative and passes the significance test at the 5 percent level. However, the coefficient of the error term is very low and it shows that adjustment to long run equilibrium is slow. Though, there exists long term relationship among most of the variables, there is no short term relationship among them.

From the Variance Decomposition, it was revealed that the Nigerian economy is very vulnerable to oil price fluctuations. The exchange rate falls significantly (domestic currency depreciates) for the entire period, and base on the economic situation of the country, the exchange rate is still falling. This is worrisome and calls for concern by policy-makers. The implication of this finding is that there is likelihood for potential currency crisis after a shock occurs especially negative shock in the international oil market just as it is fluctuating around $50/barrel at present. This has also resulted to increase in the price of imports, and despite the traditional belief that this should boost the non-oil sector; the findings from the study are different.

4.3   Comparison of Result with Other Findings

Broadly speaking, it was discovered from the findings that the impact of oil price fluctuations on most of the macroeconomic variables in Nigeria is at best minimal. Specifically, the results of the variance decomposition analysis to a large extent confirmed that oil price fluctuations accounted for less effect of the variations in RGDP, external reserve and interest rate.

On the whole, a high oil price fluctuation gives rise to increased RGDP that appreciates the exchange rate, low oil price fluctuation resulted to reduced RGDP. This, arguably, makes a case for the unimportance of thresholds in the oil price macroeconomic relationship in the economic performance of Nigeria. This conclusion is not different from those of earlier studies like Ayadi et al (2000), Ayadi (2005) and Olomola and Adejumo (2006) who found oil price fluctuations to have minimal impacts on the Nigerian economy.

Due to increased imports of refined oil products and the activities of the marketers and the stakeholders in the oil sector, inflationary pressures are inevitable and are pronounced. It should therefore be noted that when a country's interest rate is high, it attracts investment from abroad which increases its exchange rate but when inflation in the country is high like in Nigeria, it mitigates the influence of interest rate on exchange rate.

On the whole, the picture paints an unstable future for the Nigerian economy following oil price fluctuations. There is a strong need for policy makers to focus on policy that will strengthen/stabilize the macroeconomic structure of the Nigerian economy with specific focus on; alternative sources of government revenue (reduction of dependence on oil proceeds), reduction in monetization of crude oil receipts (fiscal discipline), aggressive saving of proceeds from oil booms in future in order to withstand vicissitudes of oil shocks in future.

Some researchers have carried out research the issue of oil price and exchange rate further. Empirical analysis carried out on 33 oil exporting countries show that countries

with high bureaucratic quality and strong and impartial legal system have real exchange rate that are affected less by oil price. Also according to Mordi and Adebiyi (2010) the asymmetric effect of oil price changes on economic activity is different for both oil price increase and oil price decrease. Patti and Ratti (2007) shows that oil price increases have a greater influence on the economy than a decrease in oil price.

CHAPTER FIVE

SUMMARY, RECOMMENDATION AND CONCLUSION

5.1   Summary

This research study set to find out if oil price fluctuations and exchange rate volatility have a significant influence on the economic performance of Nigeria over the periods 1981 - 2015 by analyzing time series data. It also looks at other factors that can influence the performance of Nigeria like external reserves and interest rate.

To achieve these objectives, a model was formulated based on GARCH model. In the model, RRGDP was the dependent variable and the independent variables were oil price fluctuations, exchange rate volatility, external reserves and interest rate. Exchange rate volatility and oil price shock were derived using GARCH model, and VECM was used to estimate the data. After the review of relevant literature and the necessary empirical analyses it was observed that oil price increase gives rise to increased RGDP that appreciates the exchange rate, oil price decrease resulted to reduced RGDP. This study also examines the dynamic relationship between oil price volatility and the exchange rate in Nigeria.

5.2   Conclusion

This analysis was motivated by the fact that the Nigerian economy depends heavily on crude oil, hence volatility in its prices and volatility in its exchange rate have significantly affected major economic variables. The study however, reveals that though most of the movements in exchange rate are due to changes in the permanent

components, dynamic short run impact of oil price volatility on exchange rate does not hold. This may be due to the fact that transactions on crude oil are not primarily carried out using the naira and so the fluctuation in prices may not be easily transmitted to the naira exchange rate in the short run - as there was no short run causality between them. However, both the exchange rate volatility and oil price shock have impact on economic performance.

The lesson here is that permanent adjustment in exchange rate of the naira should be the main issue of concern when oil prices are fluctuating. Moreover, adequate measures should be put in place to de-link long run movements of the naira exchange rate from oil price changes. This is because oil prices are highly volatile and very unsettled.

5.3   Policy Recommendations

In the words of Jin (2008), exchange rate volatility increases the risk and uncertainty of external transactions and predisposes a country to exchange rate related risks. For the purpose of this research work, the following strategies are suggested to reduce exchange rate volatility in Nigeria:

1. Ketil (2004) research on the effect of external reserves on exchange rate volatility after enforcing controls for the endogeneity induced by the exchange rate regime that can affect both reserves and exchange rate showed that a high level of external reserves reduce exchange rate volatility. Therefore Nigeria government should take advantage of increases in the price of oil price to improve Nigeria's external reserves and reduce exchange rate volatility.

2. Research carried out on exchange rate volatility by Adeoye and Atanda showed that there is presence and persistency of volatility shocks in the nominal and real exchange rates for naira vis-à-vis U.S dollar in Nigeria between 1986 and 2008. This implies that the conservative monetary management policies put in place for stabilizing the exchange rate of a unit U.S dollar to naira over the years has been ineffective. There is a need for FOREX management measures particularly in terms of meeting the high demand for foreign currency which characterized and order the performance and trade balance and overall economic performance in Nigeria. There is also the need for sound monetary policy to attain stability in the exchange rate.

3. According to the Brahmbhatt et al (2010), resources that a gift by God to a country prices and revenues are a lot unpredictable because of the small diminutive supply elasticity of natural resource yield. Assuming government expenditure is closely aligned to revenue from natural resource, the revenue will become more unpredictable. Expenditure instability, will in turn cause instability in the real exchange rate. A bulky body of empirical work records the terrible effect of the impact of economic volatility on investment and growth. Therefore Nigeria government should look for new ways to diversify the economy from dependence on oil and explore other sectors like manufacturing sector and agricultural sector to reduce volatility in the economy and the overall effect on it.

4. Lastly, higher revenue gotten from increases in oil prices should be invested different areas of the economy the economy as the exchange rate of a country is affected by state of the economy.

5.4 Limitations to the Study

The limitations of this study were mostly data related. I originally wanted to use labour force and capital stock as one of the independent variable but the data available was only from the year 1990 to 2011. Another limitation was error in estimation when initially I originally wanted to use GARCH for the entire analysis, however, it was not significant. Then, I decided to use GARCH to generate the volatility in exchange rate and fluctuations in oil price. Variance Decomposition under VECM helped in identifying the various shocks as expected. More so, I found it hard to get quarterly data of oil prices from 1981 to 1990, otherwise, large volume of data would have been used to check the effect of oil fluctuations experienced in the past.

5.5 Suggestions for Further Study

An interesting variant to this study would be an in-depth review of past approaches to controlling or reducing exchange rate volatility in countries that have Dutch disease and lessons that can be learnt to develop strategies and approaches that will reduce exchange rate volatility in Nigeria.

Reference

Akide, A., 2007. Growth implications of oil price variations. A case study of Nigeria, 8(2): 20-27.

Aliyu S (2009). Oil price shocks and the macro economy of Nigeria: A non-linear approach. Research Journal of International Studies, (10): 4-18.

Al-Ezzee, I. (2011). Real influences of Real Exchange rate and Oil price changes on the growth of real GDP: Case of Bahrain, International Conference of Management and service science IPEDR vol.8

Amano, R., & Norden, S. (1995). Exchange Rate and Oil Price, Bank of Canada working Paper no.95-8.

Andersen, T. G.; Bollerslev, T., Diebold, F. X. and Labys, P. (2004); "Modeling and Forecasting Realized Volatility." *Econometrica*, *71*(2), pp. 579-625.

Apere OT and Ijeoma AM (2013). Macroeconomic Impact of Oil Price Levels and Volatility in Nigeria, Int. J. Acad. Res. Econ. Manage. Sci. 2(4):15-25.

Asinya, F. A. and Takon, N. (2014) "Exchange rate depreciation and government policy is Nigeria: An Empirical Evidence". The Business and Management Review. Vol. 4, no. 3, pp. 161-170.

Balke, Y., 1996. Determinants of economic growth and stagnation in oil rich venezuela. Dutch Journal of Economics, 3(1): 3-6.

Beckmann, J., & Czudaj, R. (2012) Oil price and U.s dollar exchange rate dynamics

Bjørnland, Hilde C. and Leif Anders Thorsrud (2013), "Bloom of Gloom? Examining the Dutch Disease in a Two-Speed Economy," Center for Applied Macro- and Petroleum Economics Working Paper No. 6/2013.

Chong, L. L. and Tan, H. B. (2008) "Exchange Rate Risk and Macroeconomic Fundamentals: Evidence from Four Neighbouring Southeast Asian Economies". International Research Journal of Finance and Economics. Issue 16, pp. 88-95.

Chukwuma Ogbonna (2011) "The Impact of Exchange Rate Variations on Trade Balance: Evidence from Nigeria, 1970-2005", JORIND 9(2) December, 2011. ISSN 1596 – 8308. www.transcampus.org., www.ajol.info/journals/jorind

Edelstein, Paul and Lutz Kilian (2007), "The Response of Business Fixed Investment to Changes in Energy Prices: A Test of Some Hypotheses about the Transmission of Energy Price Shocks," The B.E. Journal of Macroeconomics, 7(1) (Contributions), 1-41. Available at: http://www.bepress.com/bejm/vol7/iss1/art35.

Edelstein, Paul and Lutz Kilian (2009), "How Sensitive are Consumer Expenditures to Retail Energy Prices?" Journal of Monetary Economics, 56(6), 766-779.

Englama, A., Duke, O. O., Ogunleye, S., & Isma F. U. (2010). Oil Price and Exchange rate Volatility in Nigeria: An Empirical observation.

Favero, Carlo A., M. Hashem Pesaran, and Sunil Sharma (1994), "A Duration Model of Irreversible Oil Investment: Theory and Empirical Evidence," Journal of Applied Econometrics, 9(S1), S95-112.

Ferderer, J., 1996. Oil price volatility and the macro economy. Journal of Macroeconomics, 18(2): 1-26.

Gisser, P., 1985. Oil price changes and government revenue effect. Bangladesh Journal of Economics, 3(6): 2-4.

Goodwin, H., 1985. Oil price changes and its economic and social reactionary effect: An appraisal. Switz Journal of Social Economics, 4(2): 50-53.

Hamilton, J.D. (2008), "Oil and the Macroeconomy," in S. Durlauf and L. Blume (eds), *The New Palgrave Dictionary of Economics*, 2nd ed., Palgrave MacMillan Ltd.

Hamilton, J.D (1983). Oil and the macro economy since World War II. Journal of political economy, 96: 593-617.

Hooker, C., 1986. Effects of oil price and exchange rate variations on government revenue in china. Journal of Economics, 2(1): 2-3.

Hooker, M., 2002. Are oil shocks inflationary? Asymmetric and non-linear specifications versus changes in regime. Journal of Money, Credit and Banking, 34(2): 540-561.

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

Kandil, M. (2004). "Exchange rate fluctuations and economic activity in Developing countries: theory and evidence". Journal of Economic Development. Vol. 29, no. 1, pp. 85-108.

Kilian, L. (2014) "Oil Price Shocks: Causes and Consequences". University of Michigan and CEPR, Department of Economics. JEL Code: Q43

Korhonen, I. and T. Juurikkala (2007). Equilibrium exchange rates in oil-dependent Countries, BOFIT Discussion Papers 8/2007, Bank of Finland, Institute for Economies in Transition

Laser, Y., 1987. Interest, inflation, growth and the direction of the hong-kong economy. Chinese Economic Reviews 120.

Mark, G., T. Olsen and Y. Mysen, 1994. Impact of oil price variation on the growth prospects of african economies. African economic writer's publication, 2(5): 8083.

McKillop, A. (2004). Oil Prices, Economic Growth and World Oil Demand, Middle East Economic Survey, vol. xlvii No 35.

Nnnanna, O.J and I. Masha (2003) "Oil price Fluctuation, macroeconomic behaviour and Policy Response in Nigeria: A VAR Specification", *West African Journal of Monetary and Economic Integration.* Vol. 3, No. 1, pp. 85-113.

Obadan, M. I (1993) "Overview of Nigeria's exchange Rate policy management service, the Structural Adjustment Programme", CBN Economic and Financial Review 34(4)

Odularu, G.O. (2007). Crude Oil and Nigeria Economic Performance.

Okonju, C., (2009). Oil price fluctuations and its effects on growth. Journal of historical economics, 2(5): 15-18.

Olaokun O (2000). Oil price shock effects on economies of African Nations. African Economic Journal, 3(10): 30-39.

Olomola, P.A. (2006) "Oil Price shock and aggregate Economic activity in Nigeria" *African Economic and Business Review* Vol.4No.2, fall 2006

Omisakin AO (2008). Oil Price Shocks and the Nigerian Economy: A Forecast Error Variance Decomposition Analysis. Journal of Economics Theory 2(4): 124-130

Oriakhi DE And Iyoha DO (2013). Oil Price Volatility and Its Consequences on the Growth of the Nigerian Economy: An Examination (1970-2010). Asian Economic and Financial Review, 2013, 3(5):683-702.

Plante, M. (2008). Oil price shocks and Exchange rate management: the implications of consumer durables for the small open economy

Premium Times (2015), "Nigeria's oil revenue rises by 4.3% in second quarter 2014", May 5, 2015.

Salim R and Rafiq S (2013). The impact of crude oil price volatility on selected Asian emerging economies. In: Hoque T ed. Global Business and Social Science Research Conference, Beijing, China, 1–33

Trung, V. & Vinh, N., (2011). The Impact of Oil prices, Real Effective exchange rate and Inflation on Economic Activity: Novel Evidence for Vietnam

Vanguard (2015) "Oil crash, dwindling revenue threaten Nigeria's 2015 budget", May 5, 2015 at 8:05PM News.

Wakeford J. (2006). "The impact of oil price Shocks on the South African Macroeconomy: History and Prospects", in *Accelerated and Shared Growth in South Africa: Determinants, constraints and opportunities*. 18-20 October, 2006.

APPENDICE

ECONOMIC VARIABLES FOR ANALYSIS

YEAR	RGDP	EXR	OILP	MRS	INT	ER
1981	15258.00	0.6100	37.07	15.3	7.75	4.68
1982	14985.08	0.6729	33.59	15.6	10.25	1.03
1983	13849.73	0.7241	29.35	16.1	10.00	0.60
1984	13779.26	0.7649	28.87	17.3	12.50	0.46
1985	14953.91	0.8938	27.00	16.6	9.25	0.98
1986	15237.99	2.0206	15.04	17.7	10.50	1.58
1987	15263.93	4.0179	19.17	14.3	17.50	5.21
1988	16215.37	4.5367	15.98	14.6	16.50	6.02
1989	17294.68	7.3916	19.64	12.0	26.80	3.66
1990	19305.63	8.0378	24.47	11.2	25.50	3.36
1991	19199.06	9.9095	21.50	13.8	20.01	4.05
1992	19620.19	17.2984	20.56	12.7	29.80	2.78
1993	19927.99	22.0511	18.45	15.2	18.32	4.90
1994	19979.12	21.8861	17.19	16.5	21.00	7.94
1995	20353.20	21.8861	18.44	9.9	20.18	2.70
1996	21177.92	21.8861	22.11	8.6	19.74	2.16
1997	21789.10	21.8861	20.61	9.9	13.54	6.12
1998	22332.87	21.8861	14.45	12.2	18.29	7.81
1999	22449.41	92.6934	19.26	13.4	21.32	5.31
2000	23688.28	102.1052	30.30	13.1	17.98	7.59
2001	25267.54	111.9433	25.95	18.4	18.29	10.28
2002	28957.71	120.9702	26.11	19.3	24.85	8.59
2003	31709.45	129.3565	31.12	19.7	20.71	7.64
2004	35020.55	133.5004	41.44	18.7	19.18	12.06
2005	37474.95	132.1470	56.49	18.1	17.95	24.32

2006	39995.50	128.6516	66.02	20.5	17.26	37.46
2007	42922.41	125.8331	74.48	24.8	16.94	45.39
2008	46012.52	118.5669	101.141	33.0	15.14	58.47
2009	49856.10	148.8802	63.9	38.0	18.99	44.70
2010	54612.26	150.2980	80.9167	20.2	17.59	37.36
2011	57511.04	153.8616	113.76	19.3	16.02	32.58
2012	59929.89	157.4994	113.47	19.4	16.79	38.09
2013	63218.72	157.3112	110.987	18.9	16.72	45.61
2014	67152.79	158.5526	100.35	19.9	16.55	37.22
2015	69023.93	196.5000	54.835	20.1	17.02	30.131

RESULTS ANALYSIS

Null Hypothesis: ER has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.521167	0.5106
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ER(-1)	-0.089298	0.058704	-1.521167	0.1387
D(ER(-1))	0.383554	0.174701	2.195493	0.0360
C	1.894784	1.321913	1.433365	0.1621

R-squared	0.164878	Mean dependent var	0.881939
Adjusted R-squared	0.109203	S.D. dependent var	5.942066
S.E. of regression	5.608242	Akaike info criterion	6.372860
Sum squared resid	943.5715	Schwarz criterion	6.508906
Log likelihood	-102.1522	Hannan-Quinn criter.	6.418635
F-statistic	2.961452	Durbin-Watson stat	1.917246
Prob(F-statistic)	0.067027		

Null Hypothesis: D(ER) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.896148	0.0053
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	

	10% level	-2.615817

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ER(-1))	-0.676785	0.173706	-3.896148	0.0005
C	0.563255	1.011353	0.556932	0.5816

R-squared	0.328713	Mean dependent var	-0.104044
Adjusted R-squared	0.307059	S.D. dependent var	6.878485
S.E. of regression	5.725863	Akaike info criterion	6.386555
Sum squared resid	1016.351	Schwarz criterion	6.477253
Log likelihood	-103.3782	Hannan-Quinn criter.	6.417072
F-statistic	15.17997	Durbin-Watson stat	1.848625
Prob(F-statistic)	0.000487		

Null Hypothesis: ER has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.101055	0.7040
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	32.97150
HAC corrected variance (Bartlett kernel)	46.17020

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ER(-1)	-0.054397	0.059978	-0.906949	0.3712
C	1.578408	1.366651	1.154945	0.2567

R-squared	0.025061	Mean dependent var	0.748474
Adjusted R-squared	-0.005406	S.D. dependent var	5.902868
S.E. of regression	5.918802	Akaike info criterion	6.451168
Sum squared resid	1121.031	Schwarz criterion	6.540954
Log likelihood	-107.6699	Hannan-Quinn criter.	6.481787
F-statistic	0.822557	Durbin-Watson stat	1.282149
Prob(F-statistic)	0.371213		

Null Hypothesis: D(ER) has a unit root

Exogenous: Constant
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.621287	0.0106
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	30.79850
HAC corrected variance (Bartlett kernel)	19.76715

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ER(-1))	-0.676785	0.173706	-3.896148	0.0005
C	0.563255	1.011353	0.556932	0.5816

R-squared	0.328713	Mean dependent var	-0.104044
Adjusted R-squared	0.307059	S.D. dependent var	6.878485
S.E. of regression	5.725863	Akaike info criterion	6.386555
Sum squared resid	1016.351	Schwarz criterion	6.477253
Log likelihood	-103.3782	Hannan-Quinn criter.	6.417072
F-statistic	15.17997	Durbin-Watson stat	1.848625
Prob(F-statistic)	0.000487		

Null Hypothesis: EXRV has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.085117	0.0002
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXRV(-1)	-0.976124	0.191957	-5.085117	0.0000
C	4.616177	1.874738	2.462306	0.0194

R-squared	0.446926	Mean dependent var	0.787886
Adjusted R-squared	0.429642	S.D. dependent var	13.25623
S.E. of regression	10.01137	Akaike info criterion	7.502343

Sum squared resid	3207.282	Schwarz criterion	7.592129
Log likelihood	-125.5398	Hannan-Quinn criter.	7.532962
F-statistic	25.85842	Durbin-Watson stat	1.852540
Prob(F-statistic)	0.000016		

Null Hypothesis: D(EXRV) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.731785	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXRV(-1))	-1.482623	0.169796	-8.731785	0.0000
C	0.823954	2.120434	0.388578	0.7002

R-squared	0.710940	Mean dependent var	0.786524
Adjusted R-squared	0.701615	S.D. dependent var	22.29937
S.E. of regression	12.18094	Akaike info criterion	7.896314
Sum squared resid	4599.635	Schwarz criterion	7.987011
Log likelihood	-128.2892	Hannan-Quinn criter.	7.926831
F-statistic	76.24408	Durbin-Watson stat	2.130920
Prob(F-statistic)	0.000000		

Null Hypothesis: EXRV has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.081184	0.0002
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	94.33183
HAC corrected variance (Bartlett kernel)	93.73455

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXRV(-1)	-0.976124	0.191957	-5.085117	0.0000
C	4.616177	1.874738	2.462306	0.0194

R-squared	0.446926	Mean dependent var		0.787886
Adjusted R-squared	0.429642	S.D. dependent var		13.25623
S.E. of regression	10.01137	Akaike info criterion		7.502343
Sum squared resid	3207.282	Schwarz criterion		7.592129
Log likelihood	-125.5398	Hannan-Quinn criter.		7.532962
F-statistic	25.85842	Durbin-Watson stat		1.852540
Prob(F-statistic)	0.000016			

Null Hypothesis: D(EXRV) has a unit root
Exogenous: Constant
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.17200	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	139.3829
HAC corrected variance (Bartlett kernel)	30.28895

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXRV(-1))	-1.482623	0.169796	-8.731785	0.0000
C	0.823954	2.120434	0.388578	0.7002

R-squared	0.710940	Mean dependent var		0.786524
Adjusted R-squared	0.701615	S.D. dependent var		22.29937
S.E. of regression	12.18094	Akaike info criterion		7.896314
Sum squared resid	4599.635	Schwarz criterion		7.987011
Log likelihood	-128.2892	Hannan-Quinn criter.		7.926831
F-statistic	76.24408	Durbin-Watson stat		2.130920
Prob(F-statistic)	0.000000			

Null Hypothesis: LOG(RGDP) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic			0.724410	0.9909
Test critical values:	1% level		-3.646342	
	5% level		-2.954021	
	10% level		-2.615817	

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(RGDP(-1))	0.010868	0.015002	0.724410	0.4744
D(LOG(RGDP(-1)))	0.431689	0.174281	2.476962	0.0191
C	-0.083765	0.149111	-0.561764	0.5784

R-squared	0.274526	Mean dependent var		0.046285
Adjusted R-squared	0.226162	S.D. dependent var		0.041594
S.E. of regression	0.036590	Akaike info criterion		-3.691592
Sum squared resid	0.040164	Schwarz criterion		-3.555546
Log likelihood	63.91127	Hannan-Quinn criter.		-3.645817
F-statistic	5.676149	Durbin-Watson stat		1.906909
Prob(F-statistic)	0.008116			

Null Hypothesis: D(LOG(RGDP)) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.378729	0.0191
Test critical values:	1% level		-3.646342	
	5% level		-2.954021	
	10% level		-2.615817	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(RGDP(-1)))	-0.504682	0.149370	-3.378729	0.0020
C	0.024043	0.009216	2.608726	0.0139

R-squared	0.269140	Mean dependent var		0.001380
Adjusted R-squared	0.245564	S.D. dependent var		0.041802
S.E. of regression	0.036308	Akaike info criterion		-3.734857
Sum squared resid	0.040867	Schwarz criterion		-3.644160
Log likelihood	63.62514	Hannan-Quinn criter.		-3.704340
F-statistic	11.41581	Durbin-Watson stat		1.978405
Prob(F-statistic)	0.001980			

Null Hypothesis: LOG(RGDP) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*

		Phillips-Perron test statistic	1.799207	0.9996
Test critical values:	1% level		-3.639407	
	5% level		-2.951125	
	10% level		-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.001486
HAC corrected variance (Bartlett kernel)	0.002305

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(RGDP(-1))	0.032699	0.013822	2.365742	0.0242
C	-0.288043	0.140686	-2.047419	0.0489

R-squared	0.148862	Mean dependent var	0.044393
Adjusted R-squared	0.122264	S.D. dependent var	0.042419
S.E. of regression	0.039742	Akaike info criterion	-3.555818
Sum squared resid	0.050540	Schwarz criterion	-3.466032
Log likelihood	62.44891	Hannan-Quinn criter.	-3.525199
F-statistic	5.596734	Durbin-Watson stat	1.146202
Prob(F-statistic)	0.024218		

Null Hypothesis: D(LOG(RGDP)) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.220256	0.0277
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.001238
HAC corrected variance (Bartlett kernel)	0.000946

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(RGDP(-1)))	-0.504682	0.149370	-3.378729	0.0020
C	0.024043	0.009216	2.608726	0.0139

R-squared	0.269140	Mean dependent var	0.001380
Adjusted R-squared	0.245564	S.D. dependent var	0.041802
S.E. of regression	0.036308	Akaike info criterion	-3.734857
Sum squared resid	0.040867	Schwarz criterion	-3.644160
Log likelihood	63.62514	Hannan-Quinn criter.	-3.704340
F-statistic	11.41581	Durbin-Watson stat	1.978405

		t-Statistic	Prob.
Prob(F-statistic)		0.001980	

Null Hypothesis: INT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.376617	0.0190
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT(-1)	-0.451969	0.133853	-3.376617	0.0019
C	8.244623	2.447615	3.368432	0.0020

R-squared	0.262699	Mean dependent var	0.272647
Adjusted R-squared	0.239658	S.D. dependent var	4.317160
S.E. of regression	3.764459	Akaike info criterion	5.546108
Sum squared resid	453.4768	Schwarz criterion	5.635894
Log likelihood	-92.28383	Hannan-Quinn criter.	5.576727
F-statistic	11.40154	Durbin-Watson stat	2.426799
Prob(F-statistic)	0.001941		

Null Hypothesis: D(INT) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.712973	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INT(-1))	-1.764337	0.308830	-5.712973	0.0000
D(INT(-1),2)	0.211834	0.180653	1.172606	0.2505
C	0.387529	0.708876	0.546680	0.5888

R-squared	0.740204	Mean dependent var	0.022500
Adjusted R-squared	0.722287	S.D. dependent var	7.567692
S.E. of regression	3.988059	Akaike info criterion	5.693546

Sum squared resid	461.2339	Schwarz criterion	5.830959
Log likelihood	-88.09674	Hannan-Quinn criter.	5.739095
F-statistic	41.31301	Durbin-Watson stat	1.896097
Prob(F-statistic)	0.000000		

Null Hypothesis: INT has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.335965	0.0209
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	13.33755
HAC corrected variance (Bartlett kernel)	12.26293

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT(-1)	-0.451969	0.133853	-3.376617	0.0019
C	8.244623	2.447615	3.368432	0.0020

R-squared	0.262699	Mean dependent var	0.272647
Adjusted R-squared	0.239658	S.D. dependent var	4.317160
S.E. of regression	3.764459	Akaike info criterion	5.546108
Sum squared resid	453.4768	Schwarz criterion	5.635894
Log likelihood	-92.28383	Hannan-Quinn criter.	5.576727
F-statistic	11.40154	Durbin-Watson stat	2.426799
Prob(F-statistic)	0.001941		

Null Hypothesis: D(INT) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.256027	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	14.64928
HAC corrected variance (Bartlett kernel)	13.77944

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INT(-1))	-1.453550	0.159237	-9.128229	0.0000
C	0.326098	0.688738	0.473472	0.6392

R-squared	0.728842	Mean dependent var	-0.061515
Adjusted R-squared	0.720095	S.D. dependent var	7.464128
S.E. of regression	3.948974	Akaike info criterion	5.643481
Sum squared resid	483.4263	Schwarz criterion	5.734178
Log likelihood	-91.11743	Hannan-Quinn criter.	5.673997
F-statistic	83.32456	Durbin-Watson stat	2.197267
Prob(F-statistic)	0.000000		

Null Hypothesis: MSR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.074479	0.2557
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MRS(-1)	-0.239033	0.115226	-2.074479	0.0462
C	4.245434	2.089496	2.031798	0.0505

R-squared	0.118541	Mean dependent var	0.139947
Adjusted R-squared	0.090996	S.D. dependent var	4.099775
S.E. of regression	3.908795	Akaike info criterion	5.621358
Sum squared resid	488.9178	Schwarz criterion	5.711144
Log likelihood	-93.56308	Hannan-Quinn criter.	5.651978
F-statistic	4.303461	Durbin-Watson stat	1.760882
Prob(F-statistic)	0.046160		

Null Hypothesis: D(MSR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.470143	0.0001
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	

| | 10% level | | -2.615817 | |

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MRS(-1))	-0.982303	0.179575	-5.470143	0.0000
C	0.133073	0.736621	0.180653	0.8578

R-squared	0.491156	Mean dependent var	-0.001300
Adjusted R-squared	0.474742	S.D. dependent var	5.835433
S.E. of regression	4.229211	Akaike info criterion	5.780600
Sum squared resid	554.4730	Schwarz criterion	5.871297
Log likelihood	-93.37990	Hannan-Quinn criter.	5.811117
F-statistic	29.92246	Durbin-Watson stat	1.992085
Prob(F-statistic)	0.000006		

Null Hypothesis: MSR has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.091706	0.2490
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

Residual variance (no correction)	14.37993
HAC corrected variance (Bartlett kernel)	14.66811

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MSR(-1)	-0.239033	0.115226	-2.074479	0.0462
C	4.245434	2.089496	2.031798	0.0505

R-squared	0.118541	Mean dependent var	0.139947
Adjusted R-squared	0.090996	S.D. dependent var	4.099775
S.E. of regression	3.908795	Akaike info criterion	5.621358
Sum squared resid	488.9178	Schwarz criterion	5.711144
Log likelihood	-93.56308	Hannan-Quinn criter.	5.651978
F-statistic	4.303461	Durbin-Watson stat	1.760882
Prob(F-statistic)	0.046160		

Null Hypothesis: D(MSR) has a unit root
Exogenous: Constant
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*

			-6.001202	0.0000
Phillips-Perron test statistic			-6.001202	0.0000
Test critical values:	1% level		-3.646342	
	5% level		-2.954021	
	10% level		-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	16.80221
HAC corrected variance (Bartlett kernel)	6.303279

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MSR(-1))	-0.982303	0.179575	-5.470143	0.0000
C	0.133073	0.736621	0.180653	0.8578

R-squared	0.491156	Mean dependent var	-0.001300
Adjusted R-squared	0.474742	S.D. dependent var	5.835433
S.E. of regression	4.229211	Akaike info criterion	5.780600
Sum squared resid	554.4730	Schwarz criterion	5.871297
Log likelihood	-93.37990	Hannan-Quinn criter.	5.811117
F-statistic	29.92246	Durbin-Watson stat	1.992085
Prob(F-statistic)	0.000006		

Null Hypothesis: OILF has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.367864	0.1580
Test critical values:	1% level		-3.639407	
	5% level		-2.951125	
	10% level		-2.614300	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OILF(-1)	-0.463953	0.195937	-2.367864	0.0241
C	3.359258	1.610027	2.086460	0.0450

R-squared	0.149090	Mean dependent var	0.882133
Adjusted R-squared	0.122499	S.D. dependent var	7.617956
S.E. of regression	7.136123	Akaike info criterion	6.825239
Sum squared resid	1629.576	Schwarz criterion	6.915025
Log likelihood	-114.0291	Hannan-Quinn criter.	6.855858
F-statistic	5.606781	Durbin-Watson stat	1.671811
Prob(F-statistic)	0.024101		

Null Hypothesis: D(OILF) has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.009812	0.0003
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OILF(-1))	-4.199076	0.838170	-5.009812	0.0000
D(OILF(-1),2)	2.604908	0.729920	3.568757	0.0016
D(OILF(-2),2)	2.131474	0.623571	3.418173	0.0024
D(OILF(-3),2)	1.350357	0.494416	2.731215	0.0119
D(OILF(-4),2)	0.741970	0.299709	2.475638	0.0211
C	1.580277	1.285986	1.228844	0.2316

R-squared	0.733542	Mean dependent var	0.604272
Adjusted R-squared	0.675616	S.D. dependent var	11.87489
S.E. of regression	6.763314	Akaike info criterion	6.842895
Sum squared resid	1052.076	Schwarz criterion	7.125783
Log likelihood	-93.22197	Hannan-Quinn criter.	6.931492
F-statistic	12.66348	Durbin-Watson stat	1.876344
Prob(F-statistic)	0.000006		

Null Hypothesis: OILF has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.224945	0.2016
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)		47.92871
HAC corrected variance (Bartlett kernel)		44.66590

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OILF(-1)	-0.463953	0.195937	-2.367864	0.0241
C	3.359258	1.610027	2.086460	0.0450

R-squared	0.149090	Mean dependent var	0.882133
Adjusted R-squared	0.122499	S.D. dependent var	7.617956
S.E. of regression	7.136123	Akaike info criterion	6.825239
Sum squared resid	1629.576	Schwarz criterion	6.915025
Log likelihood	-114.0291	Hannan-Quinn criter.	6.855858
F-statistic	5.606781	Durbin-Watson stat	1.671811
Prob(F-statistic)	0.024101		

Null Hypothesis: D(OILF) has a unit root
Exogenous: Constant
Bandwidth: 32 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.622421	0.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	54.77782
HAC corrected variance (Bartlett kernel)	11.49330

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OILF(-1))	-1.283434	0.209196	-6.135070	0.0000
C	0.946499	1.329725	0.711801	0.4819

R-squared	0.548362	Mean dependent var	0.739212
Adjusted R-squared	0.533793	S.D. dependent var	11.18380
S.E. of regression	7.636221	Akaike info criterion	6.962375
Sum squared resid	1807.668	Schwarz criterion	7.053072
Log likelihood	-112.8792	Hannan-Quinn criter.	6.992891
F-statistic	37.63908	Durbin-Watson stat	1.677386
Prob(F-statistic)	0.000001		

Date: 10/04/16   Time: 10:17
Sample (adjusted): 1984 2015
Included observations: 32 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(RGDP) EXRV OILF MSR INT ER
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**

None *	0.930451	200.1733	95.75366	0.0000
At most 1 *	0.738377	114.8700	69.81889	0.0000
At most 2 *	0.665567	71.96279	47.85613	0.0001
At most 3 *	0.571066	36.91262	29.79707	0.0064
At most 4	0.164105	9.826161	15.49471	0.2943
At most 5 *	0.119984	4.090076	3.841466	0.0431

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.930451	85.30328	40.07757	0.0000
At most 1 *	0.738377	42.90722	33.87687	0.0032
At most 2 *	0.665567	35.05017	27.58434	0.0046
At most 3 *	0.571066	27.08646	21.13162	0.0064
At most 4	0.164105	5.736085	14.26460	0.6473
At most 5 *	0.119984	4.090076	3.841466	0.0431

Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LOG(RGDP)	EXRV	OILF	MSR	INT	ER
-0.509911	0.028139	-0.566963	0.176169	0.015136	0.134203
4.427982	-0.118072	0.018456	0.334320	0.007783	-0.232004
-3.225336	0.247099	-0.457310	0.353117	-0.053016	0.071535
2.775107	0.019774	0.011752	0.283874	0.249837	-0.094353
5.384243	0.015476	0.167957	-0.258165	-0.069916	-0.134453
3.924759	-0.023109	0.111585	-0.011450	-0.222299	-0.091242

Unrestricted Adjustment Coefficients (alpha):

D(LOG(RGDP))	-0.002854	-0.003223	0.014073	0.008496	0.000777	0.005689
D(EXRV)	2.933262	-0.537610	-6.236461	-3.850033	1.081586	1.076501
D(OILF)	5.125449	-0.920808	0.159941	-1.777357	0.571815	0.060699
D(MSR)	0.870500	-0.930679	-0.001122	-0.362501	0.869393	-0.254789
D(INT)	-1.069493	-0.517188	0.499920	-1.798203	-0.423015	0.488989
D(ER)	-0.632317	2.560885	1.267954	0.205250	1.098290	-0.453198

1 Cointegrating Equation(s):	Log likelihood	-340.0319

Normalized cointegrating coefficients (standard error in parentheses)

LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1.000000	-0.055183	1.111885	-0.345489	-0.029683	-0.263189
	(0.03013)	(0.08438)	(0.08121)	(0.04346)	(0.02025)

Adjustment coefficients (standard error in parentheses)

D(LOG(RGDP))	0.001455

	(0.00321)
D(EXRV)	-1.495704
	(1.21511)
D(OILF)	-2.613525
	(0.39324)
D(MSR)	-0.443878
	(0.30892)
D(INT)	0.545347
	(0.37178)
D(ER)	0.322425
	(0.54368)

2 Cointegrating Equation(s):	Log likelihood	-318.5783

Normalized cointegrating coefficients (standard error in parentheses)

LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1.000000	0.000000	-1.031558	0.469132	0.031155	0.144699
		(0.07666)	(0.08116)	(0.04543)	(0.02113)
0.000000	1.000000	-38.84223	14.76209	1.102468	7.391510
		(2.63084)	(2.78529)	(1.55897)	(0.72511)

Adjustment coefficients (standard error in parentheses)

D(LOG(RGDP))	-0.012818	0.000300
	(0.02783)	(0.00076)
D(EXRV)	-3.876233	0.146015
	(10.6065)	(0.28883)
D(OILF)	-6.690846	0.252945
	(3.29846)	(0.08982)
D(MSR)	-4.564909	0.134382
	(2.51714)	(0.06855)
D(INT)	-1.744754	0.030971
	(3.20407)	(0.08725)
D(ER)	11.66198	-0.320161
	(3.91757)	(0.10668)

Dependent Variable: D(LOG(RGDP))
Method: Least Squares
Date: 10/04/16   Time: 10:24
Sample (adjusted): 1984 2015
Included observations: 32 after adjustments
D(LOG(RGDP)) = C(1)*(LOG(RGDP(-1)) - 0.0551833357637*EXRV(-1) +
    1.111885168*OILF(-1) - 0.345489167766*MSR(-1) - 0.0296828262524
    *INT(-1) - 0.263188778192*ER(-1) - 5.38721625037) + C(2)
    *D(LOG(RGDP(-1))) + C(3)*D(LOG(RGDP(-2))) + C(4)*D(EXRV(-1)) +
    C(5)*D(EXRV(-2)) + C(6)*D(OILF(-1)) + C(7)*D(OILF(-2)) + C(8)
    *D(MSR(-1)) + C(9)*D(MSR(-2)) + C(10)*D(INT(-1)) + C(11)*D(INT(-2))
    + C(12)*D(ER(-1)) + C(13)*D(ER(-2)) + C(14)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.014552	0.003207	0.453694	0.6555
C(2)	0.283618	0.210146	1.349623	0.1939
C(3)	0.070643	0.198716	0.355497	0.7263
C(4)	-0.000632	0.000736	-0.858534	0.4019

C(5)	-0.000913	0.000704	-1.296580	0.2112
C(6)	-0.001587	0.002633	-0.602580	0.5543
C(7)	-0.000343	0.001908	-0.179832	0.8593
C(8)	0.001906	0.002542	0.749520	0.4632
C(9)	0.002048	0.002712	0.755115	0.4599
C(10)	0.002539	0.002120	1.197905	0.2465
C(11)	0.001672	0.002020	0.827509	0.4188
C(12)	0.000548	0.001455	0.376908	0.7106
C(13)	0.000918	0.002039	0.450064	0.6580
C(14)	0.030783	0.010469	2.940432	0.0087

R-squared	0.419140	Mean dependent var	0.050193
Adjusted R-squared	-0.000371	S.D. dependent var	0.035574
S.E. of regression	0.035580	Akaike info criterion	-3.534411
Sum squared resid	0.022787	Schwarz criterion	-2.893151
Log likelihood	70.55057	Hannan-Quinn criter.	-3.321851
F-statistic	0.999116	Durbin-Watson stat	2.100338
Prob(F-statistic)	0.489536		

Variance Decomposition of LOG(RGDP):

Period	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	0.035580	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.062679	97.55132	0.324682	1.161816	0.182061	0.762620	0.017503
3	0.089323	91.30209	1.674627	5.610384	0.129037	0.928582	0.355276
4	0.113000	87.26255	1.557407	8.657013	0.113328	0.837485	1.572218
5	0.133280	85.33556	1.247917	10.17067	0.183125	0.959817	2.102903
6	0.151012	85.00055	1.307779	10.10990	0.233737	0.933345	2.414687
7	0.167558	85.00169	1.412548	9.829843	0.192137	0.878888	2.684897
8	0.183408	84.40789	1.490057	10.01663	0.165891	0.825706	3.093826
9	0.198666	83.70501	1.519646	10.31697	0.142964	0.783955	3.531453
10	0.212459	83.39140	1.452972	10.49945	0.163496	0.760788	3.731891

Variance Decomposition of EXRV:

Period	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	13.48015	23.67173	76.32827	0.000000	0.000000	0.000000	0.000000
2	14.30293	25.52975	73.23839	0.000345	0.099769	0.262468	0.869278
3	15.92629	27.71988	62.83486	3.994298	1.474021	1.410009	2.566928
4	17.74707	26.63313	64.01542	3.318589	1.295110	1.140519	3.597236
5	19.03334	27.82547	62.87842	2.939982	1.139248	1.188644	4.028238
6	20.33000	26.59187	63.28605	3.269121	1.447089	1.198880	4.206989
7	21.76877	26.59645	62.93514	4.402242	1.304950	1.089636	3.671576
8	22.54226	26.79923	60.95630	5.044890	1.842787	1.177072	4.179722
9	23.52384	26.98840	59.48431	4.708028	2.410449	1.233318	5.175499
10	24.70884	26.73455	59.71212	4.315886	2.204699	1.177096	5.855653

Variance Decomposition of OILF:

Period	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	4.362526	2.777270	23.16432	74.05841	0.000000	0.000000	0.000000
2	5.223021	2.123642	16.41721	58.32867	0.312670	2.319739	20.49806

3	5.660680	2.879264	14.44957	52.47027	7.625317	2.031239	20.54434
4	8.014651	1.447867	13.36751	26.70999	18.94105	3.857233	35.67634
5	9.169115	1.127786	10.95088	28.82942	15.13011	3.594393	40.36741
6	9.920640	0.963654	12.87479	26.28932	16.65525	3.645287	39.57170
7	10.21346	1.170204	12.40474	27.77269	17.03439	3.845913	37.77207
8	10.92227	1.158227	12.34127	27.09163	19.89061	4.317902	35.20035
9	12.50641	1.096445	11.86848	20.95145	24.91703	4.072612	37.09397
10	13.65770	0.923333	9.961352	22.37771	21.79126	3.834641	41.11170

Variance Decomposition of MSR:

Period	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	3.427138	1.921070	4.878399	37.53928	55.66125	0.000000	0.000000
2	5.961417	0.662122	3.073890	26.78257	47.03042	0.481854	21.96914
3	7.079417	0.617080	2.339747	23.55452	43.01458	0.351801	30.12227
4	8.051450	0.671595	1.848431	27.11935	37.11350	0.397060	32.85006
5	8.719090	0.633034	1.826618	28.99412	33.21135	0.657501	34.67737
6	9.052458	0.619506	2.365020	29.06948	31.96451	0.738111	35.24338
7	9.539068	0.665966	2.420952	26.56265	33.58856	0.836413	35.92545
8	10.55187	0.590784	2.746851	23.69079	36.37561	0.900816	35.69516
9	11.67132	0.506704	2.275299	24.92755	34.26143	0.910204	37.11881
10	12.30562	0.468623	2.451597	27.13872	31.22114	0.886207	37.83372

Variance Decomposition of INT:

Period	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	4.124463	0.822813	14.93845	11.82927	41.26998	31.13948	0.000000
2	4.985559	2.517305	10.23046	18.93319	35.94884	30.27923	2.090967
3	5.848879	2.592530	7.973411	28.88326	30.29071	27.50064	2.759449
4	6.785271	2.172785	10.16365	29.01967	29.96636	26.59871	2.078818
5	7.444707	1.874281	8.594277	29.20088	31.56567	26.98860	1.776287
6	7.803519	1.707289	8.025482	29.51969	31.32979	27.79117	1.626570
7	8.391319	1.500360	7.572775	32.24587	29.55239	27.52401	1.604592
8	8.944232	1.335751	7.041082	33.52083	29.44278	27.02390	1.635655
9	9.514163	1.196348	7.014467	33.34199	30.34700	26.64197	1.458227
10	9.926591	1.112958	6.845559	32.99347	30.89320	26.81483	1.339983

Variance Decomposition of ER:

Period	S.E.	LOG(RGDP)	EXRV	OILF	MSR	INT	ER
1	6.031507	0.043854	8.471199	2.350232	12.51265	7.409922	69.21214
2	9.756359	0.193267	6.247880	1.153659	11.14426	8.608593	72.65234
3	12.58459	0.389465	3.925721	1.026288	6.890018	9.725724	78.04278
4	14.60182	1.261159	3.101391	1.102470	5.306193	11.11574	78.11305
5	16.22521	2.183509	2.742689	1.684752	4.300459	12.65262	76.43597
6	18.34479	3.206352	3.313016	2.385583	4.191629	13.07317	73.83025
7	20.48941	3.598669	3.790048	2.015290	4.658606	12.88856	73.04883
8	22.54729	3.844928	3.635819	1.685870	4.213559	12.72169	73.89813
9	24.00952	4.144261	3.242124	1.490624	3.734464	12.86432	74.52421
10	25.21815	4.551689	3.003783	1.609038	3.429031	13.21365	74.19281

Cholesky Ordering: LOG(RGDP) EXRV OILF MSR INT ER

Vector Error Correction Estimates
Date: 10/04/16   Time: 10:20
Sample (adjusted): 1984 2015
Included observations: 32 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LOG(RGDP(-1))	1.000000
EXRV(-1)	-0.055183
	(0.03013)
	[-1.83127]
OILF(-1)	1.111885
	(0.08438)
	[13.1775]
MSR(-1)	-0.345489
	(0.08121)
	[-4.25415]
INT(-1)	-0.029683
	(0.04346)
	[-0.68297]
ER(-1)	-0.263189
	(0.02025)
	[-12.9947]
C	-5.387216

Error Correction:	D(LOG(RGDP))	D(EXRV)	D(OILF)	D(MSR)	D(INT)	D(ER)
CointEq1	0.001455	-1.495704	-2.613525	-0.443878	0.545347	0.322425
	(0.00321)	(1.21511)	(0.39324)	(0.30892)	(0.37178)	(0.54368)
	[0.45369]	[-1.23092]	[-6.64613]	[-1.43685]	[1.46685]	[0.59304]
D(LOG(RGDP(-1)))	0.283618	-39.06246	19.83440	1.307007	-45.66339	19.22506
	(0.21015)	(79.6169)	(25.7661)	(20.2415)	(24.3600)	(35.6235)
	[1.34962]	[-0.49063]	[0.76979]	[0.06457]	[-1.87452]	[0.53967]
D(LOG(RGDP(-2)))	0.070643	12.63044	-13.57496	-7.100981	27.77239	10.89923
	(0.19872)	(75.2864)	(24.3646)	(19.1405)	(23.0351)	(33.6859)
	[0.35550]	[0.16777]	[-0.55716]	[-0.37099]	[1.20566]	[0.32356]
D(EXRV(-1))	-0.000632	-0.779282	-0.021330	-0.064623	-0.111033	0.103075
	(0.00074)	(0.27885)	(0.09024)	(0.07089)	(0.08532)	(0.12477)
	[-0.85853]	[-2.79460]	[-0.23636]	[-0.91153]	[-1.30137]	[0.82613]
D(EXRV(-2))	-0.000913	-0.281930	0.001791	0.005612	-0.116398	0.137141
	(0.00070)	(0.26691)	(0.08638)	(0.06786)	(0.08166)	(0.11942)
	[-1.29658]	[-1.05629]	[0.02073]	[0.08271]	[-1.42533]	[1.14836]
D(OILF(-1))	-0.001587	1.341188	1.595880	0.312347	-0.421107	-0.401348
	(0.00263)	(0.99768)	(0.32288)	(0.25365)	(0.30526)	(0.44640)
	[-0.60258]	[1.34430]	[4.94270]	[1.23142]	[-1.37952]	[-0.89908]
D(OILF(-2))	-0.000343	0.546365	0.883713	0.111591	-0.252273	0.152690
	(0.00191)	(0.72282)	(0.23392)	(0.18377)	(0.22116)	(0.32341)
	[-0.17983]	[0.75589]	[3.77782]	[0.60724]	[-1.14070]	[0.47212]
D(MSR(-1))	0.001906	-0.388813	-1.191756	-0.145049	0.333093	-0.107750
	(0.00254)	(0.96319)	(0.31171)	(0.24488)	(0.29470)	(0.43097)

	[0.74952]	[-0.40367]	[-3.82325]	[-0.59233]	[1.13027]	[-0.25002]
D(MSR(-2))	0.002048	-0.698862	-0.404130	-0.342051	0.349635	-0.770067
	(0.00271)	(1.02759)	(0.33255)	(0.26125)	(0.31441)	(0.45978)
	[0.75511]	[-0.68010]	[-1.21523]	[-1.30929]	[1.11204]	[-1.67486]
D(INT(-1))	0.002539	0.463561	-0.087033	0.204263	-0.437628	-0.066495
	(0.00212)	(0.80311)	(0.25991)	(0.20418)	(0.24572)	(0.35934)
	[1.19790]	[0.57721]	[-0.33486]	[1.00041]	[-1.78097]	[-0.18505]
D(INT(-2))	0.001672	-0.325547	-0.008401	0.278009	0.096325	-0.086869
	(0.00202)	(0.76541)	(0.24771)	(0.19459)	(0.23419)	(0.34247)
	[0.82751]	[-0.42532]	[-0.03392]	[1.42866]	[0.41131]	[-0.25365]
D(ER(-1))	0.000548	-0.127894	-0.216590	0.440027	-0.000142	0.406439
	(0.00145)	(0.55107)	(0.17834)	(0.14010)	(0.16861)	(0.24657)
	[0.37691]	[-0.23208]	[-1.21448]	[3.14078]	[-0.00084]	[1.64839]
D(ER(-2))	0.000918	0.033958	-0.370906	-0.192170	0.275102	0.235723
	(0.00204)	(0.77247)	(0.24999)	(0.19639)	(0.23635)	(0.34563)
	[0.45006]	[0.04396]	[-1.48368]	[-0.97852]	[1.16397]	[0.68201]
C	0.030783	2.154567	1.287026	0.021345	0.816664	-1.023093
	(0.01047)	(3.96631)	(1.28360)	(1.00838)	(1.21355)	(1.77467)
	[2.94043]	[0.54322]	[1.00267]	[0.02117]	[0.67295]	[-0.57650]
R-squared	0.419140	0.435832	0.821073	0.618763	0.497804	0.419528
Adj. R-squared	-0.000371	0.028378	0.691848	0.343425	0.135106	0.000298
Sum sq. resids	0.022787	3270.861	342.5694	211.4149	306.2015	654.8233
S.E. equation	0.035580	13.48015	4.362526	3.427138	4.124463	6.031507
F-statistic	0.999116	1.069647	6.353826	2.247287	1.372504	1.000711
Log likelihood	70.55057	-119.4392	-83.33785	-75.61542	-81.54215	-93.70410
Akaike AIC	-3.534411	8.339950	6.083615	5.600964	5.971385	6.731507
Schwarz SC	-2.893151	8.981209	6.724875	6.242223	6.612644	7.372766
Mean dependent	0.050193	0.837393	0.911910	0.125919	0.219375	0.922919
S.D. dependent	0.035574	13.67559	7.858789	4.229504	4.434922	6.032406

Determinant resid covariance (dof adj.)	2157.952
Determinant resid covariance	68.35606
Log likelihood	-340.0319
Akaike information criterion	26.87699
Schwarz criterion	30.99937