



Exchange rate volatility: an analysis of the relationship between the Nigerian naira, oil prices, and US dollar

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Abstract

This study seeks to assess the correlation which exists between exchange rate of Nigerian naira and United States dollar and oil price on the basis of monthly data from 1999-2009. The research employ the fundamental variables which were assumed to be the monthly spot crude oil price, monthly exchange rate of Nigeria naira and monthly exchange rate of United States dollar. The empirical result adopted the ordinary least square using regression analysis and also the correlation model which shows that there is a weak/negative relationship between exchange rate and oil price as there are other factors that brings about changes in oil price other than the exchange rate. The activities of cartel pricing policy and oil speculators too have come to greatly affect the price of crude oil, and it will be interesting to examine the impact speculators have on the change in price of crude oil against the normal drivers of crude oil price.

Key words: Exchange rate Volatility, oil price, Nigerian naira, US dollar and OLS

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1. Introduction

1.1 Background

Exchange rate fluctuation is seen as a general phenomenon around the globe which might have adverse effect on trade. Economists are still very much interested in the operations involved in exchange rate especially in developing countries. Exchange rate uncertainty is said to probably have a negative effect on international trade as bilateral trades are threatened with the risks involved. The economic relationship supporting the negative link is the unwillingness of firms to take on risky activity, namely trade (Anderton and Skudely (2001)).

Aliyu (2008) stated that the conception behind the exchange rate is not exclusively as an important relative price, which creates a correlation between the domestic market and the world market for goods and assets, but as well distinguishes the competitiveness of a country's exchange power vis-à-vis the rest of the world in a pure market. It also sustains the internal and external macroeconomic balances over the medium-to-long term.

Exchange rate volatility is a risk associated with unexpected changes in exchange rate, this is caused by some economic factors such as inflation rate, interest rate and balance of payments (Ozturk 2006). Ozturk argued in his paper on impact of oil price shock and exchange rate volatility on economic growth that depreciation of exchange rate leads to increase in exports and decrease in imports while appreciation of exchange rate would tend to discourage exports and encourage imports. With this argument, it is obvious that when exchange rate is high the exporting country benefit more while importing country pay more for her imports thus a change in exchange rate leads to exchange rate depreciation from importing countries to exporting countries which is as a result of shift in terms of trade.

Williamson (1994) concluded that there was no simple answer in determining exchange rate equilibrium, and estimating the equilibrium exchange rate and the proportion of misalignment of the exchange rate remains part of the most defying empirical problems in an open-economy macroeconomics. A country's actual exchange rate deviation from such an unobservable equilibrium is referred to as an exchange rate misalignment, when an exchange rate depreciates more than the equilibrium it is referred to as undervalued, and an appreciation of an exchange rate more than its equilibrium is referred to as overvalued.

The beginning of the generalized floating system in 1973 led to a high proportion of volatility and uncertainty of movements in exchange rate have which led to investigating the nature and extent of the impact of such movements on the volume of trade by policy makers and researchers. Both real and nominal exchange rates have fluctuated widely since the breakdown of the Bretton Woods system of fixed exchange rates. Several attempts were taken through intervening in the exchange rate in order to address the nominal and real exchange rate volatility, a fear of floating are often accompanied by a belief that some form of domestic liquidity sterilization is necessary to deliver on an inflation target. Sterilization, in turn, raises concerns over interest rate volatility, the effects on private investment, and the quasi-fiscal burden of increased domestic borrowing.

The end of 2005 brought a successful consolidation to the financial sector and also in early 2006 a de facto unification of the foreign exchange market, with the introduction of the fiscal responsibility act in 2007; foundations for an improved fiscal management of oil revenue were made. Nigeria as a country known to be export base on the fact of her richness in oil with regard to our vast knowledge of the country so we decide to narrow our research to Nigeria as a case study, thus this research will validate other research from other scholar whom has study and shown consistent increase in the exchange value of Nigeria currency (#: Naira) to other strong currencies like Euro, the US dollar, and British pound sterling which are mostly used for international transactions. For the purpose of this research, the US dollar will be consider as a deflator vis-à-vis the Nigeria naira since the US is one of Nigeria's largest trade partner.

1.2 Research Question

Several studies have proven that there is strong correlation between changes in oil prices and exchange rate, McKillop (2004) and Jin (2008) argued that an increase in oil prices result in the fluctuation of exchange rate which result in an adverse effect on trading countries economy. Trade in the European Union (EU) countries is negative due to the effect of exchange rate uncertainty; trade increases as volatility falls and gets increasingly larger as volatility approaches zero (Baldwin, Skudelny and Taglioni (2005)).

Nigeria benefits when there is an increase in the price of oil and experience a decline in the value of her currency against the US dollar as a large chunk of revenues is from oil export and at the same time, the country is spending huge sum of money to import refined petroleum and other oil related products which are basically traded in US dollars. The challenge here is that an increase in oil price and exchange rate instabilities on Nigerian currency is vast.

The naira exchange rate has witnessed some period of relative calm since the Implementation of the structural adjustment programme (SAP) in July, 1986; its continued depreciation, however, scored an indelible mark in the level of real sector activities in the country. The naira which traded at N0.935 = 1.00USD in 1985 depreciated to N2.413 = 1.00USD and further to N7.901 against the US dollar in 1990. The naira as since depreciated from N21.886 = 1.00 USD to N142.00 = 1 USD between the period of 1994 to 2009 as a result of pegging and further deregulation It majorly declined by 12.95% and a further decline of 7.98% in 2008 and 2009 respectively. In spite of these developments, the national income accounts, for the country revealed an impressive performance. Real GDP grew at an average of 5.01 percent between 2000 and 2008 with the highest of 9.6 percent in 2003.

McKenzie (1999), Clark et. al, (2004) are amongst several scholars to analyze the relationship between exchange rate volatility and international trade concluded whether or not there is a boom international trade as a result of balance to the exchange market. McKenzie (1999) further stated that there are theoretical models which support both negative and positive relationship between them as empirical studies has not provided an apparent results due to most presenting a negative relationship, but with little substantial relationship.

Our research on the subject of exchange rate volatility is to contribute to the vast arrays of comprehensive literatures through updating previous studies with the recent and up-to-date data and methodology in measuring exchange rate volatility with the aim of proving there exist a correlation between the Nigerian naira, oil price, and US dollar or not and also the impact of exchange rate volatility on international trade. Against this background, this research seeks to quantitatively measure the impact of exchange rate volatility on oil sector in Nigeria taking into consideration the correlation between the Nigerian naira, oil price, and US dollar from 1999 to 2009.

1.3 Aim of the research

The aim of this research is to ascertain the impact of exchange rate volatility on trade using the Nigerian oil sector as a case study. The main research purpose is:

- To determine the relationship that exists between the Nigerian naira, oil prices, and the US dollar between the periods of 1999 to 2009.

1.4 Research outline

This research is divided into five (5) chapters: first chapter gives an in-depth introduction of the research consisting of the background, the research question, the aims of the research and the research outline. The second (II) chapter consists of the literature relating to exchange rate volatility, the relationship between oil trade and exchange rate and measuring exchange rate volatility. The third (III) chapter examines the research methodology and hypothesis with a quantitative research method using secondary data from the Central Bank of Nigeria (CBN) statistical bulletin, Organization of the Petroleum Exporting Countries (OPEC) annual statistical bulletin, and the Nigerian National Petroleum Corporation (NNPC) annual statistical bulletin. The fourth (IV) chapter analyses the result on the correlation between the Nigerian naira, oil prices, and US dollar. The last chapter (V) summarizes the whole research with conclusions and recommendations for further research.

2. Literature review

The risk involved in exchange rate has evidence significant on the volume of international trade and also consequently on the balance of payments. Scholar's including Hooper and Kohlhaugen (1978) have carried out an analytical inquiry on the relationship that exists between exchange rate volatility and international trade transactions. The main contention of argument here is that higher exchange rate volatility leads to a higher cost for non risk taking traders and also to less foreign trade. The result of this is because the exchange rate is agreed upon at the time the trade contract took place, but the payments are usually not made until a forward delivery actually takes place. There are unpredictable changes to the exchange rate which ultimately reduces the benefits of international trades, the parties involved are to bear all the risks, countries generally do not hedge because the future market are not susceptible to all traders. Numerous empirical studies have been conducted to investigate whether trade is influenced by exchange rate volatility. (Surveys of the literature can be found in Cote (1994), McKenzie (1999), IMF (1984) and Clark, Tamirisa, and Wei (2004)).

There is an agreement in the literature on the impact of exchange rate stability neither on economic growth nor on the mechanism through which economic growth is affected by the variations that occurs in the price of oil. According to Schnabl (2007), exchange rate flexibility creates an easy adjustment to unbalanced country specific real shocks. Under the fixed exchange rate, the aftermath of low exchange rate volatility subsequent to a microeconomic perspective is in correlation with lower transaction cost for international trade and capital flows which further contributes to higher growth. International price transparency is easier as consumer can compare prices easily between different countries due to the flexible exchange rate system. The probable elimination of exchange rate volatility, international arbitrage will increase efficiency, productivity and welfare. Earlier conclusion about the monetary and exchange rate policies are the chief source of volatility in small open countries and economic growth is increased when exchange rate fluctuation are smoothed was made by Mundell (1973a, 1973b). An extensive argument was made by Schnabl (2007), about how large and similarly closed economies such as Japan and the European area are easily affected by fluctuations in the exchange rate in particular to the case of appreciation.

Jin (2008) stated about the transmission mechanism through which the real economic activity including both the demand and supply channels is been affected by the oil prices. The demand side effects affect both the consumption and investment decision due to the changes acquired in oil prices. Consumption is negatively affected because a surge in the oil price disturbs disposable incomes and the price of domestic tradable. Increase in oil prices also affects firms' input prices and thereby increasing cost which ultimately affects investment adversely. The aftermath of the supply channels is linked to the basis that the basic input to production is crude oil, and an increment in the prices of oil leads to a surge in production cost that decreases the firms' lower output. A strong effect of short and long run negative effect of the fluctuations in the exchange rate which adversely affects the economic growth performance through the trade channel had been shown through various empirical evidences. The nature of the effect could either been seen positively or negatively.

According to IMF (1984) and European Commission (1990), mixed conclusion exists about the systematic positive and negative reactions of what a steady exchange rate can have on trade and growth in small open economies. Bacchetta and van Wincoop (2000) discovered based on a general equilibrium framework that a steady or balanced exchange rate is not necessarily identified with more trade. The significance of exchange rate stability on trade and growth particularly from a monetary union context has been ascertained mainly through the use of gravity model. Schnabl (2007) found proof that in the EMU boundary that exchange rate stability is accompanied with more growth. The evidence according to him is the transition during the observation period of Europe from a high macroeconomic instability to macroeconomic stability.

2.1 Relationship between oil trade and exchange rate

Gounder and Barleet (2007) ascertain a direct correlation between the net oil price shock and the economic growth in New Zealand using both linear and nonlinear oil price transformation. Jin (2008) made a comparative study on the impact of oil price shock and exchange rate volatility on economic growth based on his research; he discovered that a surge in oil price applies a negative impact on the economic growth in strong economies such as China and Japan and a positive impact on economic growth such as Russia. Russia's GDP growth of 5.16% correlates with a

10% permanent surge in international prices of oil and there is a 1.07% decrease in the GDP of Japan. A positive GDP growth in Russia is as result of the appreciation of the real exchange rate which subsequently results to a negative GDP growth in Japan and China.

For oil exporting countries all things being equal, an increase in the prices of oil should be considered positive while for oil importing countries should be considered as negative and vice versa if there is an abate in the prices of oil. However, the challenge for oil producing nations such as Nigeria is regarded as huge due to the combine effects of the increase in oil price and exchange rate fluctuations on macroeconomic economic stability and economic growth. Nigeria relies heavily on the revenue from oil exports, but, at the same time extensively imports refined petroleum and other related products. Evidence, for instance, shows that Government spending, which hitherto, before 1999 remained well below N0.5 trillion, hit N1.02 trillion mark in 2001 and N1.5 trillion in 2004. The figures for 2006 and 2007 stood at N2.04 and N2.45 trillion respectively. Additionally, the Nigeria's total visible trade between 2000 and 2007, in the oil sub sector total imports – with fuel importation as one of the major factors, accounts for an average of 22.4 percent. Specifically, the sub sector which accounts for 17.5 percent in 2001 and rose to 28.5 percent in 2005. The figures, however, stood at 27.3 percent and 21.2 percent in 2006 and 2007 respectively (Aliyu (2009)).

According to various empirical studies done by Ojo, et al (1978), Osagie (1985), deemphasizes the role of exchange rate on the import-export trade in Nigeria. The system of exchange rate before the commencement of the structural adjustment programme (SAP) in Nigeria in July 1986 made it feasible. Nnanna (2002) made a connection to the swings in exchange rate in Nigeria to the interest rate, inflation, growth in the supply of money, negative monetary policy impact and its failure which was linked to fiscal dominance in the country's economy. According to Aliyu (2007b), Nigeria's particular nature of exports and its infinite and diversified nature of her imports reveal that the exchange rate substantially affects imports more than exports.

The largest oil producing nation in Africa is Nigeria and also in terms of oil reserves in the world, Nigeria is known has the tenth largest. The production level of oil production in Nigeria is about two million barrels per day although; this has been majorly affected due to the increasing number of crisis happening in the region where oil is been produced. The start of the second Gulf

war was a beneficial moment for the oil producing sector of Nigeria. The country's balance of payment over a period of 20 months was in a very affirmative condition which amounted to over \$55 billion of reserves. The exchange rate during 2000 and 2008 was fairly stable, while real GDP growth averaged 5.01 percent also within the same period.

However, due to the collapse of local refineries in the country during the late 1980's, Nigeria relies heavily on the importation of required petroleum and its products for its oil consumption, the country's domestic needs of oil are sourced from oil import which amounts for over 80%. The near collapse of the power generation and distribution industry in the country further accentuates the acute shortage of energy. The burden on the government to provide energy resources at subsidized rate became very unwieldy and between 1999 and 2008, the federal government of Nigeria has reduced its subsidy approximately 9 times. This seriously affects production, consumption and investment decisions.

2.2 Measuring Exchange Rate Volatility

In the vast comprehensive literatures on exchange rate volatility, there is no unison in the applicable approach for evaluating such volatility. The lack of a consensus on this topic echoes a number of factors as theory cannot provide a conclusive guidance as to which measure is the most suitable. Besides, the type of measure to be adopted will to some extent be imposed by the scope of analysis. The time period over which variability is to be measured, as well as whether it is unconditional volatility or the unexpected movement in the exchange rate parallel to its predicted value needs to be taken into consideration. Lastly, in determining the pertinent measure of exchange rate to be used, the level of aggregate trade flows would be largely acknowledged.

Clark et. al, (2004) made an empirical analysis on the relationship between aggregate exchange rate volatility and aggregate trade. Constraints from looking at the aggregate data led to further analyzing the effect that exchange rate volatility has on trade. The switch to bilateral trade and volatility allows for better ways to deal with an array of other factors that could affect trade other than volatility which consequently, improves the chances of detecting the effect of exchange rate volatility on trade.

The extent to which exchange rates due to its usually high volatile state are a source of risk and ambiguity depends on the degree to predicted movements in the exchange rate. With hedging, the anticipated part can be hedged away so as not to have much consequences on trade. A feasible measure would be to use the forward rate as an indicator of the future spot rate, and indicating the exchange rate risk with the discrepancies between the current spot rate and the previous period forward rate even though using the forward rate as an indicator as a problem with predicting the future exchange rates adding to the fact that quotations are only available for major currencies. According to McKenzie (1999) there are several measures to be taken into consideration ranging from the structural models to the time series equation making use of the ARCH/GARCH approaches.

The standard deviation of the first difference of logarithms of the exchange rate is the most extensively used in measuring exchange rate volatility. (See, for example, Brodsky (1984), Kenen and Rodrick (1986), Frankel and Wei (1993), Dell’Ariccia (1999), Rose (2000), and Tenreyro (2003)). If the exchange rate is on a consistent trend, which apparently could be forecasted and consequently would not be a source of uncertainty, the measure as the ability that it will equal zero. The standard deviation is calculated over a period of one year to indicate a short-run volatility and in acquiring long-term variability, a period of five years is used.

Finally, measuring exchange rate volatility, the role of currency invoicing is to be taken into consideration. Usually, trade between two developing countries is not invoiced in the currency of either country. A standard currency is been used mostly the U.S. dollars is often used as the invoicing currency. It may seem to emerge that the volatility of the exchange rate between the two trading partners’ currencies is not the important volatility to consider however this is wrong. For example, if exports from China to India are invoiced in U.S. dollars, it might seem that the Chinese exporters would only care about the fluctuations between the U.S. dollar and the Chinese yuan, but not between the Indian rupee and the Chinese yuan. However, any change between the Chinese yuan and the Indian rupee holding constant the Chinese yuan/U.S. dollar rate must reflect fluctuations in the Indian rupee/U.S. dollar rate. As the latter could affect the Indian demand for Chinese exports, fluctuations in the Chinese yuan/Indian rupee exchange rate would also affect the Chinese exports to India even if the trade is invoiced in the U.S. dollar (Clark, Tamirisa, and Wei (2004)).

3. Research methodology

The first chapter of this research focuses on the subject of the research, aims and objectives, and contribution of the study. The chapter focuses on research methods, research design, and data collection and analysis. The hypothesis will show if there is a positive correlation between Nigerian naira, oil prices, and US dollar with the use of large number of macroeconomic variables, oil price and exchange rate volatility as the control variables.

3.1 Research design

Research design can be described as the general plan relating the aforementioned research problem. Research design provides information on the framework of the research, methods of collecting data, instrument to be used in collection e.g. (questionnaire, sampling plan, and sampling size) and specify the type of research in use (Ghauri, Gronhaug and Kristianslund 1995).

Research design can be categorized into three namely: exploratory, descriptive, and casual. Whenever a research is badly understood, it is said to be (more or less) exploratory research design which is adequate. Besides, the key element in exploratory research is mostly the ability to observe, extract information, and make a meaningful explanation i.e. theorizing. For descriptive research, the problem is structured and well understood and the key features of descriptive research are; well structured precise rules, and procedures. In casual research, the problems under scrutiny are structured as well. However, in contrast to descriptive research, the researcher is also confident with “cause and effect problems” (Ghauri, Gronhaug and Kristianslund 1995).

3.1.1. Qualitative research and its criticisms

It is a method of collecting, analyzing, and interpreting data by paying a strict attention to respondents. It is open-ended and seeks an unstructured response that reflects the person's thought on the subject matter. The method seeks to interpret what the people in the sample are

like, their feeling, attitude, and opinions as well as their resulting actions. This method of research is used mostly in international marketing research to formulate and define a problem more clearly and to determine relevant questions to be examined in subsequent research. It is highly useful in revealing the impact of socio cultural factors on behavioural patterns and to develop research hypothesis that can be tested in following studies design to quantify the concepts and relevant relationships uncovered in qualitative data collection. The most commonly used forms of qualitative questioning are interviews, focus groups, and case studies.

Though we found qualitative research very appropriate for our thesis, it has some of its drawbacks; in quantitatively-oriented social science, qualitative research is considered as a relatively minor methodology that should be used during the early exploratory processes of a study. These reservations do have some grounds as qualitative research is by definition stronger on long descriptive narratives than on statistical tables. Marshall and Rossman (1989) argue that if we treat social reality as always influx, then it makes very little sense to worry whether or not our research instruments measure accurately.

3.2 Data collection

We initiated our data collection with the help of secondary data sources from the Central Bank of Nigeria statistical bulletin, Organization of the Petroleum Exporting Countries (OPEC) annual statistical bulletin, and the Nigerian National Petroleum Corporation (NNPC) annual statistical bulletin; this helped us to understand the topic we seek to develop and the challenge ahead of us. We started with reading previous and current literature, which stood out to be relevant to our research question, and provided us beneficial understanding and knowledge of key objective terms on which further study should be approached. Finding exactly specific and relevant secondary sources in accordance to the chosen research question is a complex activity as it is a tough job to find objectively same previous or current work. But reasonably relevant secondary sources have been identified and included throughout the research work.

The sources of secondary data on which will be used for this research were quarterly data from first quarter of 1999Q1 to the last quarter of 2009Q4 will be used for all variables on oil export and exchange rate which will mainly be obtain from the Central bank of Nigeria, University

Library's electronic search engine at Gotland University . The ease of access to large amount of secondary data sources especially the electronic resources at the Gotland University library has been the most utilized source of information for our study. Due to technological advancements and availability of almost all kind of data regarding any issue and topic on the Internet, science direct, jstor and ssrn has been one very useful site for us to obtain some articles and books written on the subject of this research.

4. Interpretation and result

This study has proved some other authors research to be reliable while measuring the correlation between exchange rate and oil price. In agreement with the methodology used by Mann (1989), Peree and Steinherr (1989), Medhora (1990), Aktar and Hilton (1991), Kumar and Dhawar (1991), Frankel and Wei (1993) and Baak (2004). This research adopt an ordinary or simple linear regression model in analyzing the correlation in the exchange rate volatility on Nigerian currency (Naira)/US dollar and oil price between 1999 and 2009.

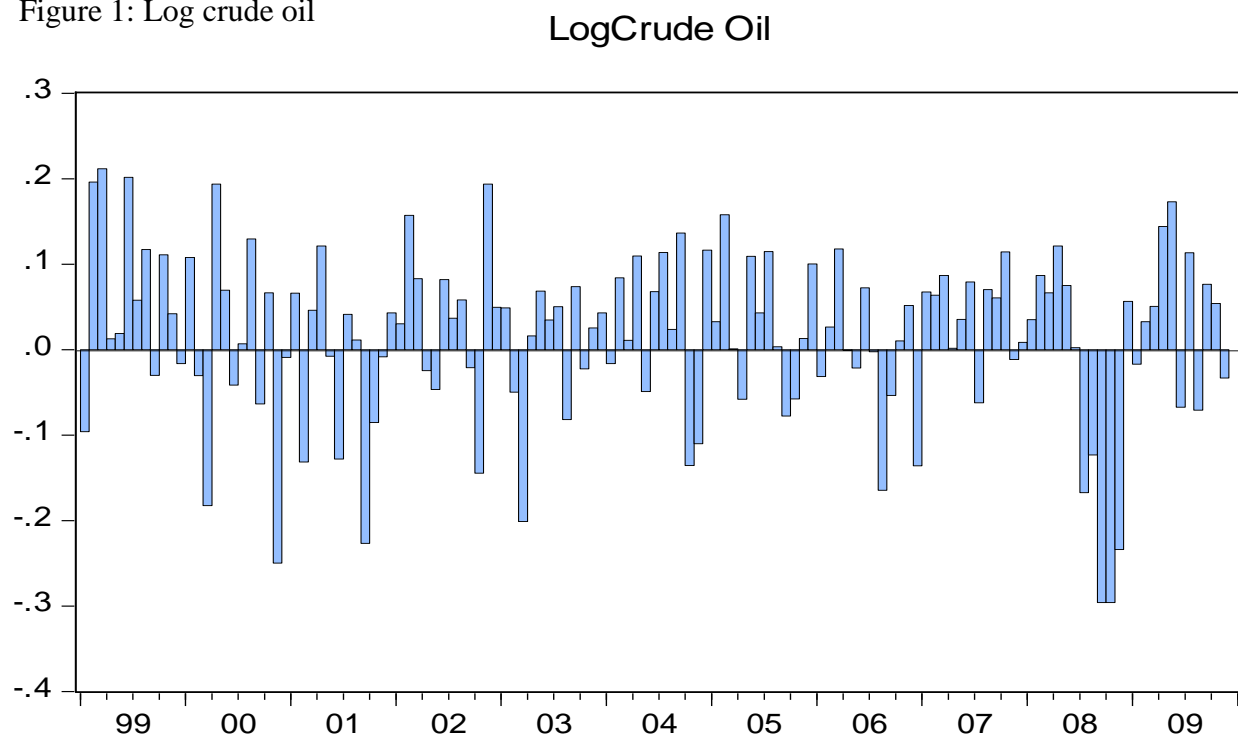
4.1 Measurement of variables used

The variables that were used in analyzing the correlation includes the spot crude oil prices, monthly average exchange rate of Nigerian naira, and the monthly average exchange rate of US dollar which we computed using indirect quotation.

Monthly Spot Crude Oil Price

The data on the monthly spot crude oil prices were obtained from Organization of the Petroleum Exporting Countries (OPEC) annual statistical bulletin from 1999 to 2009. This was converted into natural log to determine the monthly percentage change.

Figure 1: Log crude oil



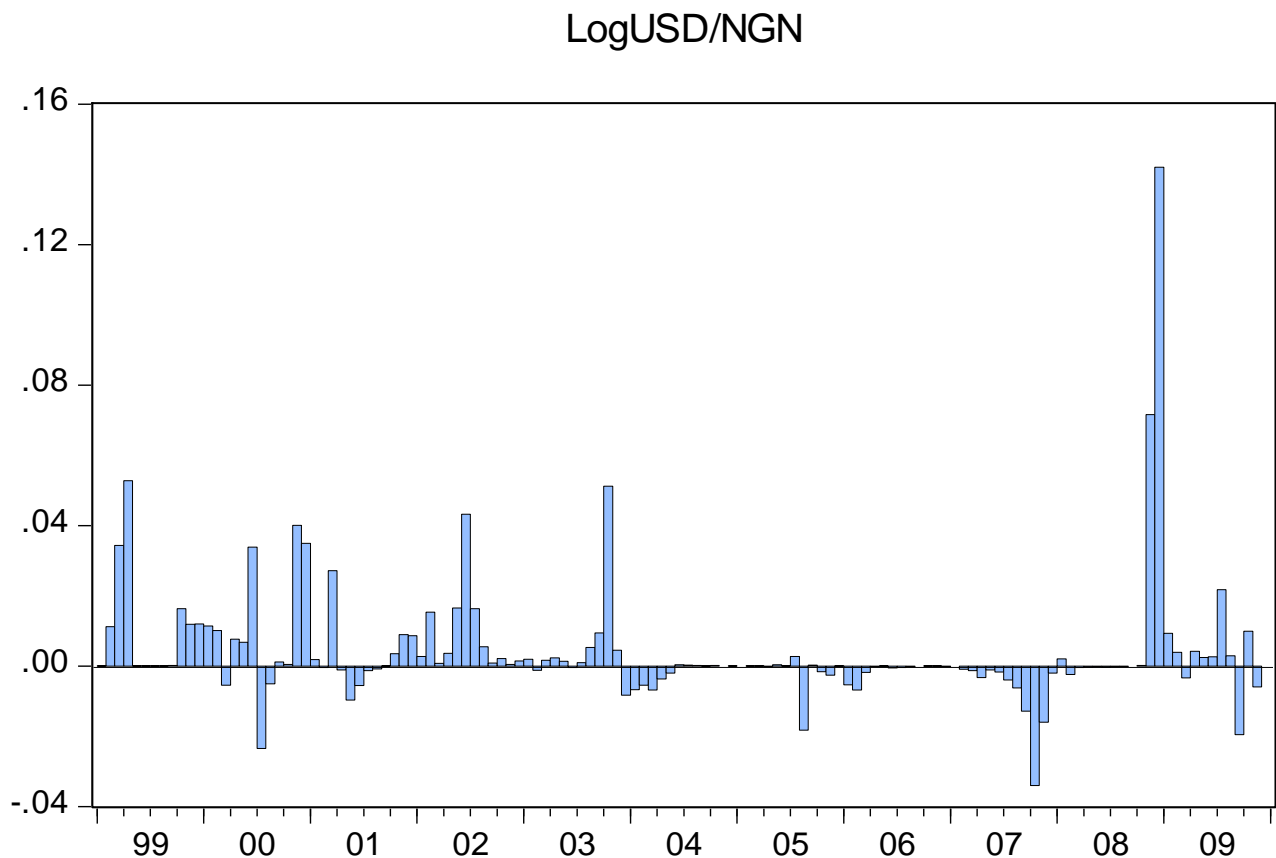
Monthly average exchange rate of the Nigerian naira to US dollar

Monthly data on monthly average exchange rate of the naira was obtained from the Central Bank of Nigeria (CBN) statistical bulletin and were converted into natural log and used as an independent variable to test regression against oil price and then use both the raw data and logged to measure the correlation of both variables. The sample where later divided into two sub-samples tests the reliability of the chosen sample size.

Monthly Average Exchange Rate of the US dollar to Naira

The data on the monthly average exchange rate of naira was use to calculate the average exchange rate of the USD indirectly using the naira as a base. The data was later converted into natural log and used as a dependent variable to test regression against the oil price within the same sample size before testing for two other sub-samples.

Figure 2: Log USD/NGN



4.2 Analysis summary

Table 1: Descriptive Statistics

	LogCrude Oil	Log USDNGN
Mean	0.015	0.004244
Median	0.033	0.000
Maximum	0.211	0.142
Minimum	-0.296	-0.034
Std. Dev.	0.100	0.018
Skewness	-0.783	4.206
Kurtosis	3.839	29.248
Jarque-Bera	17.252	4147.150
Probability	0.0002	0.000000
Sum	1.913	0.555
Sum Sq. Dev.	1.307	0.042
Observations	131	131

In the descriptive statistics table above which shows the characteristics of the full sample data set, we see the mean of both the returns on crude oil and USD/NGN exchange rate are both positive, this suggests we have more of increase than decrease in the changes in both of the variables. The standard deviation of the crude oil is much higher than that of the exchange rate which suggests that degree of variability of that of the crude oil is higher than that of the exchange rate, which means the dispersion the data points of the exchange is closer to its mean. The returns of the crude oil is negatively skewed which suggests that the majority of the distribution is concentrated to the right, which means the low values in the distribution are relatively few, whereas the returns of the exchange rate is positively skewed which suggests that the majority of the distribution will be to the left, and the high values in this distribution are relatively few. The exchange rate returns has a higher excess kurtosis than the crude oil which suggests that more of the exchange rate variance might be as a result of infrequent high deviations. The Jarque-Bera suggests the exchange rate departure from normality is high.

Figure 3: Monthly percentage change in crude oil and exchange rate 1999-2009

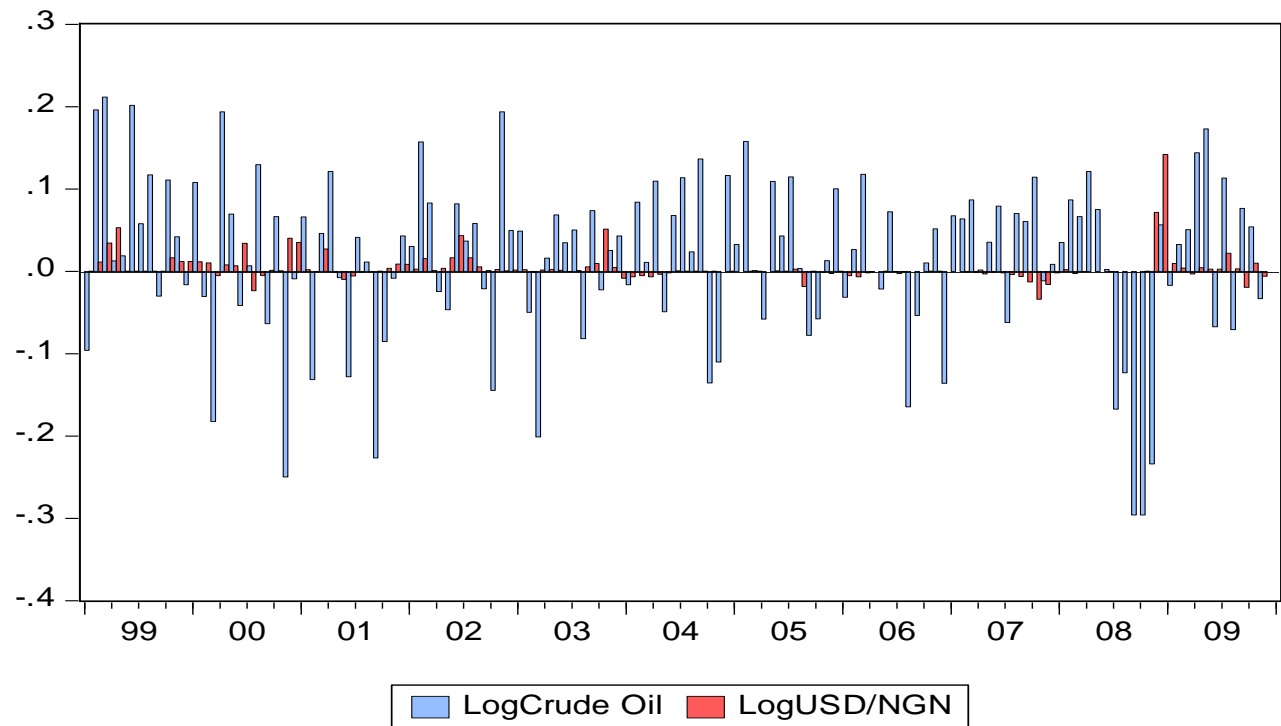


Figure 4: Monthly percentage change in crude oil and exchange rate 1999-2003

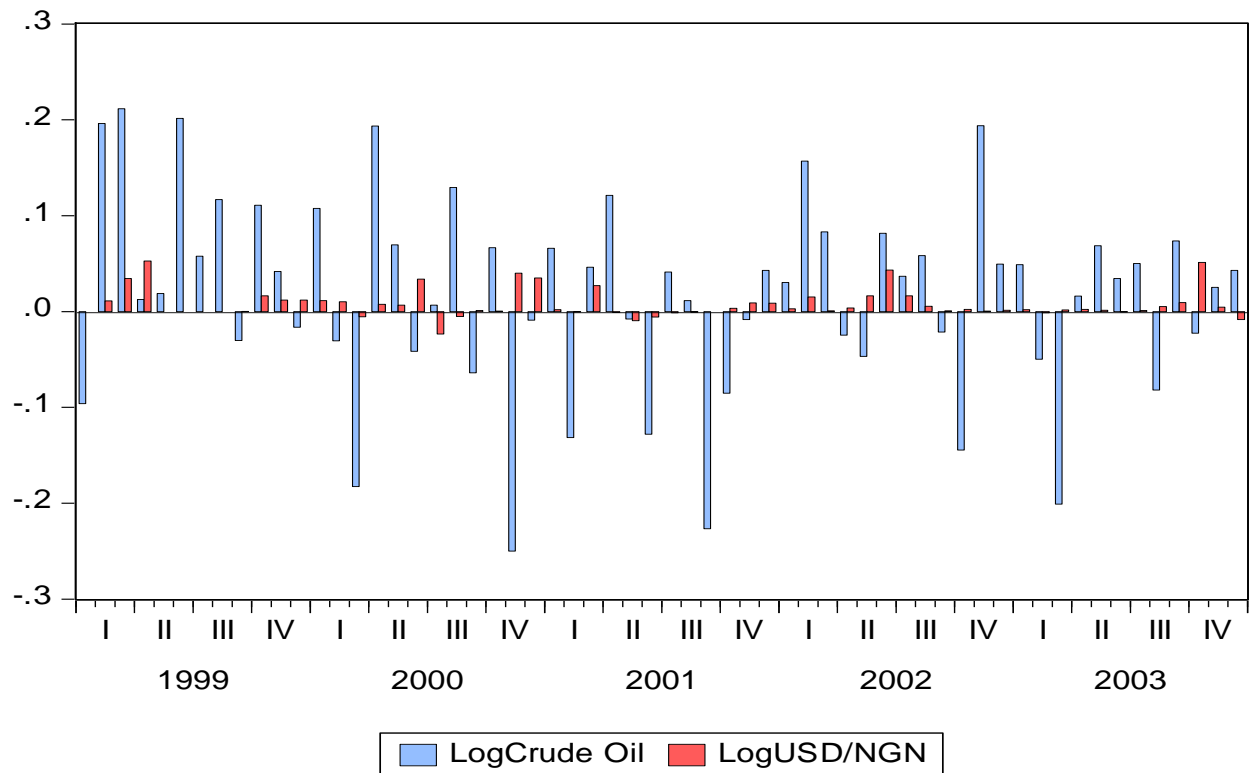
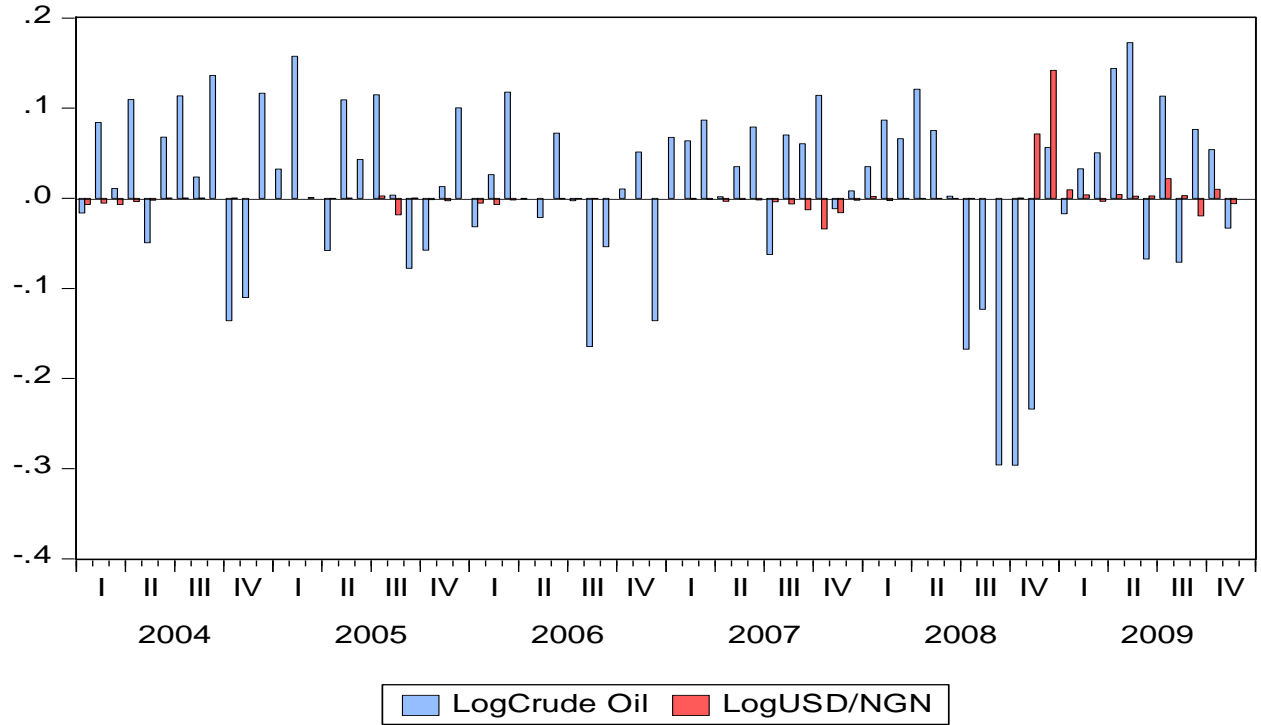


Figure 5: Monthly percentage change in crude oil and exchange rate 2004-2009



In this section, we present the results of the statistics of the overall sample size: 1999-2009 and the sub-samples of 1999-2003, 2004-2009. This study applies the ordinary least square (OLS) regression test based on the specifications given in equations 1- below:

$$Y_t = \alpha + \beta X + \varepsilon_t, \quad (1)$$

Substituting our variables into our equation, we have:

$$LogCrudeOil = C + \beta LogUSDNGN + \varepsilon_t \quad (2)$$

Y_t is the dependent variable on an independent variable X which is the USDNGN in this case, α is the value of Y when $X = 0$, βX is the change in Y per unit change in X , and ε_t is the residual value which is the difference between the observed and predicted values of the dependent variable Y for a given value of X

Table 2: Correlation 1999-2009

Correlation	Crude Oil	Log Crude Oil	Log USDNGN	USDNGN
Crude Oil	1			
Log Crude Oil	-0.16	1		
Log USDNGN	-0.21	-0.04	1	
USDNGN	0.38	0.01	-0.18	1

Table 3: Correlation 1999-2003

Correlation	Crude Oil	Log Crude Oil	Log USDNGN	USDNGN
Crude Oil	1			
Log Crude Oil	-0.42	1		
Log USDNGN	-0.15	0.03	1	
USDNGN	0.57	-0.15	-0.16	1

Table 4: Correlation 2004-2009

Correlation	Crude Oil	Log Crude Oil	Log USDNGN	USDNGN
Crude Oil	1			
Log Crude Oil	-0.24	1		
Log USDNGN	-0.13	-0.09	1	
USDNGN	-0.53	0.26	-0.05	1

The correlation results threw up some interesting findings. For the full sample period, the correlation between the raw price of crude oil and the raw USD/NGN exchange was about 38%, while in the 1999 to 2003 sub-sample, it was about 58%. However, in the 2004-2009 sub-sample periods, this relation was negative 53%; this suggests a change in the direction of the relation in this time period. The close to 50% correlation between the raw prices of the crude oil and

exchange rate however disappeared when examined in the context of their rates of change. For the full sample period, the rate of change of the crude oil and that of the USD/NGN was about negative 4%; in the 1999 to 2003 sub-sample period, the correlation was about 2.8% while in the 2004-2009 sub-sample period, it went to almost negative 10%. The results of the correlation suggest that the relationship between changes in the price of crude oil and the USD/NGN exchange rate is so low that they could be termed negligible.

Table 5: Regression analysis output

Parameters	Estimation time period		
	(1999-2009)	(1999-2003)	(2004-2009)
α	1.6* (1.73)	1.5* (1.02)	1.3* (1.12)
β	-24.05* (-0.49)	19.8** (0.22)	-47.69 (-0.81)
R^2	0.18%	0.07%	0.90%
F	0.24	0.046	0.65
N	131	60	71

*, **, *** denotes significance at 10%, 5%, and 1% respectively, R^2 describes the goodness of fit for the observations that have been adjusted for the sample. t Stat in parenthesis

As shown in Table 5 above which summarises the result of the regression analysis test applied to the variables, the R^2 for the 1999 to 2009 time period is 0.18%; which explains that 0.18% of the variation in the price of oil can be explained by the variability in USDNGN. This shows there is a negative or weak relationship between the two variables, the unreported adjusted R^2 is -0.69%, which suggests that the simple regression model is probably not the best fit model for our sample data and doesn't show any improvement in value between different measures of volatility. The beta coefficient of the LogUSD/NGN is -24.05%, shows an inverse relationship between the variables and it is not statistically significant.

For the 1999-2003 sub-sample period, the result for R^2 means that 0.07% of the variation in the price of oil can be explained by the variability in USDNGN. This shows there is a negative or

weak relationship between the two variables during this sub-sample period, the unreported adjusted R^2 is -1.64%, which suggests that the simple regression model is probably not the best fit model for our sample data. The beta coefficient of the LogUSD/NGN 19.82%, which shows the inverse relationship between the exchange rate and the oil price and does not show any significance statistically.

For the 2004-2009 sub-sample period, the R^2 for the USD/NGN is 0.9%; which explains that 0.9% of the variation in the price of oil can be explained by the variability in USDNGN. This shows there is a negative or weak relationship between the two variables,, the unreported adjusted R^2 is -0.49%, doesn't show any improvement in value between different measures of volatility which suggests that the simple regression model is probably not the best fit model for our sample data. The beta coefficient of the LogUSD/NGN is -47.69, which is not significant statistically and further shows the inverse relationship that exists between the exchange rate and oil price. Although Nigeria is seen as one of the leading oil countries, yet, the result is not credible as oil is an international commodity and the price could be dictated by events and developments in the global economy and also through the Cartel pricing policy of the organization of petroleum exporting countries (OPEC).

The result of our regression calculation shows a weak relationship between oil price and exchange rate as the coefficient figure is negative for the sub samples as well as the whole sample period as shown in table 5 above. These suggest that there are different explanations for this; Nigeria is a peculiar nation in which there has been frequent changes in monetary policy e.g. the structural adjustment programme (SAP) affects exchange rate indirectly, theses make the naira to be volatile because it consistently depreciate in value during this period against the US dollar and the US dollar consistently gaining more value against the naira. .

The above results are valid and consistent with some earlier research on the assessment or impact of oil price shock and exchange rate volatility on economic growth and international trade in Nigeria and Switzerland, Ozturk (2006), Gounder and Bartleet (2007), Aliyu (2008, 2009). The studies discovered that Nigerian economy will converge towards its long run equilibrium level in a moderate speed after an oil price shock or a fluctuation in the level of the exchange rate.

5. Conclusion and recommendations for further research

From the results above we can infer that there are other factors that affect the change in the oil price apart from the exchange rate. Crude oil price change is usually very sensitive to events around the world and tension in the oil producing areas. OPEC too affects the price of crude oil by increasing or decreasing the allocations to be sold by countries. The activities of oil speculators too have come to greatly affect the price of crude oil, and it will be interesting to examine the impact speculators have on the change in price of crude oil against the normal drivers of crude oil price.

The exchange rate of Nigeria is quite peculiar. There have been about at least three different exchange rate regimes enforced in Nigeria between 1999 and 2009, from the floating exchange rate to the wholesale Dutch auction system, and all these have bearings on the existing exchange rates. Nigeria is a largely consuming economy, and most of these importations are done in US dollars, this also puts pressure on the dollar. Monthly allocations of the three tiers of government are also done in US dollars, all these factors affect the exchange rate of the Naira vis-à-vis the dollar in one way or the other.

We expected some level of relationship between the crude oil price and the USD/NGN exchange rate, especially since Nigeria is one of the top oil exporting nations; however, our results suggest the impact of the crude oil price impact on the USD/NGN exchange rate is negligible bearing towards non-existent. Some reasons have been adduced above that might explain the peculiarity in the USD/NGN exchange rate, and inclusion of some macroeconomic variables in the model might help improve or shed more light on this relationship. It will also be interesting to interchange the dependent and the independent variables to see how crude oil price affects the exchange rate rather than how the exchange rate affects the crude oil since there are many factors that affect crude oil prices for which Nigeria naira can only have a minimal impact.

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Appendix

Monthly spot crude oil 1999-2009

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	11.13	25.40	25.30	19.53	30.72	30.86	43.82	64.16	56.20	93.89	47.84
Feb	10.11	28.29	27.03	20.13	32.26	30.36	45.27	62.17	60.12	97.23	47.03
Mar	12.30	27.44	23.70	23.55	30.69	33.02	53.00	63.83	64.07	106.03	48.59
Apr	15.20	22.86	24.82	25.59	25.10	33.38	53.05	71.80	69.88	113.29	51.11
May	15.39	27.74	28.02	24.97	25.51	37.24	50.06	71.74	70.00	127.87	59.02
Jun	15.68	29.74	27.80	23.83	27.32	35.45	55.84	70.22	72.51	137.85	70.15
Jul	19.18	28.53	24.46	25.86	28.28	37.94	58.29	75.49	78.47	138.16	65.57
Aug	20.32	28.72	25.49	26.83	29.73	42.50	65.38	75.29	73.73	116.85	73.44
Sep	22.84	32.69	25.78	28.44	27.39	43.51	65.60	63.87	79.10	103.30	68.42
Oct	22.16	30.67	20.55	27.84	29.48	49.87	60.69	60.53	84.03	76.83	73.85
Nov	24.76	32.78	18.87	24.09	28.82	43.54	57.29	61.15	94.20	57.14	77.95
Dec	25.82	25.53	18.71	29.24	29.56	39.00	58.04	64.38	93.11	45.22	75.40

Monthly average official exchange rate of the naira

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	86.0000	98.7800	110.5045	113.9625	127.0695	136.0823	132.8600	130.2900	128.2772	117.9768	145.7803
Feb	86.0000	99.9143	110.7050	114.2759	127.3150	135.1625	132.8500	129.5931	128.2687	118.2100	147.1444
Mar	86.9659	100.9319	110.6550	116.0400	127.1640	134.4317	132.8500	128.7043	128.1513	117.9218	147.7226
Apr	90.0000	100.3783	113.7000	116.1286	127.3700	133.5091	132.8500	128.4652	127.9814	117.8737	147.2272
May	94.8800	101.1452	113.5667	116.5500	127.6676	133.0119	132.8200	128.4518	127.5596	117.8342	147.8427
Jun	94.8800	101.8286	112.4750	118.4900	127.8317	132.7500	132.8700	128.4543	127.4090	117.8086	148.2018
Jul	94.8800	105.3286	111.8455	123.7232	127.7720	132.7991	132.8700	128.3811	127.1859	117.7671	148.5890
Aug	94.8800	102.8848	111.6957	125.7547	127.8950	132.8295	133.2271	128.3273	126.6753	117.7420	151.8580
Sep	94.8800	102.3619	111.6000	126.4491	128.5750	132.8445	130.8102	128.2902	125.8826	117.7256	152.3017
Oct	94.8980	102.4773	111.6000	126.5553	129.7886	132.8552	130.8392	128.2830	124.2760	117.7243	149.3550
Nov	96.4541	102.5205	111.9864	126.8294	136.6067	132.8690	130.6271	128.2858	120.1206	117.7433	150.8469
Dec	97.6022	106.7111	112.9861	126.8833	137.2233	132.8600	130.2900	128.2919	118.2097	126.4756	149.9513

Monthly average official exchange rate of the US dollar

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	0.011628	0.010124	0.009049	0.008775	0.00787	0.007348	0.007527	0.007675	0.007796	0.008476	0.00686
Feb	0.011628	0.010009	0.009033	0.008751	0.007855	0.007399	0.007527	0.007716	0.007796	0.00846	0.006796
Mar	0.011499	0.009908	0.009037	0.008618	0.007864	0.007439	0.007527	0.00777	0.007803	0.00848	0.006769
Apr	0.011111	0.009962	0.008795	0.008611	0.007851	0.00749	0.007527	0.007784	0.007814	0.008484	0.006792
May	0.01054	0.009887	0.008805	0.00858	0.007833	0.007518	0.007529	0.007785	0.007839	0.008487	0.006764
Jun	0.01054	0.00982	0.008891	0.00844	0.007823	0.007533	0.007526	0.007785	0.007849	0.008488	0.006748
Jul	0.01054	0.009494	0.008941	0.008083	0.007826	0.00753	0.007526	0.007789	0.007863	0.008491	0.00673
Aug	0.01054	0.00972	0.008953	0.007952	0.007819	0.007528	0.007506	0.007793	0.007894	0.008493	0.006585
Sep	0.01054	0.009769	0.008961	0.007908	0.007778	0.007528	0.007645	0.007795	0.007944	0.008494	0.006566
Oct	0.010538	0.009758	0.008961	0.007902	0.007705	0.007527	0.007643	0.007795	0.008047	0.008494	0.006695
Nov	0.010368	0.009754	0.00893	0.007885	0.00732	0.007526	0.007655	0.007795	0.008325	0.008493	0.006629
Dec	0.010246	0.009371	0.008851	0.007881	0.007287	0.007527	0.007675	0.007795	0.00846	0.007907	0.006669

Summary output of USDNGN/oil 1999-2009

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.0433452							
R Square	0.00187881							
Adjusted R Square	-0.0058586							
Standard Error	0.10056302							
Observations	131							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	0.002455642	0.0024556	0.2428222	0.623012849			
Residual	129	1.30456688	0.0101129					
Total	130	1.307022522						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0156251	0.009027138	1.7309029	0.0858601	-0.00223531	0.0334855	-0.0022353	0.03348551
log USD/NGN	0.24052839	0.488114959	0.49277	0.6230128	-0.725219	1.2062758	-0.725219	1.20627578

Summary output of USDNGN/oil 1999-2003

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.02826256							
R Square	0.000798772							
Adjusted R Square	-0.016428835							
Standard Error	0.10341345							
Observations	60							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	0.000495852	0.000495852	0.046365829	0.830267579			
Residual	58	0.620271816	0.010694342					
Total	59	0.620767668						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.015480677	0.015093854	1.02562786	0.309325653	-0.014732954	0.045694308	-0.014732954	0.045694308
log USD/NGN	-0.198242703	0.920657714	-0.21532726	0.830267579	-2.04113933	1.644653924	-2.04113933	1.644653924

Summary output of USDNGN/oil 2004-2009

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.097302588							
R Square	0.009467794							
Adjusted R Square	-0.004887746							
Standard Error	0.099209176							
Observations	71							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	0.006491319	0.006491319	0.659521973	0.419521722			
Residual	69	0.67912978	0.009842461					
Total	70	0.685621099						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.013234181	0.01180129	1.121418182	0.265997524	-0.010308748	0.03677711	-0.010308748	0.03677711
log USD/NGN	0.476868578	0.58719733	0.812109582	0.419521722	-0.694558028	1.648295184	-0.694558028	1.648295184