The Nigerian Stock Market and Oil Price: A Cointegration Analysis

T.O. Asaolu
Department of Management and Accounting
Obafemi Awolowo University , Ile –Ife, Nigeria
B.M. Ilo
Department of Accounting , Banking and Finance,
Olabisi Onabanjo University, Ago –Iwoye, Nigeria

Abstract

It has been theorized that oil price shocks impact negatively on stock prices. This paper subjects this proposition to test in the Nigerian case, a major world oil exporting country.

Specifically, this study investigates the relationship between the Nigerian stock market return and the world crude oil price . This has been analysed under the cointegration and vector error correction (VECM) framework from 1984 to 2007.

The study shows that the Nigerian stock market return and oil price   are tied together in the long –run as anticipated given the dominance of the oil sector on the Nigerian economy. However, contrary to expectation Nigeria, an oil exporting country still experiences the golden rule- "oil up, stock down" which should be applicable to oil importing countries. This may be an indication the country's failure to translate its huge foreign exchange earnings from oil into an improved industrial sector productivity. It also an indirect manifestation of the deleterious effect of huge annual foreign exchange expenditure on importation of petroleum products for energy supply bothering on the inability to locally refine a substantial part of its crude oil and the apparent collapse of power supply by the Power Holding Company of Nigeria (PHCN) for domestic and industrial use.

It is recommended that the most viable solution towards improved economic performance lies in refining the Nigerian crude oil locally so that the huge benefits of the naturally endowed oil can be realized rather for the development of the economies of other nations.

1.0 INTRODUCTION

The Nigerian economy has been dominated by the crude oil revenue since the early 1970s . The country is now rated as the world seventh largest producer of oil. Generally, oil revenue has continued to account for about 40 per cent of the gross domestic product. For instance oil revenues accounted for an average of 27.75 per cent of total export between 2000 and 2005 and also provided an average of 38.16 per cent of the gross domestic product over the same period. The oil has effectively dominated the nation's economic activities and the national budget is built annually around the oil production and revenue. It therefore implies that the general performance of the government budget , aggregate economy and its sub sectors will become much more sensitive to the vagaries of the oil production activities and market performance .

If the government generates enough revenue from oil either as budgeted or above budget estimates (as has been the case since the Iraq –US, and Middle East crises) it will spend more . The federally collected revenue stood at N5, 695.1billon in 2006, 7.5 per cent over the 2005 performance. The revenue performance, which was 32.7 per cent of GDP, was largely attributed to huge receipts from the oil sector as the prices of crude oil exceeded the budget benchmark price of US $35.99 per barrel (CBN, 2006). This expectedly will boost the purchasing power of the economy, promote industrial growth and investment. Consequently, it is expected that this

will boost the earnings of corporate firms, dividend payment to investors, while simultaneously increasing stock prices.

Given the above background it is thought that the performance of the oil Nigerian oil sector will be one of the major systematic factors affecting the performance of quoted firms in Nigeria although there has been no empirical evidence to support this. This is what this paper sets out to achieve given the pervasiveness of the oil on the entire economy. Many industries depend on the oil sector domestically either for the supply of raw materials or to generate energy in the face of total collapse of electricity supply from the Power Holding Company of Nigeria. For instance Osei(2006) found that an upward movement in the world price of gold a major mineral export in Ghana increases the demand for shares thus, moving up stock prices on the Ghana Stock Exchange. The CallWriter (2004) asserted that oil prices exerted terrible influences on the stock markets in the 1970s and 1980s and are now doing so again .

As affirmed by Eryigit(2009) there are many studies on the relationship between oil prices and stock prices and real economic activity but only a few concentrated on the emerging economies financial markets. In the Nigerian case, no study to the best of our knowledge has specifically investigated the relationship between the oil price and Nigerian stock market, except for Somoye and Ilo (2008) who included the oil price in their evaluation of the performance of Nigerian Stock market and economic activity. Meanwhile many authours like Gisser and Goodwin(1986), Cunnado and Gracia(2005) Bashar and Sadorsky(2006) Erygit(2009),   have confirmed the significance of the shocks in oil price on the real activity and the stock market in particular in the U.S.A , Jordan , Greece and other economies.

The CBN(2006) reported that the output of industrial sector declined by 2.6 percent in 2006 , largely due to the fall in crude oil production . This further amplifies the need to start including the impact of shocks from the crude oil prices as one of the relevant factors when constructing a multifactor model for pricing of shares in Nigeria.

This paper therefore, hypothesizes that the dollar price of crude oil as determined at the world oil market has a significant impact on the performance of the Nigeria capital market. It is therefore expected that this study will further enhance our understanding of another important factor in the pricing of shares in Nigeria.

1.2 **An Overview of the Nigerian Stock Market and Crude Oil**

Table 1 shows some basic statistics about the stock market and the performance of the Nigerian economy and the oil market. It is obvious that increases in oil price lead to an appreciation of the naira as more foreign currencies are generated through improved oil revenue as further shown by growth in value of oil export as a percentage of total export.

Table 1. The Nigerian Stock market and the oil statistics

	2002	2003	2004	2005	2006
Average Crude oil price per barrel (dollar)	25.0	29.2	38.7	55.4	66.4
Average exchange Rate (N/ US $)	121.0	129.4	133.5	132.1	128.7
Oil export/Total Export (%)	15.4	20.5	28.7	32.0	41.0
Oil output/GDP (%)	34.58	41.50	37.22	38.87	38.65
Market Capitalization/ GDP	9.4	13.1	16.5	19.5	28.1
NSE Index growth(%)	10.7	65.8	18.5	1.00	38.5

Number of Quoted equities

	258	265	277	288	288

All Share index(1984=100)

	12,137.7	20,128.9	23,844.5	24,085.8	33,358.3

Market capitalization

(N'billion)	748.6	1,324.9	1,925.9	2,900.1	5,120.9

Sources: CBN Annual Reports and Accounts December, 2006.

The stock market has also assumed an upward trend over this period as indicated by the growth in the number of quoted companies, the market index and market capitalization. In addition the stock market has continued to follow the same trend with the oil as shown by the size of the capital market relative to the overall economy as indicated by the ratio of market capitalization to the gross domestic product. In summary the Nigeria stock market and the Nigeria economy have both moved in the direction of oil price shocks over the five-year period illustrated above.

2.0 LITERATURE REVIEW
Economic Effects of Oil Prices

Oil is perhaps the world's resources with almost an unlimited range of uses .From petroleum case the primary product like gasoline, petrol and diesel fuel , heating oils etc that is burnt to even generate electricity not only in Nigeria but also other parts of the world. Other bye products like wax, bitumen, gas are becoming of increased demand for both household and industrial use. The effect is becoming increasingly manifest on the overall economy starting from its revenues generation to government up to its pervasiveness on the industrial output. As indicated by CallWriter (2004), the crude oil market is the largest commodity market in the world. The total world consumption is 70-80million barrels per day of which the USA consumes approximately 25 percent. In the last few years there has been a continuous increases in the price of crude oil. CallWriter, 2004 attributed this to factors like continuing increase in demand for oil for household and industrial use (ii) organized terrorism in the Middle East; destroying oil production in Iraq and other producer countries,(iii) political unrest Venezuela –the number five oil-producing country and finally the world's failure to develop alternative energy sources. In the Nigerian case the continuous hostage activities in the Niger Delta and vanderlisation of oil pipelines have also contributed to the decline in oil exploration and production. All these have over the years culminated sporadic increases in oil prices in the world market. Oil prices exerted terrible influences on the stock markets in the 1970s and 1980s and are now doing so again.

Fama (1981) observes that the world has shifted attention from oil dependent economy to electronic era and hence a possible reduced impact of oil shock in the economy, though still indirectly affects production , output and price. Since the price is still associated with macro factors that may cause increase in inflation. Gisser and Goodwin(1986) indicate that oil price shocks have an adverse effect on the macro economy and may even cause a recession.

Cheung and Ng (1998) found an empirical evidence in support of a long run relationship between some stock market indices and some macroeconomic factors including oil prices .They found a negative correlation between oil prices and stock prices, they argued that increase in oil prices generally leads to increase in cost of production and then a fall in aggregate output.

Papapetrou(2001) investigated the relationship oil price shocks, stock market , economic production activity and unemployment in Greece. The industrial production index, and unemployment were used as measures of economic activity. He found that oil price shocks have negative impact on industrial production and unemployment. This result suggests that a positive oil price shock creates a depressed real stock return.

Brasher(2004) in their analysis of how the oil affects stock market documents that authours found in the case of the U.S.A that all sectors are not affected equally, or at the same time. They found that when oil prices rise : cyclical stocks are the most negatively influenced , cyclical consumer goods are the nest most negatively influenced, and lastly financials are the next most negatively influenced. According to the documentation cyclical stocks include, general retailers, support services, leisure and hotels, entertainment and

media. Cyclical consumer goods comprise household goods and textiles, automobiles and parts, while the financials are the investment companies, banks, especially and other finance, life assurance and insurance and real estate. Beyond this analysis it is also obvious that stock prices and stock prices are inversely related in the U.S.A .

Bashar and Sadorsky (2006) explain that the extension of the law of demand and supply is applicable to oil price movement s. A demand surplus for oil leads to price increase. The oil price increase creates an indirect effect on the stock price through: (i) oil price increase acts like an inflation tax. (ii) makes consumers source for alternative energies (iii) increases in the cost of non-oil producing companies' oil price volatility increases risk and uncertainty which negatively affect the stock price and reduces wealth and investment.

Other authours like Cunnado and Gracia (2005) and Lardic and Mignon (2006) based their argument on the classical supply side effect. An increase in oil price , pushes up production cost leading to a decline in output growth and productivity. It impacts negatively on the trade of oil importer countries. It also leads to increases in money demand to meet extra cost which subsequently creates inflation , wage increases, with consequent decline in investment and ultimately in gross decline in domestic product.

Yurtserver and Zahor(2007) studied the impact of oil price shocks on the stock returns in Netherlands . They found that oil shocks have a negative impact on stock returns of some industries and individual companies, whereas they have positive impact on oil and gas companies.

Somoye and Ilo (2008) examined the Nigerian stock market performance and the Nigerian economic activity from 1985 to 2005. Due to the short time span covered by the study their estimation stopped at the vecto-autoregressive(var) estimate level for lack of sufficient degree of freedom required for a cointegration analysis. The study however, concluded that among the variables examined in the VAR model the price of the Nigerian crude oil, exchange rate and the rate of inflation are the most significant macroeconomic variables influencing the aggregate stock market returns in Nigeria.

Erygit(2009) investigated the effects of oil price changes on the sector indices of Instanbul Stock Exchange (ISE) ,Jordan from 2000:01:04 to 2008:01:11. He extended the market model by incorporating oil prices (in Turkish Lira), oil prices in dollars , and the exchange rate between the dollar and the Turkish Lira to determine the effects of oil price changes on the sectoral indices. He found that while increase in oil price (Us dollar or lira) leads to growth in some sector indices , it causes a decline in others . However, the authour did not advance reasons for such behaviour which would have guided investors based on his study.

3.0 METHODOLOGY

The study covers the period between 1985 and 2007. The terminal date of the study was to avoid possible distortions arising from the global financial crisis which became very manifest in 2008 in Nigeria, The data for the study were obtained from the Central Bank Statistical Bulletin (CBN) and the factbook published by the Nigeria Stock Exchange(NSE). The   model adopted for the study regresses annual stock market return(*MR)* on the dollar price of oil(*DPO*) , exchange rate of the US dollar to naira (*EXR*) and the gross domestic product (*DGP*). The structural model is presented in equation 1 as:

$MR_t = f(DPO_t, EXR_t, GDP_t)$ -----------1

The model expressed explicitly as

$MR = \alpha + \beta_1 DPO + \beta_2 EXR + \beta_3 GDP$ ---------2

Where , βi represents the regression estimate of each variable.

The a priori expectations are : $\beta_{1<0}, \beta_{2>0}, \beta_{3>0}$

The principal variable under study is the oil price while the gross domestic product and exchange rate are important control variables having impact on every sector of the Nigeria economy. Somoye and Ilo (2008) have demonstrated the importance of these variables on the performance of the Nigerian capital market.

Unit Root Test

All the variables are non-stationary based on the unit root test, they are I(1). It then implies the application of OLS will produce a spurious regression whose estimates will not only be unreliable but also misleading. Modern econometric techniques have shown that a linear combination of two variables that are each I(1), (containing stochastic trends) can be achieved through appropriate methods such that their residuals become I(0) or stationary. Adam(1992) noted that if y and x are I(1)then the residuals from the regression of those series would be I(0) unless they are cointegrated .

Cointegration Test

The cointegration test based on the Johansen technique indicates that the market return ,oil price and the gross domestic products are tied together in the long run. The result presented in Table 2 as indicted by the maximum eigen values(λ) and the likelihood ratios indicates that there are at least two co-integrating vectors among the variable (MR, DPO , GDP and EXR) . This suggests that though these variables are non-stationery, their linear combination is stationery, hence an indication of a stable long run relationship existing among them.

Table 2: Johanson Cointegration Test Result

Eigenvalue	Likelihood Ratio	5% critical value	1% critical value	Hypothesized No. of CE
0.848364	75.14021	47.21	54.46	None**
0.678738	35.52854	29.68	35.65	At most 1*
0.436380	11.68307	15.41	20.04	At most 2
0.000548	0.011506	3.76	6.65	At most 3
*(**) denotes rejection of the hypothesis at 5%(1%) significant level L.R test indicates 2 cointegrating equations at 5%significance level				

Source: E-view cointegration test on data

Long Run Equation (Cointegrating Equation)

        Given the existence of two cointegrating equations , we resort to economic theory to identify the true cointegrating relationship (see Maddala, and Kim 1988) . We then estimate an error correction model that combines both the short and long run dynamics of the model.

The estimated normalized cointegrating equation (*normalized on the oil price*) from which the error correction estimates are obtained is given as :

MR	DPO	EXR	GDP	C
1.0000	0.4099	0.0040	-1.2897	109.3366
s.e	(0.1128)	(0.0027)	(0.1956)	

t-values   (3.6355)*   (1.4921)   (-6.5924)*
*Log likelihood: - 367.1649,   * : Significant at 1 per cent*

The cointegrating relationship above shows that the oil price and the economic growth (gdp) have a very strong and significant long-run relationship with the performance of the Nigerian stock market. The oil price has a negative and significant impact on stock prices. It thus, implies that the Nigerian stock market also obeys the "golden rule" that "oil up stock down" .Increased oil price drives the stock market down in the long run. A persistent bearish (bullish) oil market creates a bullish (bearish) stock market in the long run in Nigeria. This finding negates the expectation for Nigeria being the 7th highest oil producing country in the world (see for instance Cunnado and Gracia , 2005).

However, it may not be too surprising because Nigeria still expends huge amount of funds annually to import refined petrol and other petroleum products with the attendant negative impact on the economy. A negative impact of rising oil price on the stock market may be considered reasonable for non-oil producing countries , and not for an oil producing country like Nigeria. Rising oil prices lead to increase in production cost, increase in product prices and subsequent decline in demand for goods in the case of non-oil producing countries.

An improved economic activity as expected impacts positively on the stock market in the long run as increase in the gross domestic product leads to significant improvement in stock prices. The exchange rate impacts negatively on market performance but not significant, implying that continuous depreciation of the naira will lead to the depression of stock prices.

Vector Error Correction Model (VECM)

The parsimonious VECM which captures the short an long run behaviour of the variables is presented in table 3. It shows that the estimated ECM is a good fit (F =5.54) and the good log –likelihood value(-88.94) and the Akaike information Criteria (9.04) further corroborate the appropriateness of the model.

Apart from the reported diagnostic tests above , the error correction term is rightly signed(negative) as theory has predicted. The VEC term captures the adjustment from the short to long-run equilibrium in the stock market. The VEC coefficient of -1.203(which is also very significant) indicates a rapid contemporaneous adjustment in the stock market in the short run to its long-run position.

Table 4 : Vector Error Correction Model

Error Correction	D(MR)	t-value
ECM	-1.2030	-3.9295
D(MR(-1)	0.6546	3.0481
D(DPO(-1)	-0.5949	-1.2603
D(EXR(-1)	0.0606	3.2305
D(GDP(-1)	-0.5229	-1.7659

Adj. R^2: 0.5316; Sum sq. resides: 5868.968;
S.E equation: 19.7804; F-statistic: 5.5402;
Log likelihood: -88.9433; Akaike AIC 9.9422;
Schwarz SC: 9.3406; Mean dependent 2.3105

5.0 SUMMARY AND CONCLUSION

The paper examines the relevance of the Nigerian crude oil price in the evaluation of the long-run performance of the Nigerian stock market. The crude oil has been the major source of revenue to Nigeria since its discovery and has continuously accounted for about 40 per cent of the gross national product annually. It is therefore, thought to be a major driver of almost every other sectors of the economy including the capital market hence the essence of this study.

The analysis has been based on the NSE yearly market return data from 1985 to 2007 and the Nigerian crude oil prices. The data has been subjected to time series econometric analysis and found to be non-stationary. The model produced two cointegrating equations. The study concludes that the Nigeria stock market and the oil price are tied together in the long run. A rise in the price of oil leads to a decline in the return performance of the market. Although this is in line with theory, it is considered abnormal for an oil producing economy like Nigeria. It is therefore recommended that the country should ensure that the revenue from oil is prudently utilized in order for it to impact positively on the economy. The finding also further corroborates the critical importance of refining the Nigerian crude oil locally, to conserve foreign exchange, and eliminate importation of refined petroleum products and its attendant general deleterious effect on the economy in terms of imported inflation, high production cost, and pressure on foreign exchange and the consequential decline in stock prices in particular.

Crude Oil Price and NSE Returns
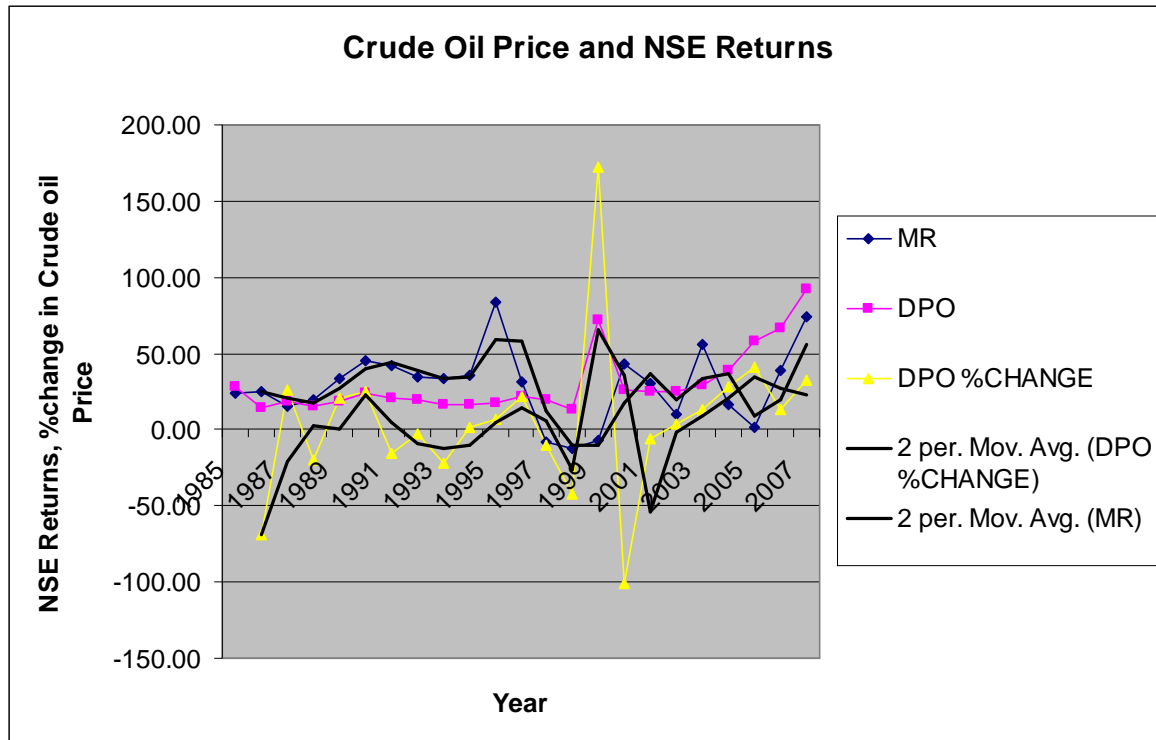
REFERENCES

Adam, C. S. (1992) Recent Developments in Econometrics: An Application to the Demand for Money in Kenya, *African Economic Research Consortium(AERC)*, Special paper 15, September pp1-53.

Basher, S.A. and Sadorsky, P., (2006) Oil Price Risk and Emerging Stock Markets . *Global Finance Journal*, 17, p. 224-251.

Brasher J. (2004) Oil's Effects on the Stock Market , CallWritter's Money Newsletter, August 22, 2004, pp1-6

CallWriter (2004) How Oil Affects Stock Markets : *Money News Letter Achieves* , August 22, 2004

CBN(2006) Annual Reports and Accounts, December

Cheung, Y.W. and Ng, L.K (1998) International Evidence on the Stock Market and Aggregate Economic Activity. *Journal of Empirical Finance,* 5; pp.281-296

Cunado, J. and Gracia F.P (2005) Oil Prices , Economic Activity and Inflation: Evidence from Some Asian Countries, *The Quarterly Review of Economics and Finance;* 45, pp.65-83.

Eryigit M. (2009) Effects of Oil Price Changes on the Sector Indices of Istanbul Stock Exchange . *International Research Journal of Finance and Economics ,* Issue 25, pp. 209-216.

Fama, E. F(1981) Stock Returns, Real Activity, Inflation and Money, *American Economic Review*, vol.71(4) , pp. 545-565 , September.

Gisser, M. Goodwin T.H (1986) Crude Oil and the Macroeconomy: Tests of Some Popular Notions, *Journal of Money,* 18, 95-103.

Hamilton, J.D(1983) Oil and the Macroeconomy since the World War II, *Journal of Political Economy* 91, pp.228-248

Lardic, S. and Mignon , V.(2008) Oil Prices and Economic Activity: An Asymmetric Co-integration approach. *Energy Economics*; 30, pp. 847-855.

Osei, K. A.(2006) "Macroeconomic Factors and the Ghana Stock Market ", *The African Finance Journal* , volume 8 part 1, 26-38.

Papapetrou, E. (2001) Oil Price Shocks, Stock Market, Economic Activity and Employment in Greece. *Energy Economics*, 23, pp.511-532.

Somoye R.O.C and B.M Ilo(2008) Stock Market Performance and the Nigerian Economic Activity, *Lagos Journal of Banking , Finance and Economic Issues*, vol. 2.No.1 July , pp.133-145.