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Review of oil price volatility and stock returns of oil and gas companies

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Abstract

The broad objective of this study is to theoretically examine the effects of oil price volatility on stock returns of oil and gas companies around the world. This study is essentially a library research which was based on empirical literature survey and secondary information. The study started by reviewing the influence of oil price volatility as well as its effects on oil exporting economies. It examined the determinants of oil price volatility which include: flow demand shocks, flow supply shock, the role of expectation in the physical market of crude oil, financial expectations in the oil future markets and the role of OPEC. Various theories associated with oil price volatility were examined. Prior empirical studies on the effects of oil price volatility on oil stocks and the effect of volatility in crude oil prices on stock markets were discussed. It was discovered that there exists significant relationship between oil price and the oil stocks both in the short and long run. Volatility of the stocks of the oil companies is persistently affected by oil price volatility transmission. An upward trend in oil prices leads to higher stock returns of oil and gas companies operating in the upstream sector but there exist a negative relationship between oil price volatility and stock returns of oil and gas companies operating in the downstream sector and many other industries outside the oil and gas sector. The rate of information flow and volatility in oil prices lead to volatility in other markets.

Keywords: Oil Price Volatility, Oil Stocks, Oil Exporting Economies, Flow Demand Shocks, Flow Supply Shocks, OPEC.

1. Introduction

Oil price volatility is one of the major problems facing the Nigeria economy today. Other developed and developing countries are also not spared from the effect of the negative downturn in oil prices as it affects balance of payment. Economist and analyst pay close attention to these changing prices with a view to minimizing loss of revenue in the future as a result of price volatility. According to Berk and Aydogu (2012) ^[8] since 1973 when the first oil crisis occurred, academic researchers, policy makers and investors have at various times discussed and researched on the impact of oil price changes on macroeconomic activity. The ground-breaking study of Hamilton (1983) ^[27], whose findings reveals that there is significant relationship between US recessions and increase in crude oil prices, has been acknowledged as the essential basis for successive studies on the effects of crude oil price shocks on macroeconomic indicators such as, inflation, industrial activity and GDP growth rate

Crude oil is probably the physical commodity that most affects the state of the economy. This impact can take place through various paths. When crude oil prices rise, cost of producing goods and services increase, and so do transportation and heating costs, which in turn lead to inflationary pressures and thus restricted consumption from consumers. This produces a negative effect to capital markets, the macro economy as a whole and consumer confidence (Chaibi & Gomes, 2013) ^[11]. There are thus, various theoretical reasons for which oil prices can have a significant impact on financial markets, and stock markets in particular. One of them is that the value of stock prices in equity asset valuation models theoretically equals the sum of future discounted earnings prospect of companies or future cash flows. Consequently, changes in crude oil prices can directly have an impact on share prices through the anticipated cash flows on the one hand, and through the discount rate on the other hand. However, according to Chaibi and Gomes (2013) ^[11] it is worth noting that not all companies will react the same way to changes in oil prices. Indeed, the direction of stock price reactions depends on whether the company is an oil producer or an oil consumer. Oil producers will profit from an oil price increase while oil consumers will suffer from it. Overall, since the great majority of companies are oil consumers, it is logical to look forward to a negative effect of oil prices on stock prices.

This study is necessitated in that, it seeks to find out if the volatility of oil prices goes a long way

to affect the stock returns of oil and gas companies which determine their ultimate survival and performance in the industry. The findings of this research will help oil and gas companies to know the impact of oil price volatility on their stocks returns and the various determinants of oil price volatility which will equip them in making decision that will mitigate the effects of unfavorable oil prices. The primary objective of this research is to examine the effects of oil price volatility on stock returns of oil and gas companies while the specific objectives are to examine the effect of oil prices on oil stock and to determine the effects of volatility in crude oil prices on stock market.

2. Literature Review

2.1 Conceptual Framework

Volatility has been defined as the standard variation or deviation in a given period. Sauter and Awerbuch (2003) [48] posit that from 1948 – 1985 most oil price movement consisted in price increase, but from 1986 onwards the pattern changed as there were large increases and decreases resulting to a considerable rise in the instability of the real oil price. The first quarter of 1997, witnessed the fall in oil price from \$21.02 per barrel to \$10.86 per barrel in 1999, then from the second quarter of 1999, there was a dramatic rise to \$29.11 in the third quarter of 2000 (Sauter & Awerbuch 2003) [48]. As a

result this, Hooker (1996) [30] argue that the correlation of U.S. economic growth and oil price had changed and could not be explained either by the asymmetric relation offered by Mork (1989) [43] or by a linear relation between oil prices and output. Hooker’s study could not confirm if it is only oil price increase that effect economic growth and not decreases. These findings are completed by successive studies.

Hamilton (1996) [26] found out that since 1986 majority of increases in the prices of oil was immediately followed by even larger decline, this finding agrees with that of Hooker. Rather than comparing the current price level of oil with the price level of previous quarter Hamilton decided to compare it with the price level of previous year. He then introduced the “Net Oil Price Increase” (NOPI). He applied the data after 1986 which then revealed that except for the Gulf War period, individual price increases were simple corrections to earlier declines. In contrast to Hooker, Hamilton posited that when the entire sample from 1948 to 1994 is used, the relationship between GDP growth and NOPI remains very significant. Hamilton therefore concluded that despite the fact that oil price increases had a smaller macroeconomic effect after 1975, oil supply disruption have a significant effect on the macro economy as evident in the Gulf War. The fluctuations in oil prices can be seen below in figure1.

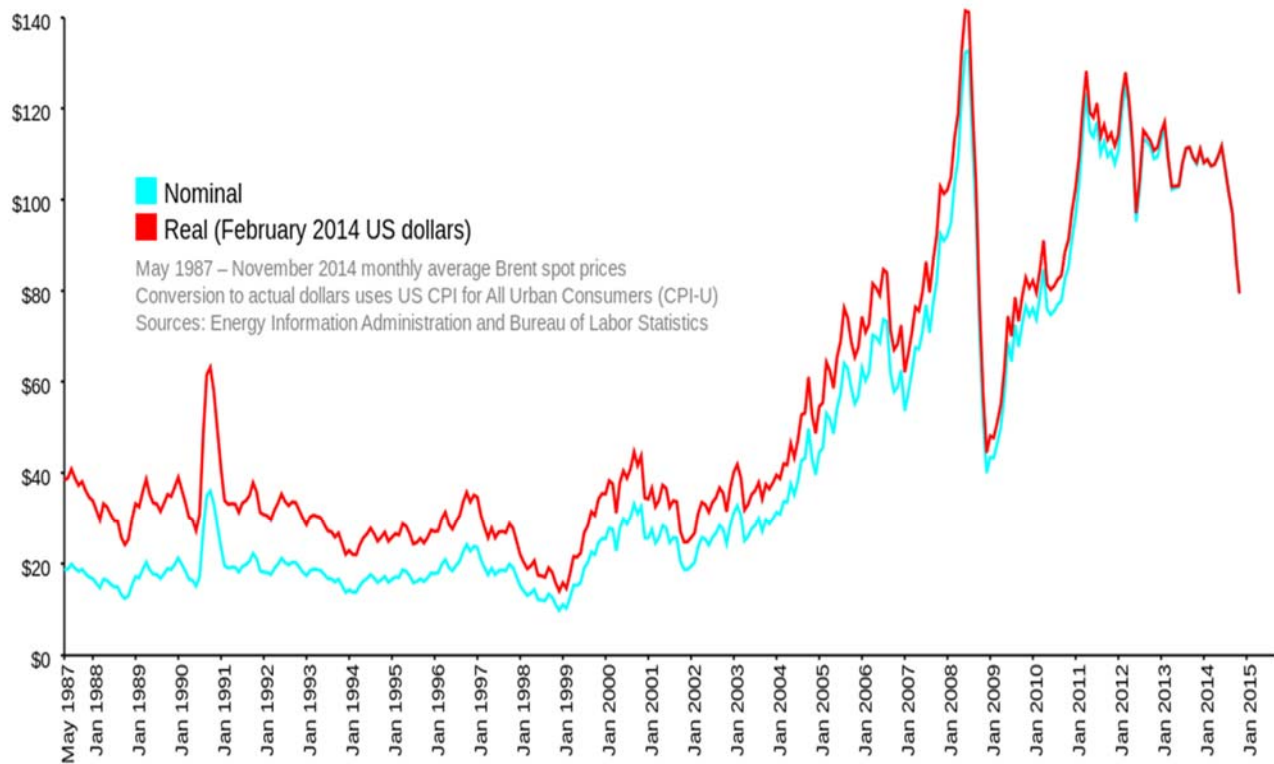


Fig 1: Brent oil price from May 1987 to January 2015

Source: Wikipedia, (2014)

2.1.1 The Effect of Oil Price Volatility on Oil-Exporting Economies

Most countries involved in oil exploration rely heavily on oil revenue as their main source of income. Rising oil price can easily be accommodated by oil producing countries but falling oil prices can become a major problem as it put a strain on their fiscal balances and hinder their ability to obtain loans from abroad, hence there is need for oil producing economies to plough back their excess oil revenue into the global

financial system. First and foremost there is an incentive to smooth expenditures with the expectation of decline in the real price of oil in the future. Secondly, the oil producers may decide to diversify the economy with this extra revenue in other to reduce the effect of unfavorable volatility in oil prices, but when there are no viable domestic investment opportunities these extra revenue can be invested in oil importing economies (Killian, 2009), an example of this is the sovereign wealth fund which is maintained by several oil

producing countries. In reality, investments opportunities abroad are quite limited, resulting in oil revenue fund to be deposited in international bank thereby creating ease to global credit. He further opined that this led to banks lending capital which they had obtained from OPEC countries to oil importing developing countries with little regard to creditworthiness. While this fund recycling seemed successful by helping many oil importing countries cope with external deficit during the short-run, the over reliance on short-term funds for financing long-term deficit eventually caused the global debt crisis of the 1980s, this happened as a result of the drying up of credit followed by an increase in global interest rates. Additionally, banks found out that oil producers are better prospects for making loans because the high level of oil prices seems to guarantee their credit worthiness. As a result of the lack of viable productive investment opportunities in the oil producing countries, these loans were used to finance higher domestic consumption as well as higher imports. This later proved to be a misjudgment since oil prices did not remain high forever and became volatile, which made oil rich countries like Mexico to go into default and it further threatened the stability of the international financial system. This problem of excess borrowing by oil producers is yet to be resolved as the recent experience in Dubai reveals (Killian, 2009).

2.1.2 Determinants of Oil Price Volatility

According to Fleming and Ostdiek (1999) ^[22] oil price has been considered more volatile since the oil crisis of 1973. The strong fluctuations of oil prices can be traced to its non-renewable and scarce nature. Killian (2013) opined that the determinants of oil price volatility are;

- i) Flow Demand Shocks
- ii) Flow Supply Shocks
- iii) The Role of Expectations in the Physical Market for Crude Oil
- iv) Financial Speculation in Oil Futures Markets
- v) The Role of OPEC

Flow Demand Shocks

From 1973 to 1994, there was evidence that flow demand shocks were largely responsible for oil price increases. Flow demand entails the demand for oil for immediate consumption when producing refined products like diesel, gasoline, heating oil, kerosene and Jet fuels. As a result of the fact that oil is a necessary component for the modern day economy, flow demand for oil increases as the global economy expands. Therefore the real price of oil largely depends on the global economy. Flow demand for oil was first identified as one of the major determinants of the real price of oil by Barsky and Killian (2002), they were able to reveal that major oil price fluctuations from 1970 – 1980 were as a result of fluctuations in global business cycles. This view is also supported by Killian (2009).

Flow Supply Shocks

The effect of supply side factors on oil prices has been discussed in a broad range of studies - either with a focus on the theory of exhaustible resources, with an emphasis on the possible depletion of oil, or with an attempt to assess the power of the OPEC cartel. The theory of exhaustible resources is based on the work of Hotelling (1931) ^[31], who suggests that the price of an exhaustible resource increases over time at a rate which is given by the interest rate, a result

which is frequently cited in long-term studies on the oil price. It is however unclear if the implications of Hotelling's analysis can be directly applied to the oil industry. One problem is that there exists a high degree of uncertainty on the available stock of the resource (oil reserves) as well as on future technology - for the exploration and production and other alternative sources of energy. Empirically, the effect of changes in the real interest rate on oil prices has been assessed with regard to both the demand and the supply side. Frankel (2006) ^[23], for example, argues that real interest rates affect the real price of commodities by changing incentives concerning when to extract the commodities, by making the holding of inventories more or less attractive, and finally also by altering the return on other ways of investment (treasury bills). The data on real commodity prices and the real interest rate confirm the negative relationship. Similarly, Akram (2008) ^[1] finds a negative effect of the real interest rate on real oil prices. Krichene (2008) ^[39] argues that an overly expansionary monetary policy contributed to the rise in commodities prices in the period 2003-2007, as it led to high credit growth and increased demand for real assets, goods, and services and thereby created excess demand facing supply constraints. As the surge in prices was not restricted to oil prices but applied to all commodities, the shock is identified as a common monetary shock rather than an oil price shock. In recent times, a weak U.S. dollar may have also contributed to the oil price upsurge along several channels. On the demand side, countries whose currency has gained against the dollar increased in purchasing power. On the supply side, oil producers aim to keep their purchasing power stemming from export revenues, which are typically denominated in U.S. dollar. Finally, the exchange rate also determines investment behaviour as commodity investments increase in attractiveness over U.S. dollar investments and currency markets do of course also reflect fundamental factors (Breitenfellner & Cuaresma, 2008).

The Role of Expectations in the Physical Market for Crude Oil

Irrespective of the fact that flow supply disruptions have had a little effect on the real price of oil, does not imply that the political happenings in the Middle east do not matter as they in fact affect oil prices by shifting the expectation about future foreseeable shortfall of oil supply in relation to demand. This view have been supported by (Kilian, 2009; Alquist and Kilian, 2010; Dvir and Rogoff, 2010; Knittel and Pindyck, 2013) ^[3, 14, 38]. The basic idea is that, when someone expects the price of oil to rise in the future they have an incentive to hold or store oil for future use, which in turn acts as a motivation to reduce current oil consumption and stimulate further oil production. Expectation shifts therefore represent shocks to the demand for oil stocks rather than affecting flow demand. As demonstrated in Killian and Murphy (2013) ^[37] the implication of unobservable change in expectation for real price of oil may be inferred from fully recognized structural VAR oil market models that consist of data on changes in crude oil inventories held above ground. Killian and Murphy (2013) ^[37] opined that shift in expectation played a very important role during some past events, for example the oil price hike in the second half of 1979, the fall of oil prices in 1986 and oil price surge of 1990, they did not find any justification for speculative demand shocks playing a major role in the surge in the real price of oil between 2003 and mid 2008. This view is further illustrated using the graph below

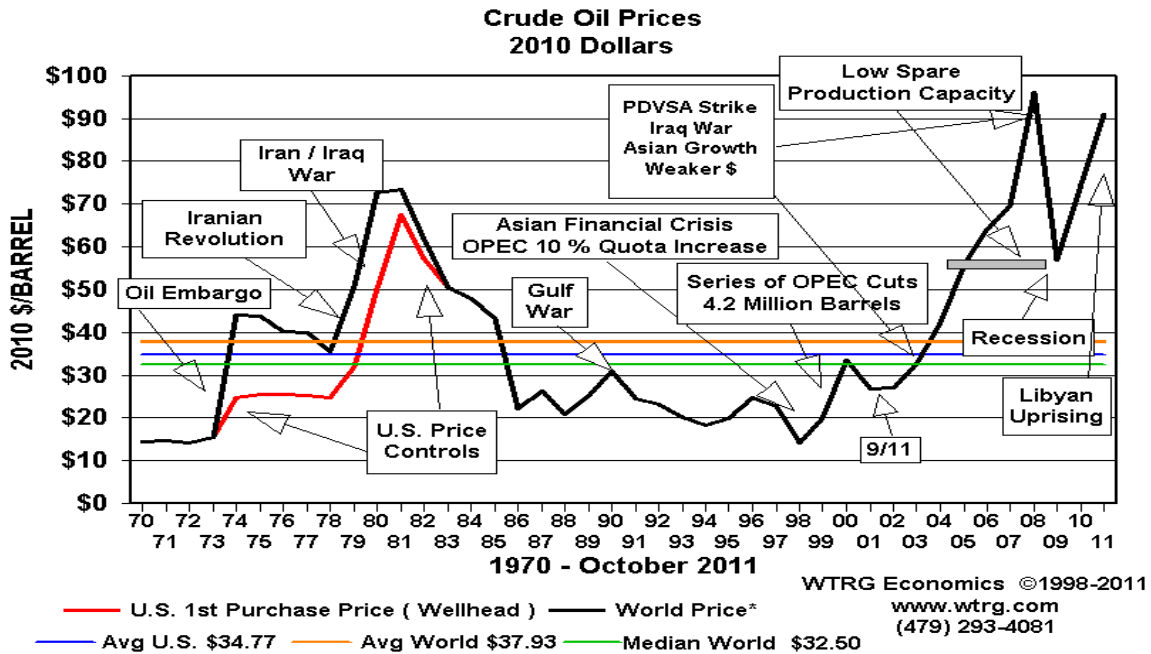


Fig 2:

Source: West Texas Research Group Economics (2011)

Though recently, despite the upheavals in oil producing countries in the middle east like the Israeli and Hamaz conflicts in Gaza Strip, civil war in Syria, Islamic state Militia in Iraq which has led to some form of shortfall in crude oil supply, oil prices are still declining. The decline in oil prices can be traced to the increase in oil production as a result of the emergence of new oil producing countries like the United States, Ghana amongst others, which has reduced oil prices to as low as \$50 per barrel from \$120 per barrel.

Financial Speculation in Oil Futures Markets

Different researchers have argued on the possibility of trade activities of investors in the oil future market as a contributing factor to the surge in the real price of oil between 2003 and mid-2008. Future contracts allow investors to enter into an agreement in advance with a seller to exchange a given quantity of crude oil at a particular price and at a given date in the future. The essence of this is to allow investors speculate on the future price of oil, in other to make money in exchange for assuming risk. Since around 2003, the fraction of speculators has increased dramatically. This has given rise to the perception that the positions taken by investor after 2003 was what led to the pressure on oil future prices which spread over to the crude oil physical market.

Alquist and Kilian (2010) ^[3], asserts that subject to the perception above, one would expect an equivalent change in stock demand driven by speculative motive after 2003, as the future and physical market are driven by arbitrage condition. Arbitrage is important as it explains how price of oil in the physical market is raised by exogenous increase in oil future prices. The implication of this is that the supposition that financial traders caused the increase in the real price of oil after 2003 can be tested using the same model that shed light on the presence of speculative demand shocks in the physical market for oil.

In view of the above supposition, Killian and Murphy (2013) ^[37] and Killian and Lee (2013) ^[36] studies showed that there is no evidence of such speculative demand pressures in the physical oil market after 2003, which under the maintained

assumption of arbitrage also rules out speculative pressures in the future market. This is said to be in line with the studies of (Fattouh & Mahadeva 2013, Knittel and Pindyck 2013) ^[19, 38].

The Role of OPEC

As a result of OPEC's global oil production and crude oil reserve, OPEC cartel plays a major role on the supply of crude oil globally. OPEC's own data reveals that the twelve OPEC member states generate 40% of global oil production and about 55% of crude oil exports. About 80% of known reserves are situated in the OPEC countries, compared to 10% in the FSU and only 4% in the OECD countries (OPEC, 2010). Among OPEC members, Saudi Arabia has by far the highest share in world known oil reserves (19,2%), followed by Iran, Iraq, Kuwait, Venezuela, and the United Arab Emirates (EIA, 2010).

Within the literature on the OPEC and oil prices, results on the actual extent of the power of the cartel over oil prices differ. Wirl and Kujundzic (2004) ^[54] investigate the effect of OPEC conference decisions on oil market developments. They find that OPEC decisions seem to have only limited impact in directing oil prices. Although the impact is small and statistically insignificant, the direction of price adjustment has the expected sign. Kaufman (2004) ^[54], on the other hand, applies a Vector Error Correction model on quarterly data from 1986 to 2000 and finds that OPEC Capacity Utilization, OPEC Quotas and the degree to which the OPEC cheats on its quotas do in fact have a significant impact on world oil prices. Fattouh (2007) ^[18] emphasizes that the ability of the OPEC to influence oil prices has changed considerably over time. He argues that there have been several occasions when the cutting of production prevented oil prices to fall to undesired levels. He also points to the role of the OPEC, and in particular Saudi Arabia, in setting off production shortfalls of other member states, as happened in 1990 or 1979-1980. According to Wirl and Kujundzic (2004) ^[54], most studies find a rather weak influence of the OPEC on oil prices after the period 1973-1985. Still, the OPEC is said to have been able to affect oil prices to some degree up to the mid nineties (Chevillon &

Rifflart, 2009) [12]. Besides an anticipated delay in the OPEC's reaction to supply shortfalls due to uncertainties of future demand, Fattouh (2007) [18] points to the reduction of the OPECs spare capacity making announcements to increase production less credible. As a related phenomenon, negative

news about geopolitical tensions, wars, revolutions, leads to risk in short or medium term exogenous supply may also result to greater oil price volatility
The role of OPEC in influencing oil prices can be seen from the graph below

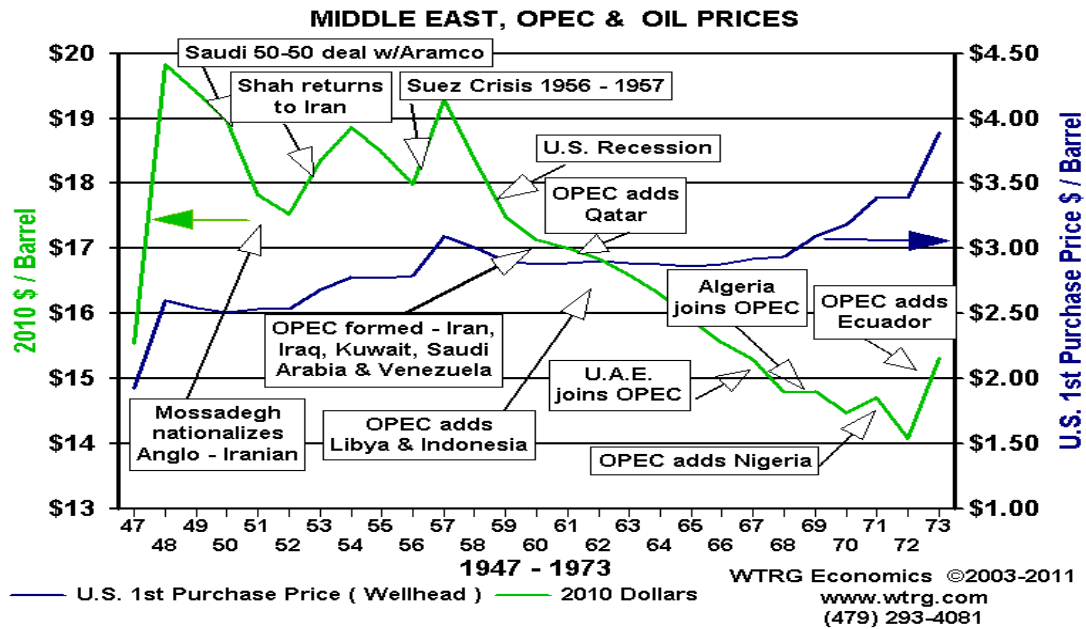


Fig 3:

Source: West Texas Research Group Economics (2011)

2.2 Theoretical framework

2.2.1 The Linear/Symmetric relationship theory

This theory which has as its proponents, Hamilton (1983) [27], Gisser (1985) [24], Goodwin (1985) [25], Hooker (1986) [28] and Laser (1987) [40] 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) [29], after rigorous empirical studies demonstrated that between 1948 and 1972 oil price level and its changes exerted influence on stock market performance and GDP growth significantly. Laser (1987) [40], who was a late entrant into the symmetric school of thought, confirms the symmetric relationship between oil price volatility, stock market performance and economic growth. After an empirical study of her own, she submitted that an increase in oil prices necessitates a decrease in GDP and stock prices, while the effect of an oil price decrease on GDP is ambiguous, because its effects varied in different countries.

2.2.2 The Asymmetry-in-effects theory

This theory used the U.S economy as a case study. The theory posits that the relationship between crude oil price decreases and economic activities in the U.S economy is significantly different and perhaps zero (Oriakhi & Osazee, 2013) [45]. Mark, Olsen and Mysen (1994) [42], 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) [21] another member of this school clarified 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 discovered a significant correlation

between oil price increases and counter-inflationary policy responses. Balke (1996) [6] supports Federer's position/submission, he posited that monetary policy alone cannot sufficiently explain real effects of oil price volatility on real GDP.

2.3 Review of Prior Empirical Studies

2.3.1 Effect of Oil Price Volatility on Oil Stocks and Stock Market

So many research works have been focused on the world's oil industry stocks and oil sensitive industry stock to oil price growth. A study conducted by Strong (1991) [51] explained how investors can hedge oil price risk using oil equity portfolios. Nandha and Faff (2007) [44] using 35 Data stream global industry indices for the period April 1983 to September 2005, examined the extent to which the adverse effect of oil price shocks impact stock market returns. The result showed that oil price rises have a negative impact on equity returns for all sectors except mining, and oil and gas industries. A research conducted on the oil price changes by Hamilton (1983) [27] on the U.S. economy showed that exogenous developments attributable to petroleum sector is a function of changes in the nominal crude oil prices as a result of timing factor. The Study by Faff and Brailsford (1999) [17] on Australian industry equity returns on oil price between 1983 – 1996 showed a significant positive oil price sensitivity of Australian oil and gas and diversified resource industries unlike paper, packaging, banks and transport industries that showed negative significance to oil price hikes. Al-Mudhaf and Goodwin (1993) [2] examination of 29 quoted firms in New York stock exchange showed a positive effect of oil price stocks on ex post returns for firm with significant assets in domestic oil production. To Huang, Roger, Masulis and Stoll (1996) [32], returns of petroleum stock index are

significantly correlated with current and lag one oil future returns. Sardosky (2001) using multifactor market model to estimate expected returns to Canadian oil and gas industry prices showed that exchange rates, interest rates and crude oil prices have significant impact on stock price returns. While increase in oil price factor increase the return to oil and gas stock prices, increase in exchange rate decreases it. In addition the study of Boyer and Filion (2007) ^[9] on testing the determinants of Canadian oil and gas stock returns under multi factor framework found a positive relationship between energy stock returns and appreciation of oil and gas prices with interest rate having a negative relationship. Finally they found that exchange rate, the market return and prices of natural gas on Canadian oil and gas stocks changed significantly between 1995 -1998 and 2000 – 2002.

Scholtens and Wang (2008) ^[49], using two-step regression analysis to assess oil price sensitivities and risk premiums of all firms quoted in the New York stock Exchange, found that oil stock returns are positively related to returns of the stock market and increase in spot crude oil prices while having a negative relationship with the firms book-to-market ratio.

Ciner (2001) ^[13], using non-linear causality tests to examine the relationship between oil shocks and stock index returns in U.S. the result of the study revealed that there exist a non-linear significant relationship between the two variables, On the other hand Park and Ratti (2008) ^[46] opines that oil price stocks have a contemporaneous significant effect on real stock returns. Based on the degree at which oil prices effects stock prices, studies of El-Sharif, Brown, Burton, Nixon and Russel (2005) ^[16] showed a positive correlation between the stock returns of U.K oil and gas companies and oil price increase. Similar result was obtained by the studies of Boyer and Filion (2007) ^[9] in Canada. The findings of Arouri and Nguyen (2010) ^[4] reveal that the sensitivity of European stock returns to oil price changes seriously differ from one sector to another, as Oil & Gas stocks make profit from oil price increases, this finding is also in line with the work of Arouri, Bellalah and Nguyen (2011) ^[5] which showed that, on the basis of short-term analysis, significant positive links were found in some Gulf Cooperation Council (G.C.C.) countries between stock markets and oil prices and that this causality usually runs from oil prices to stock markets.

Ross (1989; Fazilah & Sonal, 2009) ^[20] opines that the price volatility can be a precise measure of the rate of information flow in a financial market. It may be that there is no significant lead or lag cross-correlations observable in the returns but that price volatility and the rate of information flow in one market results in volatility in the others. Proof that volatility is linked across markets would imply dependence in the information processes. The expected market risk premium (that is the expected return on a stock portfolio minus the Treasury bill yield) is positively connected to the expected volatility of stock returns. There is also confirmation that unanticipated stock market returns are negatively associated with the unexpected change in the volatility of stock returns. This negative correlation provides indirect evidence of a positive link between expected risk premiums and volatility (Schwert & Stambaugh, 1987) ^[50].

Malik and Hammoudeh (2005) ^[41] researched on the volatility and shock transmission mechanism among global crude oil market, US equity and equity markets of Kuwait, Saudi Arabia and Bahrain. Their findings showed that in all scenarios, Gulf equity markets receives volatility from the oil market but only in the case of Saudi Arabia a significant volatility spillover from the Saudi market to the oil market.

2.4 Summary of Findings

From the survey of empirical literature the paper revealed the following:

- 1) An upward trend in oil prices leads to higher stock returns of oil and gas companies operating in the upstream sector. Hence, a positive relationship exists.
- 2) Oil price volatility is negatively related to stock returns of Oil and Gas companies operating in the downstream sector and many other industries outside the oil and gas sector.
- 3) Volatility in oil prices and the rate of information flow in one market lead to volatility in other markets.
- 4) Oil price volatility is positively related to stock market returns of oil exporting economies.
- 5) The determinants of oil price volatility include; flow demand shocks, flow supply shock, the role of expectation in the physical market of crude oil, financial expectations in the oil future markets and the role of OPEC.

From the findings of this research work it can clearly be seen that there is a general agreement among various researchers that there exist a positive relationship between oil prices and oil stock returns as an increase in the prices of crude oil will lead to an increase in stock returns of oil and gas companies while a decline in the prices of crude oil will lead to a decrease in stock returns.

Conclusion

This study was embarked upon to find out the effects of oil price volatility on stock returns of oil and gas companies. The results obtained suggest that there exists considerable short run and long run relationship between oil price and the oil stocks. The oil price volatility transmission has a constant effect on the volatility of the stocks of the oil companies. It is worth noting that not all companies will react the same way to changes in crude oil prices. Indeed, the direction of stock price reactions will depend on whether the company is an oil producer or an oil consumer. Oil producers will profit from an oil price increase while oil consumers will suffer from it. Oil prices are affected by business cycles and determined by market fundamentals, which causes expected volatility in prices. Flow demand shocks, flow supply shocks, the role of expectations in the physical market for crude oil, financial speculation in oil future market and the role of OPEC go a long way to determine oil price volatility, also price hikes have in the past been affected by unexpected supply disruptions from terrorist attacks, wars and hurricanes. Rapid decline in economic growth will distort future prospect on demand, which in times gone by have caused large fluctuations in the oil price.

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