ANALYSING VOLATILITY BEHAVIOUR AND MARKET EFFICIENCY OF UK OIL & GAS SECTOR


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ABSTRACT

This research is aimed at conducting an investigation of information efficiency, and volatility behavior of stock returns in respect of oil and gas companies quoted on London stock exchange. In achieving its aim, the research will specifically test for the weak form market efficiency, conduct volatility, seasonality, and valuation analysis with an event study to identify events in the United Kingdom that can have some impact on the valuation of oil and gas stocks quoted on London stock exchange. Various statistical tools used by previous scholars in testing the information efficiency of a stock market will also be critically evaluated. Data will mainly be collected from daily closing prices of fifty-four (54) oil and gas companies listed on the exchange. FTSE-100, FTSE-ALL, FTSE-UK Oil and Gas, and FTSE-UK Oil and Gas Production share indices will also be used for critical evaluation. Numerous statistical tools such as Augmented Dickey-Fuller Tests, Variance Ratio Test, Auto Regression Conditional Heteroscedasticity (ARCH) Model, Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Model, Co integration and Error Correction Model, Moving Average Trading Rules, Unit Root Tests, Price/Earnings Ratio, and Momentum Analysis will be employed to test the information efficiency of the market, volatility and valuation of UK oil stocks, and come up with a better explanation of the behavior stock prices in London stock exchange. The findings of the research will be of tremendous benefit to investors and investment analysts because the data set includes boom period (2001-2007) and worst recession since World War II (2008-2009). This makes the study unique in analyzing volatility and market efficiency in different phases of business cycle.
1.0 INTRODUCTION

The role of information or market efficiency in the determination of the behavior of stock markets cannot be overemphasized. Mittal and Jain (2009) believe that the study of market efficiency has been an area of interest to many researchers, investors, regulators, and other market participants. Several researches have been conducted on market efficiency using various techniques to assess different stock exchanges, (Mollah, 2007). Surprisingly, the outcome of these previous researches in the extensive literature of market efficiency and behaviour of stock returns remains controversial, (Mittal and Jain, 2009; Mollah, 2007; Tung and Marsden, 1998). Scholars such as Tung and Marsden (1998) affiliated the reason for the conflicting results to lack of control in the field or variables of study. Alexeev and Tapon (2011) believe that the problem could be because researchers prefer using stock market index instead of data series from individual stock. Similarly, Quirin et al (2000) attributed the controversy to the diverse cross-sectional studies on various industries with different characteristics, business environments, accounting policies, taxation, and regulations. Generally, most of the previous researches on market efficiency affirmed that developed markets are weak form efficient. Future or successive share returns are independent and follow random walk, (Mollah, 2007; Adelegan, 2003). The information efficiency of these developed markets has not been traced to the individual industries or sectors in the markets, usually because researchers are concerned with the study of all-share index.

A specific industry analysis such as that of this study will eliminate the problems of cross sectional studies and allow for the consideration of specific
economic environment in which data are reported. Furthermore, the study is unique because market efficiency and volatility behaviour is examined in both boom period (2001-2007) and worst recession since World War II (2008-2009)

2.0 LITERATURE REVIEW

Studies on market efficiency and predictability of stock returns have been an age-old area of research. It is among the most extensively researched areas in finance, attracting serious interests from financial economists, analysts, investors, and numerous stakeholders in every economy, (Roberts, 1959; Milionis, 2007). From the viewpoint of Milionis (2007), market efficiency has been defined in various ways by different scholars such as Rubinstein (1975); Beaver (1981); and Black (1986), but affirmed that the definition by Fama (1970) became the theoretical framework of many scholars, see also (Milionis and Moschos, 2000). According to Fama (1970), market efficiency can be seen from three (3) distinctive forms which all have to do with ‘full reflection’ and ‘relevant information’. These distinctive classifications are weak, semi-strong, and strong form efficiency. Fama (1970) opined that capital markets are weak form efficient if prices fully reflect all relevant historical information or past patterns of price movement. Semi-strong efficient markets fully reflect all publicly available information such as pronouncement of earnings, dividend, and stock split information. Thirdly, the strong form efficiency is when markets fully reflect all publicly and privately available information. If market is efficient, then current and past information are already reflected in market prices, and future prices are determined by new information which cannot be predicted, and therefore abnormal returns cannot be achieved by few
individuals using privilege information to forecast market prices, (Adelegan, 2003). Existing literature has shown a greater work on the validity of market efficiency hypothesis especially with respect to developed markets, (Al-loughani and Chappell, 1997).

The tests on the validity of weak form market efficiency in developed markets were also conducted by numerous researchers. Prior to Fama’s work on market efficiency in 1970, the most useful tool of stock market analysis was the empirical analysis of physical processes such as tides, waves, and patterns in respect of share price movement termed as technical analysis, (Roberts, 1959). The empirical evidences gathered suggested that random changes were large between time series data of stock prices, and that led to the invention of ‘Random Walk Model/Theory’, (Kendall 1953; Dimson and Mussavian, 1998). The attention of researchers was diverted to the Efficient Market Hypothesis developed by Fama in 1970. Fama (1970) discovered that markets can be efficient in three (3) forms; weak, semi-strong, and strong form efficiency, and argued that trading on the availability of information in the market cannot lead to any abnormal return. Hudson et al (1996) conducted a weak form efficiency test on United Kingdom (UK) stocks prices between 1935 and 1994 using the technical trading rules used by Brock et al (1992) to find whether their result can be replicated on UK data. Brock et al (1992) used moving average and trading-range breakout rules on Dow Jones Index to confirm the forecasting power of technical analysis in obtaining excess return from the market. Hudson et al (1996) have tested the Financial Times Industrial Ordinary Index of UK, and contrary to the findings of Brock et al (1992) affirmed that the use of technical trading rules cannot assist
investors to realize any excess return, unless if long series of the stock indices are considered. Nevertheless, the use of long series data may affect the reliability of technical trading rules as practical investment tools. Al-loughani and Chappell (1997) tested for weak form market efficiency on FTSE 30 share index, London stock exchange between 30 June 1983 and 16 November 1989. All the assumptions of Random Walk Hypothesis were tested using Dickey-Fuller tests, Lagrange Multiplier test, Brock, Dechert and Scheinkman (BDS) statistic, and GARCH-M model. Interpretation from the results of the empirical tests shows that the weak form efficiency is absolutely not valid for the FTSE 30 index because the series were not consistent with any random walk. The series were also seen to be characterized by significant heteroscedasticity. The rejection of the weak form market efficiency on FTSE 30 index by Al-loughani and Chappell (1997) was basically because of the conditional heteroscedasticity found on the series after applying BDS statistic to examine the data. Milionis and Moschos (2000) reviewed the empirical work and interpretation of the results from the work of Al-loughani and Chappell (1997), and suggested that the empirical results do not support their interpretation. Milionis and Moschos (2000) justified their argument by stating that Alloughani and Chappell (1997) assigned successive logarithmic values to FTSE 30 index in a stochastic process of random walk. In that process, successive returns of FTSE index are required to be independently and identically distributed for the expected returns to be constant. Therefore, random walk hypothesis test is an integrated test of both weak form market efficiency and constancy of expected returns, and the rejection of random walk hypothesis does not mean the absolute rejection of the weak form market efficiency hypothesis. Milionis and Moschos (2000) concluded that according to the work
of Al-loughani and Chappell (1997) weak form efficiency hypothesis cannot be rejected on FTSE 30 index. This also supports the view that London stock exchange is weak form efficient. Buguk and Brorsen (2003) had tested for weak form market efficiency in Istanbul stock exchange between 1992 and 1999 using Augmented Dickey-Fuller test, Rank and sign-based variance ratio test, GPH fractional integration test, and LOMAC single variance ratio test. Results from all the four (4) tests employed are consistent with random walk hypothesis which led to the conclusion by the researchers that Istanbul stock exchange is absolutely weak form efficient. Kawakatsu and Morey (1999) had similar inferences that Istanbul stock exchange is weak form efficient. According to Laopodis (2004) several tests conducted on Athens stock exchange by various researchers suggested that the market is weak form efficient. Laopodis (2004) tested for the effect of financial market liberalization on the Athens stock exchange efficiency. It was revealed that the announcements for financial deregulation by the Greek authorities have not change the stand of Athens stock exchange of being weak form efficient for a long time. The Chinese stock market has two major exchanges with four (4) classes of shares. Shanghai stock exchange (SHSE) for Shanghai class A and B shares, and Shenzhen stock exchange (SHZE) for Shenzhen class A and B shares. Balsara et al (2007) analyze the indexes of daily stock prices for class A and B shares both from Shanghai and Shenzhen exchanges in order to test for weak form efficiency by examining random walk model and technical trading rules. Analytical tools such as variance ratio test, ARIMA forecasting model, moving average crossover rule, channel breakout rule, and the Bollinger band breakout rule were employed for the study. Findings inferred that Chinese stock markets are consistent with random walk hypothesis using
variance ratio test, and ARIMA model appeared to be more superb to naïve model of testing random walk hypothesis. However, the technical trading rules tested signified positive returns on buy trades suggesting an important role in Chinese stock markets. Lim and Brooks (2009) also ascertained that the weak form market efficiency has been subjected to years of various tests such as serial correlation tests, runs test, variance ratio tests, unit root tests, and spectral analysis. These tests are mostly to ascertain whether the market is efficient or not. Researchers have not been investigating the relationship between levels of efficiency of different markets. Lim and Brooks (2009) conducted a similar research to that of Cajueiro and Tabak (2006) by employing rolling bi-correlation test statistic to compare the efficiency of stock markets from China, Korea, and Taiwan with different price limits. Conclusions were made that restrictive price limits and price limits per stock exchange are not barriers to market efficiency. In other words, market efficiency is determined by events that destabilise the market and the time needed to adjust prices to new equilibrium level but not price limits. Jain and Mittal (2009) also tested for weak form market efficiency on Indian stock exchange in the form of random walk using various tools such as unit root test, t-test, run test, serial correlation, ANOVA, tables, and graph. It was discovered by Jain and Mittal (2009) that the Indian stock market is fully weak form efficient without the existence of any anomalies. Some scholars have tested the impact of some factors such as transaction cost on weak form market efficiency. Among those scholars is Liu (2010) who tested for the impacts of explicit transaction costs in the context of brokerage commission deregulation in Japan on weak form market efficiency of Japanese equity markets and Japanese stocks listed in the United States. Liu (2010) found that the return
randomness increases significantly for Japan markets without any change to Japanese stocks listed in the United States after the brokerage commission deregulation in Japan. This showed that weak form market efficiency increases with brokerage commission deregulation in Japan. Alexeev and Tapon (2011) argued that testing for weak form market efficiency can best be achieved by using the data series of individual stock instead of using stock market index. A model-based bootstrap and modified chart pattern recognition algorithm were applied on all the stocks quoted on the Toronto Stock Exchange (TSX) between August 1980 and August 2010. Inferences were made from the result of the test that the null hypothesis of weak form efficiency on the Toronto stock exchange cannot be rejected, showing that the market is inefficient with some sectors less efficient than others.

The tests on the validity of semi strong form market efficiency cannot also be overlooked. Several variables of financial information that are publicly available have been tested for relevance on market values of quoted companies, and findings from some of these studies were equally reviewed in this section. Basu (1977) selected and tested price-earnings (P/E) ratio as an indicator of future investment performance of a security. Empirically, (P/E) ratios of over 1200 industrial firms quoted on New York Stock Exchange (NYSE) were tested within the period September 1956 and August 1971. Portfolios of companies under study were created based on similar (P/E) ratio, and their risk-return relationship compared for evaluation of performance in the capital market. Results have shown that (P/E) ratios may be indicators for future investment performance due to the high investors’ expectations. Conclusions were made by Basu (1977) that security price behavior is not
in line with efficient market hypothesis, and thus (P/E) ratio is not fully reflected on the security price. Investors can use (P/E) ratio to gain abnormal return from the market. Marsh (1979) tested for the impact of right issue announcement on the market price of all companies that had right issues between July 1962 and December 1975 on London stock exchange. By the results from Marsh (1979) analysis, it was deduced that United Kingdom market is semi strong form efficient, and as such the right issues by companies do not have any significant impact on post right issue announcement prices. Groenewold and Kang (1993) conducted a test for semi-strong form of market efficiency using macroeconomic data on Australian share market between 1980 and 1988. The researchers set a model where share prices are dependent variables to the money supply, real government expenditure, and price level as the independent variables. All the variables in the model were used in log-difference form, and results have indicated that none of the variables can predict the market price of companies quoted on Australian market. Despite the evidence that the Australian market is semi-strong efficient, Groenewold and Kang (1993) believed that there should be more research to conclude on the semi strong form efficiency of Australian stock market. Toutkoushian (1996) opined that evidences in the existing literature support the concept of semi strong form market efficiency hypothesis. To provide more evidence, Toutkoushian (1996) studied whether New York Stock Exchange (NYSE), American Stock Exchange (AMEX), nad NASDAQ exchange are semi-strong form efficient with regard to information on insider transaction. It was tested whether investors can gain excess return by replicating the insiders’ transactions that were made publicly available in the market. The results shown indicated support to semi strong efficiency by
suggesting that investors can gain excess return by replicating publicly available insider transaction depending on the intensity of insider trading, volume of transaction, and the speed by which information insider transaction is disseminated. Hatemi-J and Morgan (2009) have also contributed the existing evidences of semi strong form market efficiency school of thought by testing whether Australian stock market is semi strong efficient with regard to interest rates and exchange rate shocks during the period 1994-2006. Leveraged bootstrap distributions were used in a case of non-normal autoregressive conditional heteroskedasticity (ARCH) to overcome the limitation of using standard estimation methods on non-normal data with the effect of (ARCH). The results from the tests have shown that the Australian market is not semi strong form efficient with regard to both interest rate and exchange rate fluctuations because investors can use the fluctuations to gain abnormal return from the market. Skogsvik (2008) had tested whether Swedish stock market is efficient with regard to variables in the financial statement information that is publicly available for the period between 1970 and 1994. It was discovered that financial statement information are helpful in generating abnormal profit which suggested that Swedish stock market is semi strong form inefficient. Alexakis et al (2010) also confirmed the findings of Skogsvik (2008) by ascertaining the usefulness of accounting information in predicting Athens stock market prices between 1993 and 2006. Tung and Marsden (1998) believe that lack of control in the variables of study while testing for market efficiency had caused significant controversial results and conclusions among researchers. Tung and Marsden (1998) employed a new dimension of investigating market efficiency by adopting a controlled laboratory experiments. An electronic market shell with stock market activities
and price adjustments were developed. Market models were considered and tested in the artificial market shell as tested in actual markets by previous researchers. Results from the study have shown that information quality is an important factor in attaining an abnormal profit from the market. The study also supports the semi-strong market efficiency, and rejected the strong market efficiency hypothesis.

On similar note, strong form market efficiency hypothesis has been empirically tested in several markets. Some of these tests are that of Finnerty (1976) who researched on the insiders’ transactions and whether there is any abnormal profit from such transactions. Finnerty (1976) had analysed stock transactions of firms quoted on New York Stock Exchange (NYSE) from January, 1969 to December, 1972, and discovered that private information can be used by insiders to gain abnormal return which suggested market inefficiency in strong form. Scholars such as Jaffe (1974), Pratt and DeVere (1970), Rogoff (1964), and Glass (1966) have also supported the hypothesis that investors do earn abnormal return from using privately available information rejecting the strong form market efficiency hypothesis, (Finnerty,1976). Ferreira (1995) and Del Brio et al (2002) also have the same opinion that insiders can use private information to secure above average profit from the stock market trading. On contrary view, Lin and Rozeff (1995) discovered that about 85 percent to 88 percent of private information is reflected or incorporated into the prices of stocks within one full trading day, which meant support for the semi strong form market efficiency hypothesis.
3.0 AIM AND OBJECTIVES:

3.1 AIM

The research is primarily the investigation of volatility behavior of stocks returns and information efficiency in oil and gas companies quoted on London Stock Exchange (LSE).

3.2 OBJECTIVES

1. To test for the weak form market efficiency in oil and gas companies quoted on London stock exchange.

2. To investigate the volatility behavior of oil and gas stocks returns, evaluating the implication to investment performance and strategies.

3. To examine the behavior of oil stocks returns during different time periods by conducting a seasonality analysis in the market.

4. To carry out an event study to identify events in United Kingdom that can have some impact on valuation of oil and gas stocks.

5. To critically evaluate various statistical tools used by previous scholars in testing the information efficiency of a stock market.
4.0 RESEARCH QUESTIONS AND HYPOTHESES FORMATION

4.1 RESEARCH QUESTIONS
The objectives of this study will clearly be achieved by providing answers to the following research questions.

1. Do technical trading rules assist investors to gain abnormal return from oil and gas sector of the London Stock Exchange?

2. What are the causes of high volatility in oil and gas stocks returns of the London stock exchange?

3. What are the best investment strategies during high volatility of oil stocks in London Stock Exchange?

4. What is the impact of seasonality on the valuation of oil and gas stocks quoted on London Stock Exchange?

5. What are the most important policies and factors that affect the valuation of oil and gas stocks quoted on London stock exchange?
4.2 HYPOTHESES FORMATION

The formal statement of the research hypotheses to be tested, in null form are:

**H1** – Market prices of oil and gas companies quoted on London stock exchange do not move in line with Random Walk Hypothesis.

In null hypothesis 1, the weak form of market efficiency developed by Fama (1970) will be tested in the oil and gas sector of the London stock exchange for relevance. If the hypothesis is accepted, then technical analysis might be considered to have impact, but if rejected, that indicates irrelevance of technical analysis in the determination of market values.

**H2** – Volatility behavior of stock returns in UK oil and gas sector cannot provide any evidence proving Efficient Market Hypothesis.

If null hypothesis 2 is rejected, then volatility of stock prices or returns will be considered as normal while only reflecting relevant information in the market. If the hypothesis is accepted, then volatility is abnormal, not reflecting the available information in the market.
5.0 DATA AND ANALYSIS TECHNIQUES:

5.1 DATA
The entire oil and gas companies listed on London stock exchange are going to be evaluated for the study except those companies without five (5) years stream of data. Share prices of companies under study will be acquired for a minimum of ten (10) years within the period of January, 2000 and June, 2011. The data will be analyzed using various tools for the test of information efficiency and volatility behavior of oil and gas stock returns quoted on London stock exchange. Fifty-four (54) oil and gas companies, and share indices such as FTSE-100, FTSE-ALL, FTSE-UK oil and gas, and FTSE-UK oil and gas production are identified for the study. See appendix.

5.2 ANALYSIS TECHNIQUES
To achieve the stated objectives of the research, numerous statistical tools are to be employed. This will enable the researcher to evaluate thoroughly the usefulness of identified tools, assessing the strengths, weaknesses, similarities, differences, and specific characteristics of the employed tools.

The share prices of companies under study will be explored using descriptive statistics such as mean, standard deviation, skewness, kurtosis, and kolmogrov-smirnov so as to establish the characteristics and nature of the series of data collected. Parametric and non-parametric tests will be applied based on the results from the descriptive statistics employed. The parametric test statistical tools will include autocorrelation test, bjung-box statistic, and auto regression conditional heteroskedasticity (ARCH) model, generalized
autoregressive conditional heteroskedasticity (GARCH) model. Non parametric test statistical tools such as the runs test will also be employed if necessary.

Specifically, to test for weak form efficiency of oil and gas sector stocks in London stock exchange the following statistical tools will be applied.

1. Augmented Dickey- Fuller Tests.
2. Autocorrelation of Returns.
5. Unit Root Tests.
6. Auto Regression Conditional Heteroscedasticity (ARCH) model, and
7. Co integration and Error Correction Model.

In testing the volatility behaviour of the oil stocks’ returns in the United Kingdom, volatility clustering will be used, and that will equally make the use of GARCH models and Autoregressive Conditional Heteroskedasticity (ARCH) models very prominent in the research. Asymmetric effects and relationship between volatility and auto correlation will equally be assessed.

In seasonality analysis, days of the week (DOTW) effect with an emphasis to distinctive weather conditions in the valuation of oil stocks on London stock exchange will be the major area of concern in the research.

Events in United Kingdom such as North Sea oil spill in 2011, and government tax boost to North Sea oil companies will be tested for significance in the valuation of oil and gas common stocks using event window methodology by
examining pre and post mean-adjusted and cumulative mean-adjusted returns events.

6.0 ORIGINALITY AND CONTRIBUTION TO KNOWLEDGE:

6.1 ORIGINALITY

The industry-based examination of information efficiency and behaviour of stock returns of oil and gas companies quoted on London Stock Exchange (LSE) has been utterly justified by the problematic nature of having a cross-sectional study on various industries with different characteristics. Therefore, this research will be among the few that eliminate the problems of cross-sectional studies, and allow for the consideration of only oil and gas sector in the stock market of United Kingdom. A similar study has not been found in the existing literature.

Ferson and Tie Su (2005) explained that the use of regressions on stock market index returns has a statistical problem especially if the data is heteroskedastic in nature. It was believed that in order to achieve the best result in information efficiency test, data series of individual stocks should be used instead of stock market index, (Alexeev and Tapon, 2011). This research is to use the data series from the share prices of individual companies under study for a minimum period of ten (10) years, and deemed necessary to overcome the stated problem above.

In recent years, the international financial markets have been so volatile especially due to the post 2008 economic crisis, which affected the reliability of both investment performance and strategies. This research will definitely be at
the right time to be a guide to the investors and investment analysts. Most particularly because the data set of the study includes both a boom period (2001-2007) and a recession period (2008-2009).

The use of various statistical tools with critical evaluation for their strengths and weaknesses will make the research very unique among similar researches of that nature undertaken earlier.

6.2 CONTRIBUTION TO KNOWLEDGE

The main contribution of this research is to identify the behaviour of oil stocks on London stock exchange and provide the desirable investment strategies to oil and gas investors. The response of the oil market to the most recent events such as the prevailing economic crisis will be evaluated and proper suggestions for maximization of shareholders’ wealth will be given.

The study will uniquely employ various analytical tools on the same set of data, which will provide a robust result to enable critical evaluation of statistical tools used by previous researchers.

Apparently, a similar study has not been sighted where the information efficiency of oil and gas stocks on London stock exchange has been investigated. This research will be first of its kind in the United Kingdom.

The findings of the research will be relevant to the contemporary financial matters because the data set includes the immediate boom period (2001-2007) and worst recession since World War II (2008-2009). Volatility and market efficiency in different phases of business cycle will be analyzed making
the contribution of the research unique.
REFERENCES


**APPENDIX**

**OIL AND GAS COMPANIES UNDER STUDY:**

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