FINANCIAL ECONOMICS | RESEARCH ARTICLE

An analysis of seasonality fluctuations in the oil and gas stock returns

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Abstract: This paper investigates the existence of seasonality anomalies in the stock returns of the oil and gas companies on the London Stock Exchange. It employs F-test, Kruskal–Wallis and Tukey tests to examine days-of-the-week effect. Generalised autoregressive conditional heteroscedasticity specification was also employed to investigate both the days-of-the-week and months-of-the-year effects. The analysis had been extended to some key FTSE indices. Our results showed no evidence of any regularity or seasonal fluctuation in the oil and gas stock returns despite the seasonal changes of demand in the companies' products. However, January effect has been observed in FTSE All Share and FTSE 100 indices.

Subjects: Economics; Finance; Business & Industry; Finance; Quantitative Finance

Keywords: seasonality; oil and gas stock returns; days-of-the-week effect; months-of-the-year effect; January effect and London Stock Exchange

JEL Classification code: G1

1. Introduction
The analysis of seasonality in stock returns has been performed by many scholars over the years in order to establish whether there are calendar-related anomalies in stock returns. If the proposition that calendar anomalies such as day-of-the-week, intraday, weekend and January effects exist in stock returns, then the random walk hypothesis would be rejected. This also contradicts the efficient market hypothesis (EMH) because at that point future stock returns can be predicted. The interest of researchers in

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PUBLIC INTEREST STATEMENT
Oil and gas sector remains one of the most important sectors in the world, and hence, we try to investigate the behaviour of stock returns of the oil and gas companies quoted on the London Stock Exchange. The study employed both parametric and non-parametric tests to examine the days-of-the-week and months-of-the-year effects. We have not found evidence in recent times that the behaviour of stock returns is abnormal in certain days of the week or months of the year except in January.
seasonality analysis was promoted by the fact that evidence gathered could be used to accept or reject the EMH. Although majority of the inferences made suggest the existence of seasonality, market inefficiency could not be confirmed especially due to the existence of transaction costs. Documented evidence in support of the seasonality presence in stock returns have also been criticised by some scholars who attributed the empirical evidence as the product of statistical misspecification. It was observed that existing studies have not provided sufficient and most reliable conclusions about the existence of seasonality in stock returns and any relating consequences to the proposition of the market efficiency.

In this paper, we employ seasonality tests as a tool to provide further evidence on the predictability of stock returns of London-quoted oil and gas stocks and some market indices.

2. Literature review

Yadav and Pope (1992) have been among the scholars that tested for the existence of calendar anomalies in stock markets. They investigated the existence of either intraweek or intraday seasonality in the pricing or returns of UK stock index future contracts using the distinctive settlement methods of the London stock exchange. The existence of seasonality was found in the UK stock market because of abnormal Monday returns discovered which could be due to the non-trading weekends. However, there was no evidence that the abnormal Monday returns could be attributed to the delay in the release of bad news until Friday as speculated by some scholars. In contrast to the findings of Yadav and Pope (1992), Mookerjee and Yu (1999) discovered abnormal returns on Thursdays from an investigation on the Shanghai and Shenzhen stock exchanges of China, although these researchers have agreed that their findings are odd when compared to that of many scholars. Mookerjee and Yu (1999) found high mean returns on Thursdays instead of Fridays (negative returns are usually found on Mondays) as reported by most of the earlier studies and barriers to the changes in daily prices (limits on daily returns). The daily returns were also found to be positively correlated with risk (standard deviation figures). Most of the studies on the day-of-the-week effect were conducted in developed markets and, according to the majority of the inferences, the effect of seasonality was evidenced in such markets. In similar developments, Chang, Pinegar, and Ravichandran (1993) investigated the day-of-the-week effect in some European markets and the United States using classical or traditional methods adopted by various scholars and an approach with sample size and error term adjustments. Results showed the existence of day-of-the-week effect in the majority of the markets similar to most of the findings in the literature. Dicle and Levendis (2014) tested whether the day-of-the-week effect still exists by investigating up to 51 international markets from thirty three countries over the period between 2000 and 2007. Similar to the findings of Yadav and Pope (1992), Mookerjee and Yu (1999), and Chang et al. (1993), they also found the existence of day-of-the-week effect in almost all the exchanges in these countries. Qadan (2013) also tested the existence of day-of-the-week effect on the recent United States data of the S&P 500 index using a threshold-ARCH model. The results of the test showed both stock returns and volumes on Monday to be lower than those of other days. In addition, they also reported that the investor’s fear gauge as measured by volatility was higher on Mondays and lower on Fridays.

Further evidence on the day-of-the-week effect in the developed markets has also been recorded by the studies of Clare, Psaradakis, and Thomas (1995), Dubois and Louvet (1996), and Steeley (2001). Steeley (2001) attributed the presence of seasonality in the UK equity market to the pattern of flow of market-wide news. Dubois and Louvet (1996) examined the day-of-the-week effect in 11 indices across 9 countries over the period between 1969 and 1992. Lower returns were found at the beginning of the week and tend to increase towards the end of the week. Dubois and Louvet (1996) concluded that there is a strong evidence of day-of-the-week in European countries. The UK equity market was also investigated by Clare et al. (1995) and found results similar to that of Dubois and Louvet (1996). Clare et al. (1995) used a deterministic seasonal model (a method adopted by Franses (1993)) on the FTSE All Share index and discovered a significant seasonality effect in the market. In a slightly contrary view, Steeley (2001) has reported that weekend effects have vanished from UK markets in the 1990s. However, day-of-the-week effect can still be traced in the market if the stock return series data is divided according to the directions ((+) or (−) of the returns) of the market. In
that case, Steeley (2001) concluded that the cause of the day-of-the-week effect was due to the pattern and nature of market-wide information classified as “bad” or “good” news.

The research on the day-of-the-week effect has also been extended to emerging markets. Al Ashikh (2012) investigated the day-of-the-week effect on the Saudi Arabian stock exchange and found evidence from both the analysis of mean returns and its variance that the market efficiency hypothesis can be rejected due to the existence of day-of-the-week effect. Haroon and Shah (2013) have also examined the Karachi stock exchange in Pakistan for the existence of day-of-the-week effect. In contrast to the results reported by Al Ashikh (2012), Haroon and Shah (2013) discovered mixed results from the two partitions of the period of study that is, sub-period I and II. Sub-period I negates the existence of day-of-the-week effect, while sub-period II found evidence of the existence of day-of-the-week effect. Ogieva, Osamwonyi, and Idolor (2013) have also conducted an investigation on the Nigerian stock exchange for the existence of day-of-the-week effect and found evidence to reject the market efficiency hypothesis.

Other calendar anomalies such as a January effect have also been investigated extensively in the field of finance. Findings reported by scholars are similar to that of day-of-the-week effect where the majority of the studies found evidence for the seasonality effect in stock returns, although scholars such as Chien, Lee, and Wang (2002) observed that the empirical evidence supporting a January effect could be due to the misapplication of statistical tools. He opined that, with high volatility in stock returns, the dummy variables in the regression model testing the existence of seasonality could generate significant coefficients. Studies like that of Haugen and Lakonishok (1988), Jaffe and Westerfield (1985), and Solnik and Bousquet (1990) have all documented evidence of a “January effect” in the stock returns of various stock exchanges which may create doubt on the work of Fama (1970) on the EMH.

3. Methodology and results

In this section, we aim to investigate the existence of the day-of-the-week and monthly effects in the stock returns of London-quoted oil and gas stocks and some related FTSE measures such as the FTSE All Share, the FTSE 100, the FTSE UK Oil and Gas, the FTSE UK Oil and Gas Producers and the FTSE AIM SS indices. Our data for this analysis covers the periods from 4 January 2010 to 31 December 2012 for the day-of-the-week effect and January 2005 to December 2014 for the monthly effect.

Firstly, daily stock returns (Monday to Friday) of individual series were calculated using \( \log \left( \frac{P_t}{P_{t-1}} \right) \) formula and mean returns compared in order to test the null hypothesis of equality. The null hypotheses of equality between the discrete week’s days’ mean returns are tested using both parametric and non-parametric statistical tools. The \( F \)-test is employed as a parametric tool to test whether there is any significant difference between the week’s days’ mean-returns. If the \( F \)-statistic value is found to be higher than the critical value (critical values for \( F \)-distribution) at a selected significance level, then the null hypothesis that \( \mu_M = \mu_T = \mu_W = \mu_{Th} = \mu_F \) is rejected for the alternative hypothesis that \( \mu_M \neq \mu_T \neq \mu_W \neq \mu_{Th} \neq \mu_F \). Kruskal–Wallis is a non-parametric test that is not based on any assumption about the underlying distribution. It performs the same function as the \( F \)-test but without consideration for the distribution of samples tested. It rather tests whether the samples are from the same distribution. If the K–W Statistic value is found to be greater than its critical value, the null hypothesis of equality is rejected and accepted if vice versa. Pairwise test of the week’s days’ mean returns were also conducted using the Tukey test to make comparison between the pair means. If the Tukey test statistical values result in the rejection of the null hypothesis of equality, then the pair of mean returns of two weekdays are regarded as not equal which signifies the existence of a day-of-the-week effect.

The results of \( F \)-test, Kruskal–Wallis test and Tukey test on the day-of-the-week return series are presented in Table 1. From the results, the null hypothesis of equality cannot be rejected in all the series except the FTSE AIM SS Oil and Gas index. The statistical values derived from the tests employed are not greater than their respective critical values at 5% significance level and that suggests
### Table 1. F-test, Kruskal–Wallis test and Tukey test on the day-of-the-week (DOTW) return series under study

|            | Monday | Tuesday | Wednesday | Thursday | Friday |
|------------|--------|---------|-----------|----------|--------|
| **FTSE All Sh.** |        |         |           |          |        |
| Mean return | −0.00022 | 0.000955 | −0.000349 | 0.000503 | −0.000170 |
| Observation | 144    | 153     | 155       | 156      | 152    |
| F-statistic | 0.399011027 |          |           |          |        |
| K-W statistic | 2.935440532 |          |           |          |        |
| Tukey statistic |         |         |           |          |        |
| Monday      | 0      | 1.315683 | −0.14976  | 0.808005 | 0.050776 |
| Tuesday     | 0      | −1.46544 | −0.507678 | −0.507678 | −1.264907 |
| Wednesday   | 0      | 0.9577646 | 0.200536 |          |        |
| Thursday    | 0      | −0.757229 |          |          |        |
| **FTSE100**  |        |         |           |          |        |
| Mean return | −0.0002 | 0.001121 | −0.000461 | 0.000429 | −0.000346 |
| Observation | 144    | 153     | 155       | 156      | 152    |
| F-statistic | 0.53241147 |          |           |          |        |
| K-W statistic | 3.554102754 |          |           |          |        |
| Tukey statistic |         |         |           |          |        |
| Monday      | 0      | 1.449682 | −0.28884 | 0.6895659 | −0.162001 |
| Tuesday     | 0      | −1.73852 | −0.760116 | −1.611683 |        |
| Wednesday   | 0      | 0.9784018 | 0.126835 |          |        |
| Thursday    | 0      | −0.851567 |          |          |        |
| **FTSE UK O&G** |      |         |           |          |        |
| Mean return | 2.71E-05 | 0.001402 | −0.000862 | −0.000437 | −0.000512 |
| Observation | 144    | 153     | 155       | 156      | 152    |
| F-statistic | 0.679264795 |          |           |          |        |
| K-W statistic | 4.797923822 |          |           |          |        |
| Tukey statistic |         |         |           |          |        |
| Monday      | 0      | 1.2744  | −0.82434 | −0.429674 | −0.49952 |
| Tuesday     | 0      | −2.09874 | −1.704074 | −1.77392 |        |
| Wednesday   | 0      | 0.3946653 | 0.324819 |          |        |
| Thursday    | 0      | −0.609846 |          |          |        |
| **FTSE UK OGP** |      |         |           |          |        |
| Mean return | 2.58E-05 | 0.001401 | −0.000870 | −0.000481 | −0.000539 |
| Observation | 144    | 153     | 155       | 156      | 152    |
| F-statistic | 0.693737153 |          |           |          |        |
| K-W statistic | 4.929917434 |          |           |          |        |
| Tukey statistic |         |         |           |          |        |
| Monday      | 0      | 1.27478 | −0.83036 | −0.469856 | −0.52385 |
| Tuesday     | 0      | −2.10514 | −1.744636 | −1.79863 |        |
| Wednesday   | 0      | 0.3605003 | 0.306507 |          |        |
| Thursday    | 0      | −0.053994 |          |          |        |
| **FTSE AIM OG** |      |         |           |          |        |
| Mean return | −0.00208 | −0.002526 | −0.000564 | 0.000448 | 0.0004435 |
| Observation | 144    | 153     | 155       | 156      | 152    |
| F-statistic | 4.010797958 |          |           |          |        |
| K-W statistic | 21.88855327 |          |           |          |        |
| Tukey statistic |         |         |           |          |        |
| Monday      | 0      | −0.32516 | 1.092983 | 1.8245219 | 4.707024 |
| Tuesday     | 0      | 1.418146 | 2.1496856 | 5.032188 |        |
|                | Monday | Tuesday | Wednesday | Thursday | Friday |
|----------------|--------|---------|-----------|----------|--------|
| **AMEC** Mean return | 2.03E-05 | 0.001658 | -0.000452 | 0.000266 | 0.000054 |
| Observation | 144 | 153 | 155 | 156 | 152 |
| **BG GROUP** Mean return | -0.00046 | 0.002049 | -0.001622 | -0.000833 | 0.000207 |
| Observation | 144 | 153 | 155 | 156 | 152 |
| **BP** Mean return | 0.000312 | -0.000301 | -0.000476 | -0.000267 | -0.001502 |
| Observation | 144 | 153 | 155 | 156 | 152 |
| **CAIRN** Mean return | -0.00187 | 0.000373 | -0.000946 | 0.000046 | -0.000003 |
| Observation | 144 | 153 | 155 | 156 | 152 |
| **DRAGON** Mean return | -0.00018 | 0.000727 | 0.001819 | 0.000822 | -0.000909 |
| Observation | 144 | 153 | 155 | 156 | 152 |
|                    | Monday | Tuesday | Wednesday | Thursday | Friday |
|--------------------|--------|---------|-----------|----------|--------|
| **Fortune**        |        |         |           |          |        |
| Mean return        | −0.00477 | 0.001849 | 0.001681 | −0.000523 | 0.002951 |
| Observation        | 144    | 153     | 155       | 156      | 152    |
| F-statistic        | 0.49235208 |        |           |          |        |
| K-W statistic      | 1.628715356 |        |           |          |        |
| Tukey statistic    |        |         |           |          |        |
| Monday              | 0      | 1.538968 | 1.499977  | 0.9878145 | 1.795065 |
| Tuesday             | 0      | −0.03899 | −0.551153 | 0.256097  |        |
| Wednesday           | 0      | −0.512162 | 0.295088 |          |        |
| Thursday            | 0      | 0       | 0.80725   |          |        |
| **Hunting**        |        |         |           |          |        |
| Mean return        | −0.0004 | 0.001374 | −0.002310 | 0.001241  | 0.002091 |
| Observation        | 144    | 153     | 155       | 156      | 152    |
| F-statistic        | 0.939621194 |        |           |          |        |
| K-W statistic      | 3.59337799 |        |           |          |        |
| Tukey statistic    |        |         |           |          |        |
| Monday              | 0      | 0.968823 | −1.03973  | 0.8966124 | 1.360206 |
| Tuesday             | 0      | −2.00856 | −0.072211 | 0.391383  |        |
| Wednesday           | 0      | 1.9363452 | 2.399383 |          |        |
| Thursday            | 0      | 0       | 0.463593  |          |        |
| **Premier**        |        |         |           |          |        |
| Mean return        | 0.000532 | −0.001777 | 0.000465 | 0.001146  | 0.000928 |
| Observation        | 144    | 153     | 155       | 156      | 152    |
| F-statistic        | 0.520226882 |        |           |          |        |
| K-W statistic      | 2.792678369 |        |           |          |        |
| Tukey statistic    |        |         |           |          |        |
| Monday              | 0      | −1.415  | −0.04113  | 0.3760816 | 0.242734 |
| Tuesday             | 0      | 1.373873 | 1.7910812 | 1.657734  |        |
| Wednesday           | 0      | 0.4172082 | 0.283861 |          |        |
| Thursday            | 0      | 0       | −0.133348 |          |        |
| **RDSB**           |        |         |           |          |        |
| Mean return        | 0.000286 | 0.002686 | −0.000721 | −0.000694 | −0.000322 |
| Observation        | 144    | 153     | 155       | 156      | 152    |
| F-statistic        | 1.753720054 |        |           |          |        |
| K-W statistic      | 7.569918787 |        |           |          |        |
| Tukey statistic    |        |         |           |          |        |
| Monday              | 0      | 2.222766 | −0.9326  | −0.907989 | −0.56335 |
| Tuesday             | 0      | −3.15537 | −3.130755 | −2.786116 |        |
| Wednesday           | 0      | 0.0246099 | 0.369249 |          |        |
| Thursday            | 0      | 0       | 0.346464  |          |        |
| **Tullow**         |        |         |           |          |        |
| Mean return        | −0.00059 | 0.000128 | −0.001841 | −0.000343 | 0.002437 |
| Observation        | 144    | 153     | 155       | 156      | 152    |
| F-statistic        | 0.763607697 |        |           |          |        |
| K-W statistic      | 4.540064018 |        |           |          |        |
Sanusi & Ahmad, Cogent Economics & Finance (2016), 4: 1128133
http://dx.doi.org/10.1080/23322039.2015.1128133

|                | Monday | Tuesday | Wednesday | Thursday | Friday |
|----------------|--------|---------|-----------|----------|--------|
| **Tukey statistic** |        |         |           |          |        |
| Monday          | 0      | 0.401267| −0.69443 | 0.1390366| 1.687078|
| Tuesday         | 0      | −1.09569| −0.262231| −0.262231| 1.28581 |
| Wednesday       | 0      | 0.8334623| 2.381503 | 0        |        |
| Thursday        | 0      | 1.548041| 0         | 0        |        |
| **AMINEX**      |        |         |           |          |        |
| Mean return     | 0.002376| −0.002853| 0.006753| −0.008139| −0.003247|
| Observation     | 144    | 153     | 155       | 156      | 152    |
| F-statistic     | 1.112091933 | | | | |
| K-W statistic   | 2.539464198 | | | | |
| **Tukey statistic** |        |         |           |          |        |
| Monday          | 0      | −0.9568 | 0.800705 | −1.923947| −1.028971|
| Tuesday         | 0      | 1.757506| −0.967147| −0.072171|        |
| Wednesday       | 0      | −2.724653| −1.829677|        |        |
| Thursday        | 0      | 0.894976 | | | |
| **JKX O&G**     |        |         |           |          |        |
| Mean return     | 0.001148| −0.001855| −0.002311| −0.000286| −0.005110|
| Observation     | 144    | 153     | 155       | 156      | 152    |
| F-statistic     | 1.202895668 | | | | |
| K-W statistic   | 5.225484511 | | | | |
| **Tukey statistic** |        |         |           |          |        |
| Monday          | 0      | −1.41191| −1.62629 | −0.674319| −2.94217|
| Tuesday         | 0      | −0.21438| 0.737594 | −1.530257|        |
| Wednesday       | 0      | 0.9519699| −1.315882|        |        |
| Thursday        | 0      | 2.267852 | | | |
| **SOCO INTL.**  |        |         |           |          |        |
| Mean return     | 0.000307| −0.000432| −0.001115| 0.000909 | 0.000786|
| Observation     | 144    | 153     | 155       | 156      | 152    |
| F-statistic     | 0.215608431 | | | | |
| K-W statistic   | 1.10832227 | | | | |
| **Tukey statistic** |        |         |           |          |        |
| Monday          | 0      | −0.3982 | −0.76594 | 0.3241272| 0.258133|
| Tuesday         | 0      | −0.36774| 0.7223266| 0.656333 |        |
| Wednesday       | 0      | 1.0900714| 1.024077 |        |        |
| Thursday        | 0      | 0       | −0.065994|        |        |
| **WOOD GRP**    |        |         |           |          |        |
| Mean return     | 0.000259| 0.002383| −0.000664| 0.001247 | 0.000278|
| Observation     | 144    | 153     | 155       | 156      | 152    |
| F-statistic     | 0.510816937 | | | | |
| K-W statistic   | 6.860733061 | | | | |
| **Tukey statistic** |        |         |           |          |        |
| Monday          | 0      | 1.153157| −0.50062 | 0.5369051| 1.101957|
| Tuesday         | 0      | −1.65378| −0.616251| −0.0512 |        |
| Wednesday       | 0      | 1.0375238| 1.602575 |        |        |
| Thursday        | 0      | 0.565052 | | | |
| **AFREN**       |        |         |           |          |        |
| Mean return     | −0.00047| 0.002852| −0.000681| 0.000786 | 0.000311|
| Observation     | 144    | 153     | 155       | 156      | 152    |

Table 1. (Continued)
| Monday | Tuesday | Wednesday | Thursday | Friday |
|--------|---------|-----------|----------|--------|
| F-statistic | 0.287916093 |        |          |        |
| K-W statistic | 1.345452187 |        |          |        |
| Tukey statistic |          |        |          |        |
| Monday | 0 | 1.262706 | −0.07933 | 0.4778316 | 0.29748 |
| Tuesday | 0 | −1.34204 | −0.784875 | −0.965226 |          |
| Wednesday | 0 | 0.5571661 | 0.376814 |          |        |
| Thursday | 0 |          | −0.180352 |        |        |
| **HARDY O&G** |        |          |          |        |
| Mean return | −0.00463 | −0.003579 | 0.001358 | 0.000717 | −0.000903 |
| Observation | 144 | 153 | 155 | 156 | 152 |
| F-statistic | 1.051237673 |        |          |        |
| K-W statistic | 6.036124707 |        |          |        |
| Tukey statistic |          |        |          |        |
| Monday | 0 | 0.413558 | 2.352295 | 2.1004191 | 1.464555 |
| Tuesday | 0 | 1.938736 | 1.6868607 | 1.050997 |          |
| Wednesday | 0 | −0.251876 | −0.88774 |          |        |
| Thursday | 0 |          | −0.635864 |        |        |
| **RDSA** |        |          |          |        |
| Mean return | −2.4E-05 | 0.002371 | −0.000904 | −0.000288 | −0.000538 |
| Observation | 144 | 153 | 155 | 156 | 152 |
| F-statistic | 1.682564012 |        |          |        |
| K-W statistic | 8.202197593 |        |          |        |
| Tukey statistic |          |        |          |        |
| Monday | 0 | 2.383797 | −0.87633 | −0.263021 | −0.511184 |
| Tuesday | 0 | −3.26013 | −2.646819 | −2.894981 |          |
| Wednesday | 0 | 0.6133119 | 0.365149 |          |        |
| Thursday | 0 |          | −0.248163 |        |        |
| **PETROFAC** |        |          |          |        |
| Mean return | 0.000824 | 0.001232 | −0.001067 | 0.002203 | 0.000233 |
| Observation | 144 | 153 | 155 | 156 | 152 |
| F-statistic | 0.484073992 |        |          |        |
| K-W statistic | 2.69118205 |        |          |        |
| Tukey statistic |          |        |          |        |
| Monday | 0 | 0.231353 | −1.07277 | 0.7819499 | −0.335171 |
| Tuesday | 0 | −1.30412 | 0.5505969 | −0.566524 |          |
| Wednesday | 0 | 1.8547179 | 0.737597 |          |        |
| Thursday | 0 |          | −1.117121 |        |        |
| **SALAMANDER** |        |          |          |        |
| Mean return | 0.000297 | −0.002800 | 0.000733 | −0.000046 | 0.000272 |
| Observation | 144 | 153 | 155 | 156 | 152 |
| F-statistic | 0.556664052 |        |          |        |
| K-W statistic | 1.9574156 |        |          |        |
| Tukey statistic |          |        |          |        |
| Monday | 0 | −1.62301 | 0.228108 | −0.179823 | −0.01321 |
| Tuesday | 0 | 1.851119 | 1.4431875 | 1.609801 |          |
| Wednesday | 0 | −0.407931 | −0.241318 |          |        |
| Thursday | 0 |          | 0.166614 |        |        |

(Continued)
|        | Monday       | Tuesday      | Wednesday    | Thursday     | Friday      |
|--------|--------------|--------------|--------------|--------------|-------------|
| **LAMPRELL** |              |              |              |              |             |
| Mean return | 0.001513    | 0.000273    | −0.007814    | −0.000394    | 0.002843    |
| Observation | 144         | 153         | 155          | 156          | 152         |
| F-statistic | 1.003828883 |              |              |              |             |
| K-W statistic | 1.004767414 |              |              |              |             |
| Tukey statistic |            |              |              |              |             |
| Monday | 0           | −0.29729    | −2.23656     | −0.457288    | 0.318952    |
| Tuesday | 0           | 1.93927     | 1.159997     | 0.616242     |             |
| Wednesday | 0               | 1.7792744 | 2.555514    |              |             |
| Thursday | 0           | 0           | 0.776239     |              |             |
| **ENDEAVOR** |              |              |              |              |             |
| Mean return | 0.001918    | −0.002845   | −0.005402    | 0.002057     | −0.002488   |
| Observation | 144         | 153         | 155          | 156          | 152         |
| F-statistic | 0.548515069 |              |              |              |             |
| K-W statistic | 0.274690258 |              |              |              |             |
| Tukey statistic |            |              |              |              |             |
| Monday | 0           | −1.08459    | −1.667       | 0.0314785    | −1.003476   |
| Tuesday | 0           | 0.5824      | 1.1160723    | 0.081118     |             |
| Wednesday | 0               | 1.6984749 | 0.66352     |              |             |
| Thursday | 0           | 0           | 0.1034955    |              |             |
| **CADOGAN** |              |              |              |              |             |
| Mean return | −0.00245    | −0.002814   | 0.002441     | −0.000277    | 0.001666    |
| Observation | 144         | 153         | 155          | 156          | 152         |
| F-statistic | 0.452860858 |              |              |              |             |
| K-W statistic | 2.068736118 |              |              |              |             |
| Tukey statistic |            |              |              |              |             |
| Monday | 0           | −0.10538    | 1.394441     | 0.6187843    | 1.173314    |
| Tuesday | 0           | 1.499822    | 0.7241653    | 1.278695     |             |
| Wednesday | 0               | 0.775656   | −0.221127    |              |             |
| Thursday | 0           | 0           | 0.554529     |              |             |
| **HERITAGE** |              |              |              |              |             |
| Mean return | −0.00352    | 0.0003045   | −0.000644    | −0.003062    | 0.000260    |
| Observation | 144         | 153         | 155          | 156          | 152         |
| F-statistic | 1.009395797 |              |              |              |             |
| K-W statistic | 4.067021843 |              |              |              |             |
| Tukey statistic |            |              |              |              |             |
| Monday | 0           | 2.480671    | 1.086682     | 0.1734628    | 1.42843     |
| Tuesday | 0           | 1.39399     | −2.307209    | −1.052241    |             |
| Wednesday | 0               | −0.91322  | 0.341748     |              |             |
| Thursday | 0           | 0           | 1.254967     |              |             |
| **KENTZ** |              |              |              |              |             |
| Mean return | −0.00064    | 0.001641    | −0.001234    | 0.002753     | 0.001784    |
| Observation | 144         | 153         | 155          | 156          | 152         |
| F-statistic | 1.069964819 |              |              |              |             |
| K-W statistic | 11.79090978  |              |              |              |             |
| Tukey statistic |            |              |              |              |             |
| Monday | 0           | 1.378884    | −0.35562     | 2.049722     | 1.464866    |
| Tuesday | 0           | 1.7345      | 0.6708383    | 0.085983     |             |
| Wednesday | 0               | 2.4053401 | 1.820484     |              |             |
the non-existence of the day-of-the-week effect in the series under investigation. In the FTSE AIM SS Oil and Gas index, the \( F \)-statistic is recorded at 4.0107 which is significantly higher than the critical value of 2.38 at 5% significance level. The non-parametric test of the Kruskal–Wallis statistic has a value of 21.88 which is also higher than the critical value of 9.48 at 5% significance level. The Tukey pairwise test suggests a significant difference between the mean returns of Fridays and Mondays at 4.7070 and Fridays and Tuesdays at 5.0321 (both higher than a critical value of 3.86 at 5% significance level) which indicate the rejection of the null hypothesis of equality and at the same time confirming the existence of the day-of-the-week effect in the FTSE AIM SS Oil and Gas index.

The next step undertaken in our investigation of the day-of-the-week effect is to create binary dummy variables for the week’s days of Mondays through Fridays as independent variables while the return series of every weekday remains as dependent variables. The variables are subjected to a regression model based on the assumption of Autoregressive Conditional Heteroscedasticity (ARCH) developed by Engle (1982) in order to explore the relationship (deviations) between variables using coefficients generated from the regression model. The ARCH model was employed because the standard ordinary least square regression model’s assumption of homoscedasticity cannot be attained by the series of stock returns. In other words, the variances and covariances of stock returns are found to be changing over time and not homoscedastic (constant). Fama (1965) and Mandelbrot (1966) reported the existence of volatility clustering (large changes in returns followed by similar changes and small changes also followed by small changes) which give rise to changing conditional variance (heteroscedasticity). Lagged returns are also included in the model in order to overcome the problem of auto-correlation. In our effort to improve the model, we have employed the generalised version of ARCH model as suggested by Bollerslev (1986). The specifications of the models employed are given as:

\[
R_t = \alpha_0 D_{Mt} + \alpha_7 D_{Tt} + \alpha_5 D_{Wt} + \alpha_3 D_{Dt} + \alpha_1 R_{t-1} + \epsilon_t
\]  

(1)

\[
\sigma_t^2 = \alpha_0 D_{Mt} + \alpha_7 D_{Tt} + \alpha_5 D_{Wt} + \alpha_3 D_{Dt} + \alpha_1 D_{Rt} + \alpha_4 \sigma_{t-1}^2 + \beta_1 \epsilon_t + \beta_2 \sigma_{t-1}^2
\]  

(2)

where \( R_t \) is the stock return series under investigation, \( D_{Mt}, D_{Tt}, D_{Wt}, D_{Dt}, D_{Rt} \) represent the binary dummy variables for Monday through Friday; for Monday returns the dummy variable is equal to 1 and all others are equal to zero. The coefficients attached to the dummy variables measure the average deviation of the week’s days’ mean return from other days’ mean returns. If any coefficient is
found to be significant, then the days’ mean return attached to the coefficient has deviated from that of the others and thus, there is the existence of the day-of-the-week effect. A constant is not included in the regression model in order to avoid the dummy variable trap. The second equation is the generalised ARCH employed where $\sigma_t^2$ is the conditional variance, $\alpha_i u_{t-1}^2$ is the ARCH term and $\beta_i \sigma_{t-1}^2$ is the generalised ARCH term. The coefficients of the ARCH and generalised autoregressive conditional heteroscedasticity (GARCH) terms are referred to as alpha and beta, respectively.

The regression results are presented in Table 2 and most of the week’s days’ coefficients are not significant at both 1% and 5% levels of significance. This indicates the absence of a day-of-the-week effect in the stock returns. However, the FTSE AIM Oil and Gas index return series has significant Monday and Friday coefficients which are signs of a day-of-the-week effect as shown by the results of the $F$-test, the Kruskal–Wallis test, and the Tukey tests depicted in Table 1. Similarly, JXX Oil and Gas has recorded a significant coefficient on Friday at 5% level of significance. Lamprell Plc stock returns also have significant coefficients on Tuesday, Wednesday and Friday at 1% level of significance. In summary, only coefficients in three stocks (FTSE AIM Oil and Gas index, JXX Oil and Gas, Lamprell) were found to be significant which is indicative of the existence of a day-of-the-week effect. The results from JXX Oil and Gas index and Lamprell Plc contradict that of the $F$-test, the Kruskal–Wallis test, and the Tukey tests which showed no evidence of day-of-the-week anomalies. The coefficients of both the ARCH and GARCH terms represented in the results as “$\alpha_i$” and “$\beta_i$” were found to be strongly significant at 1% level which is an additional sign of model appropriateness.

In testing for the monthly effect, binary dummy variables were also created for the monthly (January through December) stock returns as 12 independent variables (constant parameter would not be included in order to avoid dummy variable trap). Both the dummy variables (independent variables) and the monthly return series (dependent variables) are subjected to a regression model using GARCH specifications. The specifications of the models employed are given as:

$$R_t = \alpha_1 D_{Jt} + \alpha_2 D_{At} + \alpha_3 D_{Mt} + \alpha_4 D_{Myt} + \alpha_5 D_{MytJnt} + \alpha_6 D_{MytJyt} + \alpha_7 D_{MytJyt} + \alpha_8 D_{Myt} + \alpha_9 D_{Myt} + \alpha_{10} D_{Myt} + \alpha_{11} R_{t-1} + \epsilon_t$$

$$\sigma_t^2 = \alpha_1 D_{Jt} + \alpha_2 D_{At} + \alpha_3 D_{Mt} + \alpha_4 D_{Myt} + \alpha_5 D_{MytJnt} + \alpha_6 D_{MytJyt} + \alpha_7 D_{MytJyt} + \alpha_8 D_{Myt} + \alpha_9 D_{Myt} + \alpha_{10} D_{Myt} + \alpha_{11} u_{t-1}^2 + \beta_2 \sigma_{t-1}^2$$

where $R_t$ is the monthly stock return series under investigation, $D_{Jt}$, $D_{At}$, $D_{Mt}$, $D_{Myt}$, $D_{MytJnt}$, $D_{MytJyt}$, $D_{MytJyt}$, $D_{Myt}$, $D_{Myt}$, $D_{Myt}$, $D_{Myt}$, $R_{t-1}$, $\epsilon_t$ is the ARCH term and $\beta_2 \sigma_{t-1}^2$ is the generalised ARCH term. The coefficients of the ARCH and GARCH terms are referred to as alpha and beta, respectively.

The results in Table 3 show the monthly effect of January through December on the stock returns of the UK oil and gas companies and some related FTSE indices. Most of the monthly coefficients in the oil and gas companies were found to be insignificant at both 1 and 5% significance level except in oil companies that were listed on the Exchange recently (2010 to date). The results from the FTSE indices differ. January, May and November coefficients were found to be highly significant at 1% level in FTSE All Share and FTSE 100 indices. It shows the presence of January effect; a finding which has been famous in the literature. End-of-the-year activities such as Christmas and New Year holidays are part of the reasons for January effects. May effects were also not a surprise. In the UK, tax year begins from 6 April and ends 5 April in the following year. For that reason, most of the
Table 2. Generalised ARCH (1,1) regression results for the test of day-of-the-week (DOTW) effect on the return series under study

| FTSE All Sh. | Monday | Tuesday | Wednesday | Thursday | Friday | r (−1) | \( \alpha_1 \) | \( \beta_1 \) |
|--------------|--------|---------|-----------|----------|--------|--------|------------|------------|
| Coefficient  | 0.0001 | 0.0012  | 0.0002    | 0.0004   | 0.0004 | 0.0282 | 0.1262     | 0.8396     |
| Standard error | 0.0008 | 0.0006  | 0.0006    | 0.0007   | 0.0008 | 0.0404 | 0.0258     | 0.0306     |
| z-Statistic   | 0.1455 | 1.9132  | 0.3663    | 0.5782   | 0.5114 | 0.6977 | 4.8895     | 27.352     |
| Probability   | 0.8842 | 0.0557  | 0.7141    | 0.5631   | 0.609  | 0.4853 | 0.0000*    | 0.0000*    |

| FTSE100       |        |         |           |          |        |        |            |            |
| Coefficient   | 0.0001 | 0.0013  | 0.0002    | 0.0004   | 0.0002 | 0.0105 | 0.1277     | 0.8375     |
| Standard error | 0.0009 | 0.0007  | 0.0007    | 0.0008   | 0.0008 | 0.0405 | 0.0266     | 0.0317     |
| z-Statistic   | 0.1345 | 1.9170  | 0.3157    | 0.4732   | 0.2111 | 0.2600 | 4.8031     | 26.404     |
| Probability   | 0.8930 | 0.0552  | 0.7522    | 0.6361   | 0.8328 | 0.7949 | 0.0000*    | 0.0000*    |

| FTSE UK O&G  |        |         |           |          |        |        |            |            |
| Coefficient   | 0.0005 | 0.0014  | −0.0003   | −0.0002  | 0.0002 | 0.0063 | 0.0987     | 0.8660     |
| Standard error | 0.0011 | 0.0008  | 0.0009    | 0.0009   | 0.0011 | 0.0407 | 0.0241     | 0.0359     |
| z-Statistic   | 0.4081 | 1.7698  | −0.3415   | −0.1876  | −0.178 | 0.1551 | 4.0917     | 24.124     |
| Probability   | 0.6832 | 0.0768  | 0.7328    | 0.8512   | 0.8584 | 0.8768 | 0.0000*    | 0.0000*    |

| FTSE AIM O&G |        |         |           |          |        |        |            |            |
| Coefficient   | −0.0032| −0.0004 | 0.0013    | 0.0002   | 0.0036 | 0.1573 | 0.1937     | 0.7650     |
| Standard error | 0.0011 | 0.0010  | 0.0012    | 0.0010   | 0.0012 | 0.0415 | 0.0269     | 0.0277     |
| z-Statistic   | −3.0299| −0.4022 | 1.1395    | 0.1678   | 2.9516 | 3.7945 | 7.2036     | 27.583     |
| Probability   | 0.0024*| 0.6875  | 0.2545    | 0.8667   | 0.003*| 0.001* | 0.0000*    | 0.0000*    |

| AMEC         |        |         |           |          |        |        |            |            |
| Coefficient   | −0.0001| 0.0020  | 0.0008    | −0.0003  | 0.0011 | 0.0064 | 0.1235     | 0.7835     |
| Standard error | 0.0015 | 0.0012  | 0.0013    | 0.0012   | 0.0014 | 0.0417 | 0.0284     | 0.0482     |
| z-Statistic   | −0.0564| 1.5673  | 0.6311    | −0.2409  | 0.8064 | 0.1544 | 4.3475     | 16.250     |
| Probability   | 0.9551 | 0.1170  | 0.5279    | 0.8097   | 0.4200 | 0.8773 | 0.0000*    | 0.0000*    |

| BG GROUP     |        |         |           |          |        |        |            |            |
| Coefficient   | 0.0006 | 0.0017  | −0.0019   | −0.0006  | 0.0001 | 0.0105 | 0.0627     | 0.7959     |
| Standard error | 0.0018 | 0.0015  | 0.0015    | 0.0015   | 0.0017 | 0.0412 | 0.0277     | 0.0849     |
| z-Statistic   | 0.3371 | 1.1818  | −1.2380   | −0.3881  | 0.0811 | 0.2569 | 2.2622     | 9.3789     |
| Probability   | 0.7361 | 0.2373  | 0.2157    | 0.6979   | 0.9353 | 0.7988 | 0.023**    | 0.0000*    |

| BP           |        |         |           |          |        |        |            |            |
| Coefficient   | 0.0002 | 0.0012  | 0.0001    | −0.0008  | 0.0003 | 0.0059 | 0.1089     | 0.8570     |
| Standard error | 0.0014 | 0.0010  | 0.0011    | 0.0012   | 0.0014 | 0.0367 | 0.0150     | 0.0234     |
| z-Statistic   | 0.1760 | 1.2578  | 0.0750    | −0.6432  | −0.235 | 0.1619 | 7.2360     | 36.660     |
| Probability   | 0.8603 | 0.2085  | 0.9402    | 0.5201   | 0.8142 | 0.8714 | 0.0000*    | 0.0000*    |

| CAIRN        |        |         |           |          |        |        |            |            |
| Coefficient   | −0.0007| 0.0007  | −0.0011   | −0.0007  | 0.0002 | 0.0008 | 0.0508     | 0.9306     |
| Standard error | 0.0018 | 0.0015  | 0.0016    | 0.0014   | 0.0018 | 0.0376 | 0.0144     | 0.0241     |
| T-statistic   | −0.3765| 0.4543  | −0.6764   | −0.4705  | 0.0880 | −0.022 | 3.5244     | 38.599     |
| Probability   | 0.7065 | 0.6496  | 0.4988    | 0.6380   | 0.9298 | 0.9820 | 0.0004*    | 0.0000*    |

(Continued)
| Company | Monday | Tuesday | Wednesday | Thursday | Friday | \( r(-1) \) | \( \alpha_1 \) | \( \beta_1 \) |
|---------|--------|---------|-----------|----------|--------|----------|----------|----------|
| DRAGON  | 0.0006 | 0.0002  | 0.0015    | 0.0016   | 0.0003 | 0.0725   | 0.0643   | 0.8905   |
|         | 0.0014 | 0.0017  | 0.0016    | 0.0017   | 0.0016 | 0.0411   | 0.0156   | 0.0304   |
| z-Statistic | 0.4579 | 0.1119  | 0.9771    | 0.9369   | -0.173 | 1.7633   | 4.1155   | 29.302   |
| Probability | 0.6470 | 0.9109  | 0.3285    | 0.3488   | 0.8623 | 0.0778   | 0.0000*  | 0.0000*  |
| FORTUNE  | -0.0008| -0.0004 | -0.0007   | -0.0005  | -0.008 | -0.362   | 0.1059   | 0.7745   |
|         | 0.0030 | 0.0042  | 0.0046    | 0.0032   | 0.004  | 0.0429   | 0.0189   | 0.0305   |
| z-Statistic | -0.2501| -0.0970 | -0.1535   | -0.1639  | -0.161 | -8.444   | 5.5978   | 25.369   |
| Probability | 0.8025 | 0.9227  | 0.8780    | 0.8698   | 0.8717 | 0.0000*  | 0.0000*  | 0.0000*  |
| HUNTING  | -0.0004| 0.0014  | 0.0000    | 0.0012   | 0.0021 | 0.0197   | 0.1820   | 0.4291   |
|         | 0.0016 | 0.0017  | 0.0020    | 0.0017   | 0.0016 | 0.0398   | 0.0382   | 0.1392   |
| z-Statistic | -0.2511| 0.8065  | 0.0230    | 0.7141   | 1.3235 | 0.4950   | 4.7623   | 3.0830   |
| Probability | 0.8018 | 0.4199  | 0.9817    | 0.4752   | 0.1857 | 0.6206   | 0.0000*  | 0.0020*  |
| PREMIER  | 0.0007 | -0.0013 | 0.0003    | 0.0019   | 0.0013 | -0.033   | 0.0760   | 0.8881   |
|         | 0.0016 | 0.0014  | 0.0016    | 0.0014   | 0.0016 | 0.0385   | 0.0196   | 0.0253   |
| z-Statistic | 0.4137 | -0.9750 | 0.1626    | 1.3710   | 0.7896 | -0.875   | 3.8770   | 35.032   |
| Probability | 0.6791 | 0.3296  | 0.8708    | 0.1704   | 0.4298 | 0.3811   | 0.0001*  | 0.0000*  |
| RDSB     | 0.0004 | 0.0016  | 0.0004    | -0.0001  | -0.001 | -0.001   | 0.1004   | 0.8618   |
|         | 0.0011 | 0.0009  | 0.0009    | 0.0009   | 0.011  | 0.0414   | 0.0250   | 0.0364   |
| z-Statistic | 0.3888 | 1.8724  | 0.4015    | -0.1147  | -0.070 | -0.035   | 4.0154   | 23.647   |
| Probability | 0.6974 | 0.0612  | 0.6881    | 0.9087   | 0.9436 | 0.9716   | 0.0001*  | 0.0000*  |
| TULLOW   | 0.0002 | 0.0006  | -0.0015   | -0.0013  | 0.0023 | -0.007   | 0.0935   | 0.8460   |
|         | 0.0020 | 0.0015  | 0.0015    | 0.0016   | 0.0017 | 0.0410   | 0.0211   | 0.0371   |
| z-Statistic | 0.1086 | 0.3896  | -0.9966   | -0.7654  | 1.3769 | -0.183   | 4.4249   | 22.797   |
| Probability | 0.9135 | 0.6968  | 0.3190    | 0.4441   | 0.1685 | 0.8542   | 0.0000*  | 0.0000*  |
| AMINEX   | -0.0005| 0.0004  | 0.0036    | -0.0081  | -0.004 | -0.218   | 0.1025   | 0.8201   |
|         | 0.0044 | 0.0056  | 0.0044    | 0.0049   | 0.0061 | 0.0427   | 0.0143   | 0.0161   |
| z-Statistic | -0.1062| 0.0731  | 0.8267    | -1.6661  | -0.681 | -5.110   | 7.1804   | 51.056   |
| Probability | 0.9154 | 0.9417  | 0.4084    | 0.0997   | 0.4958 | 0.000*   | 0.000*   | 0.000*   |
| JXX O&G  | 0.0028 | -0.0027 | -0.0016   | -0.0002  | -0.004 | 0.0815   | 0.0474   | 0.9396   |
|         | 0.0022 | 0.0017  | 0.0019    | 0.0018   | 0.0020 | 0.0364   | 0.0111   | 0.0109   |
| z-Statistic | 1.3079 | -1.5837 | -0.8504   | -0.1201  | -2.033 | 2.2397   | 4.2677   | 86.453   |
| Probability | 0.1909 | 0.1133  | 0.3951    | 0.9044   | 0.04** | 0.02**   | 0.0000*  | 0.0000*  |
| SOCO INTL.| -0.0028| -0.0009 | -0.0002   | 0.0015   | 0.0011 | -0.031   | 0.2076   | 0.3555   |
|         | 0.0016 | 0.0017  | 0.0018    | 0.0019   | 0.0020 | 0.0500   | 0.0440   | 0.1036   |
| z-Statistic | -1.7033| -0.4969 | -0.1134   | 0.7904   | 0.5278 | -0.634   | 4.7163   | 3.4316   |
| Probability | 0.0885 | 0.6193  | 0.9097    | 0.4293   | 0.5977 | 0.5261   | 0.0000*  | 0.0006*  |
|       | Monday | Tuesday | Wednesday | Thursday | Friday | $r (-1)$ | $\alpha_1$ | $\beta_1$ |
|-------|--------|---------|-----------|----------|--------|----------|-----------|-----------|
| **WOOD GRP** | | | | | | | | |
| Coefficient | 0.0002 | 0.0026 | −0.0006 | 0.0006 | 0.0036 | 0.0445 | 0.0604 | 0.8889 |
| Standard error | 0.0018 | 0.0016 | 0.0020 | 0.0016 | 0.0018 | 0.0361 | 0.0138 | 0.0285 |
| z-Statistic | 0.1189 | 1.6251 | −0.2886 | 0.3957 | 2.0092 | 1.2348 | 4.3799 | 31.244 |
| Probability | 0.9054 | 0.1041 | 0.7729 | 0.6923 | 0.0445 | 0.2169 | 0.0000* | 0.0000* |
| **AFREN** | | | | | | | | |
| Coefficient | 0.0005 | 0.0038 | −0.0020 | 0.0027 | 0.0014 | 0.0416 | 0.0638 | 0.9214 |
| Standard error | 0.0026 | 0.0024 | 0.0023 | 0.0018 | 0.0025 | 0.0394 | 0.0111 | 0.0114 |
| z-Statistic | 0.1964 | 1.6102 | −0.8588 | 1.4797 | 0.5623 | 1.0551 | 5.7527 | 80.893 |
| Probability | 0.8443 | 0.1073 | 0.3905 | 0.1389 | 0.5739 | 0.2914 | 0.0000* | 0.0000* |
| **HARDY O&G** | | | | | | | | |
| Coefficient | 0.0021 | 0.0014 | −0.0005 | 0.0014 | 0.0003 | −0.066 | 0.0713 | 0.9066 |
| Standard error | 0.0015 | 0.0015 | 0.0015 | 0.0015 | 0.0015 | 0.0363 | 0.0158 | 0.0201 |
| z-Statistic | 1.3828 | 0.9510 | −0.3302 | 0.8775 | 0.1455 | −1.267 | 4.5070 | 45.165 |
| Probability | 0.1667 | 0.3416 | 0.7412 | 0.3802 | 0.8843 | 0.2049 | 0.0000* | 0.0000* |
| **RDSA** | | | | | | | | |
| Coefficient | 0.0001 | 0.0014 | −0.0001 | 0.0001 | −0.003 | 0.0355 | 0.0939 | 0.8487 |
| Standard error | 0.0011 | 0.0008 | 0.0009 | 0.0008 | 0.0010 | 0.0402 | 0.0245 | 0.0438 |
| z-Statistic | 0.0604 | 1.6520 | −0.1199 | 0.1349 | −0.298 | 0.8833 | 3.8387 | 19.373 |
| Probability | 0.9518 | 0.0985 | 0.9046 | 0.8927 | 0.7657 | 0.3771 | 0.0000* | 0.0000* |
| **PETROFAC** | | | | | | | | |
| Coefficient | 0.0021 | 0.0014 | −0.0005 | 0.0014 | 0.0003 | −0.066 | 0.0713 | 0.9066 |
| Standard error | 0.0015 | 0.0015 | 0.0015 | 0.0015 | 0.0018 | 0.0363 | 0.0158 | 0.0201 |
| z-Statistic | 1.3828 | 0.9510 | −0.3302 | 0.8775 | 0.1455 | −1.267 | 4.5070 | 45.165 |
| Probability | 0.1667 | 0.3416 | 0.7412 | 0.3802 | 0.8843 | 0.2049 | 0.0000* | 0.0000* |
| **SALAMANDER** | | | | | | | | |
| Coefficient | 0.0002 | 0.0004 | 0.0027 | 0.0002 | −0.005 | 0.0794 | 0.2946 | 0.0581 |
| Standard error | 0.0020 | 0.0018 | 0.0016 | 0.0017 | 0.0017 | 0.0404 | 0.0565 | 0.0826 |
| z-Statistic | 0.0746 | 0.5547 | 2.2047 | 0.719 | −0.290 | 1.9622 | 5.2128 | 0.7032 |
| Probability | 0.9389 | 0.8147 | 0.9046 | 0.8927 | 0.7657 | 0.3771 | 0.0000* | 0.0000* |
| **LAMPRELL** | | | | | | | | |
| Coefficient | −0.0025 | −0.0065 | 0.0028 | −0.0025 | 0.0058 | −0.084 | −0.0062 | 1.0125 |
| Standard error | 0.0026 | 0.0012 | 0.0011 | 0.0012 | 0.0033 | 0.0043 | 0.0002 | 0.0008 |
| z-Statistic | −0.9603 | −5.2635 | 50.0250 | −1.0775 | 2.592 | −19.39 | −28.715 | 1226.1 |
| Probability | 0.3369 | 0.0000* | 0.0000* | 0.2813 | 0.009* | 0.000* | 0.000* | 0.000* |
| **ENDEAVOR** | | | | | | | | |
| Coefficient | −0.0008 | −0.0019 | −0.0028 | 0.0022 | −0.004 | −0.005 | 0.0204 | 0.6597 |
| Standard error | 0.0049 | 0.0049 | 0.0058 | 0.0121 | 0.0033 | 0.0015 | 0.017 | 0.1868 |
| z-Statistic | −0.1600 | −0.3938 | −0.4909 | 0.1815 | −0.878 | −0.025 | 1.7441 | 3.5326 |
| Probability | 0.8729 | 0.6938 | 0.6235 | 0.8560 | 0.3799 | 0.9798 | 0.0811 | 0.004* |
| **CADOGAN** | | | | | | | | |
| Coefficient | 0.0003 | −0.0038 | −0.0033 | −0.0013 | 0.0043 | −0.176 | 0.1431 | 0.5097 |
| Standard error | 0.0032 | 0.0034 | 0.0033 | 0.0031 | 0.0035 | 0.0453 | 0.0307 | 0.1161 |
| z-Statistic | 0.1079 | −1.1277 | −0.9885 | −0.4184 | 1.2397 | −3.899 | 4.6588 | 4.3897 |
| Probability | 0.9141 | 0.2595 | 0.3229 | 0.6756 | 0.2151 | 0.001* | 0.000* | 0.000* |
| **HERITAGE** | | | | | | | | |
| Coefficient | −0.0036 | 0.0038 | −0.0028 | −0.0023 | 0.0002 | 0.0651 | 0.0737 | 0.7030 |

(Continued)
Table 2. (Continued)

|          | Monday  | Tuesday | Wednesday | Thursday | Friday   | r (−1)   | α₁       | β₁       |
|----------|---------|---------|-----------|----------|----------|----------|----------|----------|
| Standard | 0.0032  | 0.0025  | 0.0026    | 0.0027   | 0.0035   | 0.0419   | 0.0202   | 0.0401   |
| error    |         |         |           |          |          |          |          |          |
| z-Statistic | −1.1405 | 1.4807  | −1.0784   | −0.8314  | 0.0562   | 1.5521   | 3.6587   | 17.538   |
| Probability | 0.2541  | 0.1387  | 0.2808    | 0.4057   | 0.9481   | 0.1266   | 0.0003*  | 0.0000*  |

KENTZ

|          |         |         |           |          |          |          |          |          |
| Standard | 0.0009  | 0.0013  | −0.0009   | 0.0028   | 0.0023   | 0.1139   | 0.0812   | 0.8718   |
| error    |         |         |           |          |          |          |          |          |
| z-Statistic | 0.4795  | 0.8965  | −0.6315   | 2.2086   | 1.5204   | 3.1678   | 6.4743   | 40.604   |
| Probability | 0.6316  | 0.3700  | 0.5277    | 0.027**  | 0.1284   | 0.001*   | 0.0000*  | 0.0000*  |

EXILLON

|          |         |         |           |          |          |          |          |          |
| Standard | 0.0025  | 0.0024  | 0.0022    | 0.0021   | 0.0022   | 0.0416   | 0.0437   | 0.0527   |
| error    |         |         |           |          |          |          |          |          |
| z-Statistic | −0.9213 | −0.0918 | 1.1319    | 0.0290   | 2.1434   | 1.8657   | 5.9150   | 11.747   |
| Probability | 0.3569  | 0.9268  | 0.2577    | 0.9768   | 0.03**   | 0.0621   | 0.0000*  | 0.0000*  |

Notes: The coefficients are deemed to be significant if their z-statistic’s value is greater than its critical value or if probability value is less than 0.01 and 0.05. Probability values are used for interpretation in this case.
*Significance at 1%.
**Significance at 5%.

Table 3. Generalised ARCH (1,1) regression results for the test of monthly effect on the return series under study

**FTSE All Sh.**

|          | January | February | March | April | May | June | July |
|----------|---------|----------|-------|-------|-----|------|------|
| Coefficient | 0.0408  | 0.0070   | −0.0039 | 0.0146 | 0.0232 | 0.0100 | −0.0043 |
| Standard error | 0.0060  | 0.0083   | 0.0080 | 0.0114 | 0.0051 | 0.0037 | 0.0047 |
| z-Statistic | 6.8522  | 0.8371   | −0.4810 | 1.2885 | 4.5330 | 2.6641 | −0.9084 |
| Probability | 0.0000* | 0.4025   | 0.6305 | 0.1976 | 0.0000* | 0.0077* | 0.3637 |

| August | September | October | November | December | α₁       | β₁       |
|--------|-----------|---------|----------|----------|----------|----------|
| Coefficient | −0.0017  | 0.0039  | 0.0086  | 0.0267   | −0.012   | 1.5777  | 0.0133  |
| Standard error | 0.0062  | 0.0065  | 0.0066  | 0.0063  | 0.0085  | 0.3758  | 0.0552  |
| z-Statistic | −0.2701  | 0.5985  | 1.3008  | 4.2321  | −1.418  | 4.1981  | 0.2419  |
| Probability | 0.7871  | 0.5495  | 0.1933  | 0.0000* | 0.1560  | 0.0000* | 0.8089  |

**FTSE100**

|          | January | February | March | April | May | June | July |
|----------|---------|----------|-------|-------|-----|------|------|
| Coefficient | 0.0388  | 0.0047   | −0.0028 | 0.0141 | 0.0254 | 0.0133 | −0.0004 |
| Standard error | 0.0070  | 0.0085   | 0.0103 | 0.0125 | 0.0067 | 0.0056 | 0.0055 |
| z-Statistic | 5.5502  | 0.5515   | −0.2753 | 1.1250 | 3.7766 | 2.3817 | −0.0764 |
| Probability | 0.0000* | 0.5813   | 0.7831 | 0.2606 | 0.0002* | 0.017** | 0.9391 |

| August | September | October | November | December | α₁       | β₁       |
|--------|-----------|---------|----------|----------|----------|----------|
| Coefficient | −0.0016  | −0.0008 | 0.0081  | 0.0240   | −0.009   | 1.2737  | 0.0222  |
| Standard error | 0.0073  | 0.0084   | 0.0081  | 0.0079  | 0.0092  | 0.3665  | 0.0963  |
| z-Statistic | −0.2209  | −0.0894 | 1.0022  | 3.0453  | −1.048  | 3.4748  | 0.2307  |
| Probability | 0.8251  | 0.9288  | 0.3162  | 0.0023* | 0.2945  | 0.0005* | 0.8175  |

**FTSEUK O&G**

|          | January | February | March | April | May | June | July |
|----------|---------|----------|-------|-------|-----|------|------|
| Coefficient | 0.0230  | −0.0001  | −0.0114 | 0.0175 | 0.0341 | −0.017 | 0.0121 |
| Standard error | 0.0154  | 0.0118   | 0.0181 | 0.0199 | 0.0134 | 0.0125 | 0.0217 |
| z-Statistic | 1.4933  | −0.0052  | −0.6133 | 0.8779 | 2.5459 | −1.383  | 0.5561  |
| Probability | 0.1354  | 0.9959   | 0.5279 | 0.3800 | 0.0109 | 0.1666 | 0.5781  |

(Continued)
|             | August | September | October | November | December | $a_1$   | $\beta_1$   |
|-------------|--------|-----------|---------|----------|----------|---------|------------|
| Coefficient | -0.0076| -0.0267   | -0.0099 | 0.0278   | -0.013   | 0.4201  | 0.3737     |
| Standard error | 0.0224 | 0.0150    | 0.0157  | 0.0164   | 0.0309   | 0.2717  | 0.2961     |
| z-Statistic  | -0.3411| -1.7777   | -0.6302 | 1.6973   | -0.425   | 1.5465  | 1.2621     |
| Probability  | 0.7331 | 0.0755    | 0.5285  | 0.0896   | 0.6705   | 0.1220  | 0.2069     |
|             |         |           |         |          |          |         |            |
| FTSE UK OGP |        |           |         |          |          |         |            |
| Coefficient | 0.0222 | -0.0009   | -0.0112 | 0.0157   | 0.0365   | -0.016  | 0.0165     |
| Standard error | 0.0147 | 0.0118    | 0.0185  | 0.0194   | 0.0130   | 0.0125  | 0.0206     |
| z-Statistic  | 1.5065 | -0.0787   | -0.6034 | 0.8058   | 2.8088   | -1.285  | 0.7034     |
| Probability  | 0.1319 | 0.9373    | 0.5462  | 0.4204   | 0.0050*  | 0.1985  | 0.4818     |
|             |         |           |         |          |          |         |            |
| FTSE AIM OGP |        |           |         |          |          |         |            |
| Coefficient | 0.0158 | 0.0145    | -0.0040 | -0.0113  | -0.0038  | -0.032  | -0.0191    |
| Standard error | 0.0684 | 0.0191    | 0.0316  | 0.0229   | 0.0217   | 0.0196  | 0.0377     |
| z-Statistic  | 0.2304 | 0.7571    | -0.1260 | -0.4948  | -0.1771  | -1.634  | -0.5053    |
| Probability  | 0.8178 | 0.4490    | 0.8997  | 0.6208   | 0.8595   | 0.1021  | 0.6133     |
|             |         |           |         |          |          |         |            |
| AMEC        |        |           |         |          |          |         |            |
| Coefficient | -0.0101| 0.0493    | 0.0001  | 0.0286   | 0.0237   | 0.0023  | -0.0179    |
| Standard error | 0.0444 | 0.0217    | 0.0253  | 0.0448   | 0.0433   | 0.0191  | 0.0290     |
| z-Statistic  | -0.2274| 2.2714    | 0.0031  | 0.6378   | 0.5470   | 0.1194  | -0.6162    |
| Probability  | 0.8201 | 0.0231**  | 0.9975  | 0.5236   | 0.5844   | 0.9050  | 0.5378     |
|             |         |           |         |          |          |         |            |
| BG GROUP    |        |           |         |          |          |         |            |
| Coefficient | 0.0387 | 0.0116    | 0.0496  | 0.0314   | 0.0041   | -0.009  | 0.0147     |
| Standard error | 0.0206 | 0.0171    | 0.0196  | 0.0273   | 0.0289   | 0.0177  | 0.0201     |
| z-Statistic  | 1.8723 | 0.6778    | 2.5246  | 1.1497   | 0.1435   | -0.540  | 0.7333     |
| Probability  | 0.0612 | 0.4979    | 0.0116  | 0.2503   | 0.8859   | 0.5887  | 0.4634     |

(Continued)
|       | January | February | March | April | May   | June  | July  |
|-------|---------|----------|-------|-------|-------|-------|-------|
| BP    | 0.0118  | 0.0045   | −0.0088 | 0.0106 | 0.0189 | −0.006 | 0.0065 |
|       | 0.0186  | 0.0132   | 0.0249 | 0.0151 | 0.0166 | 0.0201 | 0.0212 |
|       | 0.6345  | 0.3425   | −0.3540 | 0.7054 | 1.1370 | −0.333 | 0.3081 |
|       | 0.5257  | 0.7320   | 0.7233 | 0.4806 | 0.2555 | 0.7385 | 0.7580 |

|       | August  | September | October | November | December | α₁ | β₁ |
|-------|---------|-----------|---------|----------|----------|----|----|
| BP    | −0.0243 | −0.0421   | −0.0127 | 0.0510   | −0.017  | 0.5463 | 0.1848 |
|       | 0.0198  | 0.0158    | 0.0189  | 0.0152   | 0.0401  | 0.2157 | 0.2707 |
|       | −1.2270 | −2.6575   | −0.6741 | 3.3676   | −0.429  | 2.5328 | 0.6830 |
|       | 0.2198  | 0.0079*   | 0.5003  | 0.0008*  | 0.6674  | 0.011**| 0.4946 |

|       | CAIRN   | January   | February | March | April | May   | June  | July  |
|-------|---------|-----------|----------|-------|-------|-------|-------|-------|
|       | 0.0442  | −0.0382   | −0.0018  | 0.0450 | 0.0321 | 0.0088 | −0.0231 |
|       | 0.0303  | 0.0287    | 0.0568   | 0.0297 | 0.0589 | 0.0268 | 0.0593 |
|       | 1.4584  | −1.3311   | −0.0312  | 1.5152 | 0.5458 | 0.3283 | −0.3895 |
|       | 0.1447  | 0.1832    | 0.9751   | 0.1297 | 0.5852 | 0.7427 | 0.6969 |

|       | August  | September | October | November | December | α₁ | β₁ |
|-------|---------|-----------|---------|----------|----------|----|----|
| CAIRN | 0.0006  | 0.0096    | −0.0415 | −0.0475  | 0.0320  | 0.0341 | 0.5523 |
|       | 0.0263  | 0.0566    | 0.0220  | 0.0285   | 0.0373  | 0.3084 | 0.4568 |
|       | 0.0232  | 0.1695    | −1.8875 | −1.6676  | 0.8584  | 0.3145 | 1.2090 |
|       | 0.9815  | 0.8654    | 0.0591  | 0.0954   | 0.3907  | 0.7532 | 0.2267 |

|       | DRAGON  | January   | February | March | April | May   | June  | July  |
|-------|---------|-----------|----------|-------|-------|-------|-------|-------|
|       | 0.0279  | 0.0746    | 0.0491   | 0.0396 | −0.0092 | −0.077 | 0.0319 |
|       | 0.0339  | 0.0513    | 0.0337   | 0.0372 | 0.0332  | 0.0203 | 0.0178 |
|       | 0.8228  | 1.4566    | 1.4563   | 1.0662 | −0.2785 | −3.793 | 1.7914 |
|       | 0.4106  | 0.1458    | 0.1453   | 0.2863 | 0.7807  | 0.001**| 0.0732 |

|       | August  | September | October | November | December | α₁ | β₁ |
|-------|---------|-----------|---------|----------|----------|----|----|
| DRAGON| −0.0096 | 0.0232    | −0.0520 | 0.0336   | −0.019  | 0.5872 | 0.4351 |
|       | 0.0313  | 0.0477    | 0.0257  | 0.0224   | 0.0399  | 0.2921 | 0.2201 |
|       | −0.3057 | 0.6870    | −2.0259 | 1.4968   | −0.495  | 2.0102 | 1.9765 |
|       | 0.7599  | 0.6263    | 0.0428  | 0.1344   | 0.6206  | 0.044**| 0.048**|

|       | FORTUNE | January   | February | March | April | May   | June  | July  |
|-------|---------|-----------|----------|-------|-------|-------|-------|-------|
|       | 0.0960  | −0.1030   | 0.0505   | −0.0361 | 0.0667 | −0.027 | −0.0145 |
|       | 0.0254  | 0.0362    | 0.0370   | 0.0326 | 0.0418 | 0.0399 | 0.0502 |
|       | 3.7838  | −2.8421   | 1.3666   | −1.1074 | 1.5981 | −0.681 | −0.2896 |
|       | 0.0002* | 0.0045*   | 0.1718   | 0.2681 | 0.1100 | 0.4956 | 0.7721 |

|       | August  | September | October | November | December | α₁ | β₁ |
|-------|---------|-----------|---------|----------|----------|----|----|
| FORTUNE| −0.0391 | 0.0672    | −0.0211 | 0.0045   | −0.045  | −0.0731 | 0.5185 |
|       | 0.0503  | 0.0531    | 0.0406  | 0.0276   | 0.0583  | 0.0172 | 0.7418 |
|       | −0.7775 | 1.2650    | −0.5199 | 0.1643   | −0.779  | −4.2597 | 0.6989 |
|       | 0.4368  | 0.2059    | 0.6031  | 0.8695   | 0.4355  | 0.0000*| 0.4846 |

|       | HUNTING | January   | February | March | April | May   | June  | July  |
|-------|---------|-----------|----------|-------|-------|-------|-------|-------|
|       | 0.0689  | 0.0354    | 0.0272   | 0.0781 | −0.0298 | −0.047 | −0.0118 |
|       | 0.0134  | 0.0178    | 0.0177   | 0.0164 | 0.0148 | 0.0112 | 0.0108 |
|       | 5.1504  | 1.9915    | 1.5386   | 4.7462 | −2.0092 | −4.206 | −1.0943 |
|       | 0.0000* | 0.0462**  | 0.1239   | 0.0000*| 0.044** | 0.000* | 0.2738 |

(Continued)
| Company | Month       | Coefficient | Standard error | z-Statistic | Probability |
|---------|-------------|-------------|----------------|-------------|-------------|
| PREMIER | August      | 0.0463      | 0.0233         | 1.9910      | 0.0465      |
|         | September   | −0.0219     | −0.0312        | −0.2471     | 0.0000      |
|         | October     | 0.0358      | 0.0219         | 0.8486      | 0.0674      |
|         | November    | 0.0000      | 0.0210         | −0.0007     | 0.0281      |
|         | December    | −0.0467     | 0.0252         | 0.1035      | 0.0635      |
|         |             |             |                |             |             |
| RDSB    | August      | 0.0480      | 0.0108         | 4.4349      | 0.0000*     |
|         | September   | 0.0422      | 0.0134         | 3.1587      | 0.0016*     |
|         | October     | −0.0133     | 0.0117         | −1.1420     | 0.2534      |
|         | November    | 0.0234      | 0.0133         | 1.7586      | 0.0786      |
|         | December    | −0.0101     | 0.0186         | −0.545      | 0.5851      |
|         |             |             |                |             |             |
| TULLOW  | August      | 0.0463      | 0.0233         | 1.9910      | 0.0465      |
|         | September   | −0.0219     | −0.0312        | −0.2471     | 0.0000      |
|         | October     | 0.0358      | 0.0219         | 0.8486      | 0.0674      |
|         | November    | 0.0000      | 0.0210         | −0.0007     | 0.0281      |
|         | December    | −0.0467     | 0.0252         | 0.1035      | 0.0635      |
|         |             |             |                |             |             |
| AMINEX  | August      | 0.0480      | 0.0108         | 4.4349      | 0.0000*     |
|         | September   | 0.0422      | 0.0134         | 3.1587      | 0.0016*     |
|         | October     | −0.0133     | 0.0117         | −1.1420     | 0.2534      |
|         | November    | 0.0234      | 0.0133         | 1.7586      | 0.0786      |
|         | December    | −0.0101     | 0.0186         | −0.545      | 0.5851      |
|         |             |             |                |             |             |

(Continued)
|          | January | February | March | April | May | June | July |
|----------|---------|----------|-------|-------|-----|------|------|
| JXX O&G | 0.0070  | −0.0198  | 0.0199| 0.0415| 0.0010| −0.054| −0.0309|
|          | 0.0482  | 0.0401   | 0.0377| 0.0795| 0.0451| 0.0400| 0.0520 |
|          | 0.1442  | −0.4934  | 0.5266| 0.5222| 0.0214| −1.350| −0.5941|
|          | 0.8853  | 0.6217   | 0.5985| 0.6015| 0.9829| 0.1768| 0.5524 |
| August   | 0.0077  | −0.0598  | −0.0103| 0.0104| −0.028| 0.4527| 0.2376 |
|          | 0.1384  | −0.0138  | 0.0138| 0.0238| −0.028| 0.4527| 0.2376 |
| SOCO INTL | 0.0011  | 0.0228   | 0.0591| 0.0006| 0.0101| −0.010| −0.0177|
|          | 0.0039  | 0.0389   | 0.0249| 0.0156| 0.0403| 0.0440| 0.0552|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
| WOOD GRP | 0.0043  | 0.0281   | 0.0787| 0.0006| 0.0101| −0.010| −0.0177|
|          | 0.0039  | 0.0389   | 0.0249| 0.0156| 0.0403| 0.0440| 0.0552|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
| AFREN    | 0.0043  | 0.0281   | 0.0787| 0.0006| 0.0101| −0.010| −0.0177|
|          | 0.0039  | 0.0389   | 0.0249| 0.0156| 0.0403| 0.0440| 0.0552|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
| HARDY O&G | 0.0043  | 0.0281   | 0.0787| 0.0006| 0.0101| −0.010| −0.0177|
|          | 0.0039  | 0.0389   | 0.0249| 0.0156| 0.0403| 0.0440| 0.0552|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|
|          | 0.2087  | 0.5848   | 2.3741| 0.0352| 0.2459| −0.010| −0.0177|

(Continued)
|     | August | September | October | November | December | $\alpha_1$ | $\beta_1$ |
|-----|--------|-----------|---------|----------|----------|------------|----------|
| **RDSA** |         |           |         |          |          |            |          |
| Coefficient | 0.0067  | 0.0321    | −0.0200 | −0.0882  | −0.036   | −0.0785   | 1.0626   |
| Standard error | 0.0438  | 0.0012    | 0.0362  | 0.0450   | 0.0476   | 0.0160    | 0.0366   |
| $z$-Statistic | 0.1528  | 27.7045   | −0.5536 | −1.9588  | −0.772   | −4.9060   | 29.013   |
| Probability | 0.8785  | 0.0000*   | 0.5799  | 0.0501   | 0.4398   | 0.0000*   | 0.0000*   |
| **PETROFAC** |         |           |         |          |          |            |          |
| Coefficient | 0.0309  | −0.0127   | −0.0172 | 0.0045   | 0.0414   | −0.008    | 0.0094   |
| Standard error | 0.0208  | 0.0164    | 0.0151  | 0.0245   | 0.0199   | 0.0107    | 0.0121   |
| $z$-Statistic | 1.4854  | −0.7745   | −1.1418 | 0.1853   | 2.0811   | −0.772    | 0.7782   |
| Probability | 0.1375  | 0.4366    | 0.2535  | 0.8530   | 0.0374   | 0.4398    | 0.4365   |
| **SALAMANDER** |         |           |         |          |          |            |          |
| Coefficient | 0.0366  | 0.0521    | 0.0006  | 0.0163   | −0.040   | 0.1448    | 0.7031   |
| Standard error | 0.0245  | 0.0554    | 0.0352  | 0.0387   | 0.0695   | 0.0218    | 0.0374   |
| $z$-Statistic | 1.4944  | 0.9410    | 0.0169  | 0.4578   | −1.646   | 1.1216    | 2.2964   |
| Probability | 0.1351  | 0.3467    | 0.9865  | 0.6471   | 0.0998   | 0.2620    | 0.021**  |
| **LAMPRELL** |         |           |         |          |          |            |          |
| Coefficient | −0.0181 | −0.0383   | −0.0381 | −0.0327  | −0.045   | 0.0623    | 0.8178   |
| Standard error | 0.0372  | 0.0536    | 0.0319  | 0.0644   | 0.0380   | 0.0747    | 0.2441   |
| $z$-Statistic | −0.4863 | −0.7149   | −1.1929 | −0.5080  | −1.205   | 0.8334    | 3.3496   |
| Probability | 0.6267  | 0.4747    | 0.2329  | 0.6114   | 0.2282   | 0.4046    | 0.0008** |

(Continued)
| ENDEAVOR | January | February | March | April | May | June | July |
|----------|---------|----------|-------|-------|-----|------|------|
| Coefficient | 0.0968 | 0.1430 | −0.0321 | 0.0327 | 0.0531 | 0.1160 | 0.1224 |
| Standard error | 0.0397 | 0.0342 | 0.0632 | 0.0676 | 0.0295 | 0.0316 | 0.0643 |
| z-Statistic | 2.4372 | 4.1838 | −0.5081 | 0.4834 | 1.7979 | 3.6670 | 1.9045 |
| Probability | 0.0148 | 0.0000* | 0.6114 | 0.6288 | 0.0722 | 0.0002* | 0.0568 |

| CADOGAN | January | February | March | April | May | June | July |
|----------|---------|----------|-------|-------|-----|------|------|
| Coefficient | −0.0896 | −0.0710 | −0.0152 | −0.0173 | −0.0451 | 1.8223 | 0.4171 |
| Standard error | 0.0397 | 0.0342 | 0.0632 | 0.0676 | 0.0295 | 0.0316 | 0.0643 |
| z-Statistic | −2.0513 | 1.0514 | −1.6901 | −0.4944 | 0.2804 | 0.1186 | 0.1877 |
| Probability | 0.040** | 0.2931 | 0.0910 | 0.6210 | 0.7992 | 0.9056 | 0.8511 |

| HERITAGE | January | February | March | April | May | June | July |
|----------|---------|----------|-------|-------|-----|------|------|
| Coefficient | 0.0656 | 0.0304 | −0.0017 | 0.0247 | −0.0041 | −0.033 | 0.0076 |
| Standard error | 0.0397 | 0.0342 | 0.0632 | 0.0676 | 0.0295 | 0.0316 | 0.0643 |
| z-Statistic | 0.3394 | 0.5940 | 0.9681 | 0.5518 | 0.9146 | 0.5063 | 0.2938 |
| Probability | 0.7395 | 0.0017 | 0.0428 | 0.0788 | 0.5678 | 0.9989 | 0.5514 |

| KENTZ | January | February | March | April | May | June | July |
|-------|---------|----------|-------|-------|-----|------|------|
| Coefficient | 0.0206 | 0.0599 | −0.0206 | 0.0813 | 0.0356 | −0.0144 | 0.0050 |
| Standard error | 0.0397 | 0.0342 | 0.0632 | 0.0676 | 0.0295 | 0.0316 | 0.0643 |
| z-Statistic | 0.4315 | 1.0602 | −0.3777 | 1.3057 | 1.2116 | −0.381 | 0.1390 |
| Probability | 0.6661 | 0.2890 | 0.7057 | 0.1321 | 0.2257 | 0.7032 | 0.8895 |

| EXILLON | January | February | March | April | May | June | July |
|--------|---------|----------|-------|-------|-----|------|------|
| Coefficient | −0.0268 | 0.0017 | 0.0429 | −0.0890 | 0.0371 | −0.038 | 0.0347 |
| Standard error | 0.0397 | 0.0342 | 0.0632 | 0.0676 | 0.0295 | 0.0316 | 0.0643 |
| z-Statistic | −0.3325 | 0.0271 | 0.4042 | −2.9158 | 0.9464 | −0.560 | 0.5660 |
| Probability | 0.7395 | 0.9784 | 0.6861 | 0.0035* | 0.3439 | 0.5749 | 0.5714 |
|                   | August | September | October | November | December | $\alpha_1$ | $\beta_1$ |
|-------------------|--------|-----------|---------|----------|----------|------------|-----------|
| **Coefficient**   | -0.0080 | 0.0062    | 0.0316  | 0.1347   | 0.0109   | -0.1521    | 1.1208    |
| **Standard error**| 0.1441  | 0.0981    | 0.0611  | 0.0643   | 0.1198   | 0.0516     | 0.0523    |
| **z-Statistic**   | -0.0556 | 0.0634    | 0.5175  | 2.0947   | 0.0907   | -2.9461    | 21.430    |
| **Probability**   | 0.9556  | 0.9494    | 0.6048  | 0.036**  | 0.9278   | 0.003*     | 0.000**   |
| **ENQUEST**       |         |           |         |          |          |            |           |
| **Coefficient**   | 0.0114  | 0.0291    | -0.0084 | -0.0345  | 0.0132   | -0.037     | -0.0883   |
| **Standard error**| 0.0141  | 0.0242    | 0.0108  | 0.0091   | 0.0024   | 0.0023     | 0.0045    |
| **z-Statistic**   | 4.6996  | 0.1865    | 15.9163 | 9.0220   | 1.9049   | 3.8353     | 0.9832    |
| **Probability**   | 0.0000* | 0.8521    | 0.0000* | 0.0000*  | 0.0568   | 0.0001*    | 0.3255    |
| **ESSAR**         |         |           |         |          |          |            |           |
| **Coefficient**   | -0.1503 | -0.1401   | 0.0221  | 0.0012   | 0.0144   | 0.0002     | -0.0428   |
| **Standard error**| 0.0396  | 0.0505    | 0.0388  | 0.0501   | 0.0403   | 0.0177     | 0.0141    |
| **z-Statistic**   | -2.9768 | -2.8532   | 2.8174  | 2.2900   | 3.068    | 2.6337     | -0.3095   |
| **Probability**   | 0.0001* | 0.0055*   | 0.0048* | 0.022**  | 0.0022*  | 0.0084*    | 0.7569    |
| **GENEL**         |         |           |         |          |          |            |           |
| **Coefficient**   | -0.0490 | -0.0565   | 0.0751  | 0.0851   | -0.079   | 2.1236     | -0.0139   |
| **Standard error**| 0.0164  | 0.0147    | 0.0267  | 0.0371   | 0.0259   | 0.8063     | 0.0450    |
| **z-Statistic**   | -2.9768 | -3.8532   | 2.8174  | 2.2900   | 3.068    | 2.6337     | -0.3095   |
| **Probability**   | 0.0029* | 0.0011*   | 0.0048* | 0.022**  | 0.0022*  | 0.0084*    | 0.7569    |
| **OPHIR**         |         |           |         |          |          |            |           |
| **Coefficient**   | 0.0230  | -0.0415   | 0.1458  | 0.0652   | 0.0540   | -0.007     | -0.1005   |
| **Standard error**| 0.1567  | 0.0945    | 0.0460  | 0.0466   | 0.0212   | 0.0091     | 0.0054    |
| **z-Statistic**   | 1.1067  | -0.8589   | 3.1692  | 1.3980   | 2.5498   | -0.073     | -1.8364   |
| **Probability**   | 0.8833  | 0.6607    | 0.0015* | 0.1621   | 0.010**  | 0.9413     | 0.0663    |

(Continued)
companies that are operating in the UK prefer to use a financial year that corresponds with tax year for easy tax assessment. November effect could be due to the actions or inactions of investors to gain from the December anomaly. The stock returns of oil and gas companies were found to be insensitive to January effects except in Fortune Oil, Hunting and Aminex. May coefficient was also significant in FTSE UK Oil and Gas index returns. Seasonal effects as a result of winter and summer periods due to changes in energy usage have not been found in any of the key FTSE Oil and Gas indices. The significance of coefficients in Enquest, Essar Energy, Ophir Energy and Ruspetro were suspected to be due to short time series of stock returns as companies were listed on the Exchange in recent times.

4. Findings
The results generated from our seasonality analysis of the day-of-the-week and monthly effects have not shown any evidence of these calendar anomalies in London-quoted oil and gas stocks and in a few FTSE share indices investigated. Based on these findings, and with all other factors held constant, we cannot ascertain the predictability of oil and gas stock returns due to seasonal fluctuation. This outcome is in line with the findings of other studies like Steeley (2001) who noted the disappearance of the weekend effect in the UK market except if the data is partitioned along the direction of the market. Chang et al. (1993) have also discovered the disappearance of a day-of-the-week-effect in the most recent data of the United States investigated. However, January effect has been observed in FTSE All Share and FTSE 100 indices. Our methodology is also similar to that of Guidi (2010) who examined for the existence of a day-of-the-week effect in the Italian stock market using the GARCH model in the regression and found no evidence of the DOTW effect in the market’s stock returns.

Table 3. (Continued)

| RUSPETRO | January | February | March | April | May | June | July |
|----------|---------|----------|-------|-------|-----|------|------|
| Coefficient | -0.1070 | -0.2810 | -0.2630 | 0.1984 | -0.0823 | -0.0166 | -0.2666 |
| Standard error | 0.7381 | 0.2822 | 0.0910 | 0.0763 | 0.0228 | 0.0763 | 0.1252 |
| z-Statistic | -0.1450 | -0.9958 | -2.8899 | 2.6021 | -3.6067 | -0.214 | -2.1299 |
| Probability | 0.8847 | 0.3193 | 0.0039** | 0.0093* | 0.0003** | 0.8302 | 0.033** |

| August | September | October | November | December |
|--------|-----------|---------|----------|----------|
| Coefficient | 0.1169 | -0.1531 | 0.1573 | -0.0742 | -0.090 | -0.2006 | 0.7203 |
| Standard error | 1.3228 | 0.1807 | 0.0906 | 0.1203 | 0.2388 | 0.0913 | 0.3857 |
| z-Statistic | 0.0884 | -0.8474 | 1.7373 | -0.6165 | -0.379 | -2.1972 | 1.8675 |
| Probability | 0.9296 | 0.3968 | 0.0823 | 0.5376 | 0.7040 | 0.028** | 0.0618 |

5. Conclusion
We have attempted to contribute to the existing studies on whether calendar anomalies have any effect on the pricing of stocks. The seasonality analysis is considered as another tool that can provide further evidence to the predictability and the market efficiency of the oil and gas sector and some FTSE share indices. Our investigation on London-quoted oil and gas stocks and some FTSE share indices which employed various statistical tools could not provide any statistical evidence to suggest the existence of seasonal effects in the UK oil and gas stock returns of the London Stock Exchange. The investigation of the monthly effect has shown the existence of January effect in the FTSE All Share and FTSE 100 indices. It was, therefore, established that end-of-the-year activities such as Christmas and New Year holidays have significant impact on the stock returns of the entire market except the oil and gas sector.
Funding
The authors received no direct funding for this research.

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Citation information
Cite this article as: An analysis of seasonality fluctuations in the oil and gas stock returns, Muhammad Surajo Sanusi & Farooq Ahmad, Cogent Economics & Finance (2016), 4: 1128133.

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