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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 (P_t/P_{t-1}) 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	−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	−0.069846
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	0.004435
	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

(*Continued*)

Table 1. (*Continued*)

		Monday	Tuesday	Wednesday	Thursday	Friday
	Wednesday			0	0.7315391	3.614041
	Thursday				0	2.882502
AMEC	Mean return	2.03E-05	0.001658	−0.000452	0.000266	0.000054
	Observation	144	153	155	156	152
	F-statistic	0.297659605				
	K–W statistic	1.424564284				
	Tukey statistic					
	Monday	0	1.115047	−0.32156	0.1672951	0.022647
	Tuesday		0	−1.43661	−0.947752	−1.0924
	Wednesday			0	0.4888587	0.344211
	Thursday				0	−0.144648
BG GROUP	Mean return	−0.00046	0.002049	−0.001622	−0.000833	0.000207
	Observation	144	153	155	156	152
	F-statistic	0.810097929				
	K–W statistic	4.736793417				
	Tukey statistic					
	Monday	0	1.61868	−0.75162	−0.242484	0.429282
	Tuesday		0	−2.3703	−1.861164	−1.189398
	Wednesday			0	0.5091399	1.180906
	Thursday				0	0.671767
BP	Mean return	0.000312	−0.000301	−0.000476	−0.000267	−0.001502
	Observation	144	153	155	156	152
	F-statistic	0.195088866				
	K–W statistic	3.140288403				
	Tukey statistic					
	Monday	0	−0.41349	−0.53138	−0.39099	−1.223996
	Tuesday		0	−0.11789	0.0225037	−0.810503
	Wednesday			0	0.14039	−0.692616
	Thursday				0	−0.833006
CAIRN	Mean return	−0.00187	0.000373	−0.000946	0.000046	−0.000003
	Observation	144	153	155	156	152
	F-statistic	0.272821274				
	K–W statistic	3.064199928				
	Tukey statistic					
	Monday	0	1.291092	0.532656	1.1032085	1.074713
	Tuesday		0	−0.75844	−0.187883	−0.216379
	Wednesday			0	0.5705525	0.542057
	Thursday				0	−0.028495
DRAGON	Mean return	−0.00018	0.000727	0.001819	0.000822	−0.000909
	Observation	144	153	155	156	152
	F-statistic	0.381826186				
	K–W statistic	0.825266994				
	Tukey statistic					

(*Continued*)

Table 1. (*Continued*)

		Monday	Tuesday	Wednesday	Thursday	Friday
	Monday	0	0.534847	1.182334	0.591457	−0.434915
	Tuesday		0	0.647487	0.0566104	−0.969761
	Wednesday			0	−0.590877	−1.617249
	Thursday				0	−1.026372
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	0.80725
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	2.399938
	Thursday				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	−0.133348
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	0.34464
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				

(*Continued*)

Table 1. (*Continued*)

		Monday	Tuesday	Wednesday	Thursday	Friday
	Tukey statistic					
	Monday	0	0.401267	−0.69443	0.1390366	1.687078
	Tuesday		0	−1.09569	−0.262231	1.28581
	Wednesday			0	0.8334623	2.381503
	Thursday				0	1.548041
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	0.7375941	−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	−0.065994
WOOD GRP	Mean return	0.000259	0.002383	−0.000664	0.001247	0.002288
	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

(*Continued*)

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*)

Table 1. (*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	−0.159997	0.616242
	Wednesday			0	1.7792744	2.555514
	Thursday				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	−1.034955
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	0.554529
HERITAGE	Mean return	−0.00352	0.003045	−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	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

(*Continued*)

Table 1. (*Continued*)

		Monday	Tuesday	Wednesday	Thursday	Friday
	Thursday				0	−0.584856
EXILLON	Mean return	−0.00166	−0.001154	0.001921	−0.000187	0.000595
	Observation	144	153	155	156	152
	F-statistic	0.269798504				
	K–W statistic	0.606926897				
	Tukey statistic					
	Monday	0	0.186483	1.309531	0.5397565	0.825446
	Tuesday		0	1.123049	0.3532738	0.638963
	Wednesday			0	−0.769775	−0.484086
	Thursday					

Notes: First column of the table shows both the indices and individual oil and gas companies on which the tests are performed. The details of the statistical tests conducted are depicted in column 2. Columns 3 through 7 of the table show the results against the days of the week (Monday to Friday). From the mean returns, the days with highest and lowest average returns can be deduced. The critical values for *F*-statistic, K-W statistic and Tukey statistic at 5% significance level are 2.38, 9.48 and 3.86, respectively.

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 21.888 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:

$$R_t = \alpha_M D_{Mt} + \alpha_T D_{Tt} + \alpha_W D_{Wt} + \alpha_{Th} D_{Tht} + \alpha_F D_{Ft} + \alpha_i R_{t-i} + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = \alpha_M D_{Mt} + \alpha_T D_{Tt} + \alpha_W D_{Wt} + \alpha_{Th} D_{Tht} + \alpha_F D_{Ft} + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (2)$$

where R_t is the stock return series under investigation, $D_{Mt}, D_{Tt}, D_{Wt}, D_{Tht}, D_{Ft}$ 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 σ_t^2 is the conditional variance, $\alpha_1 u_{t-1}^2$ is the ARCH term and $\beta_1 \sigma_{t-1}^2$ 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, JKX 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, JKX 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 JKX 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 "α_1" and "β_1" 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:

$$R_t = \alpha_J D_{Jt} + \alpha_F D_{Ft} + \alpha_M D_{Mt} + \alpha_A D_{At} + \alpha_{My} D_{Myt} + \alpha_{Jn} D_{Jnt} + \alpha_{Jy} D_{Jyt} + \alpha_{Au} D_{Aut} + \alpha_S D_{St} + \alpha_O D_{Ot} + \alpha_N D_{Nt} + \alpha_D D_{Dt} + \alpha_i R_{t-i} + \varepsilon_t \quad (3)$$

$$\sigma_t^2 = \alpha_J D_{Jt} + \alpha_F D_{Ft} + \alpha_M D_{Mt} + \alpha_A D_{At} + \alpha_{My} D_{Myt} + \alpha_{Jn} D_{Jnt} + \alpha_{Jy} D_{Jyt} + \alpha_{Au} D_{Aut} + \alpha_S D_{St} + \alpha_O D_{Ot} + \alpha_N D_{Nt} + \alpha_D D_{Dt} + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (4)$$

where R_t is the monthly stock return series under investigation, $D_{Jt} + D_{Ft} + D_{Mt} + D_{At} + D_{Myt} + D_{Jnt} + D_{Jyt} + D_{Aut} + D_{St} + D_{Ot} + D_{Nt} + D_{Dt}$ represents the binary dummy variables for January through December; for January returns the dummy variable is equal to 1 and all others are equal to zero and it goes the same way for the remaining months. The coefficients attached to the dummy variables measure the average deviation of a given month's mean return from other months' mean returns. If any coefficient is found to be significant, then the monthly mean return attached to the coefficient has deviated from that of the others and thus, there is the existence of the monthly effect. The second equation is the generalised ARCH employed where σ_t^2 is the conditional variance, $\alpha_1 u_{t-1}^2$ is the ARCH term and $\beta_1 \sigma_{t-1}^2$ 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

		Monday	Tuesday	Wednesday	Thursday	Friday	$r(-1)$	α_1	β_1
FTSE All Sh.	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 UK OGP	Coefficient	0.0004	0.0014	−0.0003	−0.0002	0.0002	0.0047	0.0991	0.8650
	Standard error	0.0011	0.0008	0.0009	0.0009	0.0011	0.0406	0.0243	0.0363
	z-Statistic	0.3982	1.7753	−0.3195	−0.1973	−0.225	0.1170	4.0821	23.798
	Probability	0.6905	0.0758	0.7493	0.8436	0.8214	0.9069	0.0000*	0.0000*
FTSE AIM OG	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	0.2549	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*)

Table 2. (*Continued*)

		Monday	Tuesday	Wednesday	Thursday	Friday	$r(-1)$	α_1	β_1
DRAGON	Coefficient	0.0006	0.0002	0.0015	0.0016	0.0003	0.0725	0.0643	0.8905
	Standard error	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	Coefficient	−0.0008	−0.0004	−0.0007	−0.0005	−0.008	−0.362	0.1059	0.7745
	Standard error	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	0.000*	0.0000*	0.0000*
HUNTING	Coefficient	−0.0004	0.0014	0.0000	0.0012	0.0021	0.0197	0.1820	0.4291
	Standard error	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	Coefficient	0.0007	−0.0013	0.0003	0.0019	0.0013	−0.033	0.0760	0.8881
	Standard error	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	Coefficient	0.0004	0.0016	0.0004	−0.0001	−0.001	−0.001	0.1004	0.8618
	Standard error	0.0011	0.0009	0.0009	0.0009	0.0011	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	Coefficient	0.0002	0.0006	−0.0015	−0.0013	0.0023	−0.007	0.0935	0.8460
	Standard error	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	Coefficient	−0.0005	0.0004	0.0036	−0.0081	−0.004	−0.218	0.1025	0.8201
	Standard error	0.0044	0.0056	0.0044	0.0049	0.0061	0.0427	0.0143	0.0161
	z-Statistic	−0.1062	0.0731	0.8267	−1.6461	−0.681	−5.110	7.1804	51.056
	Probability	0.9154	0.9417	0.4084	0.0997	0.4958	0.000*	0.0000*	0.0000*
JKX O&G	Coefficient	0.0028	−0.0027	−0.0016	−0.0002	−0.004	0.0815	0.0474	0.9396
	Standard error	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.	Coefficient	−0.0028	−0.0009	−0.0002	0.0015	0.0011	−0.031	0.2076	0.3555
	Standard error	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*

(*Continued*)

Table 2. (*Continued*)

		Monday	Tuesday	Wednesday	Thursday	Friday	$r(-1)$	α_1	β_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	−0.0015	−0.0037	−0.0002	−0.0043	0.0016	−0.091	0.1316	0.6442
	Standard error	0.0026	0.0025	0.0022	0.0023	0.0026	0.0464	0.0357	0.1103
	z-Statistic	−0.5625	−1.4622	−0.0753	−1.8934	0.6100	−1.979	3.6834	5.8429
	Probability	0.5738	0.1437	0.9399	0.0583	0.5419	0.04**	0.0002*	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	0.0001*	0.0000*
PETROFAC	Coefficient	0.0021	0.0014	−0.0005	0.0014	0.0003	−0.046	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	0.0766	0.2344	1.7155	0.1372	−0.290	1.9622	5.2128	0.7032
	Probability	0.9389	0.8147	0.0863	0.8909	0.7714	0.04**	0.0000*	0.4819
LAMPRELL	Coefficient	−0.0025	−0.0065	0.0028	−0.0025	0.0058	−0.084	−0.0062	1.0125
	Standard error	0.0026	0.0012	0.0001	0.0023	0.0022	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	0.0055	0.2054	0.0117	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)	α_1	β_1
	Standard error	0.0032	0.0025	0.0026	0.0027	0.0035	0.0419	0.0202	0.0401
	z-Statistic	−1.1405	1.4807	−1.0784	−0.8314	0.0652	1.5521	3.6587	17.538
	Probability	0.2541	0.1387	0.2808	0.4057	0.9481	0.1206	0.0003*	0.0000*
KENTZ	Coefficient	0.0009	0.0013	−0.0009	0.0028	0.0023	0.1139	0.0812	0.8718
	Standard error	0.0018	0.0015	0.0014	0.0013	0.0015	0.0360	0.0125	0.0215
	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	Coefficient	−0.0023	−0.0002	0.0025	0.0001	0.0046	0.0776	0.2585	0.6196
	Standard error	0.0025	0.0024	0.0022	0.0021	0.0022	0.0416	0.0437	0.0527
	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**	α_1	β_1
	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**	α_1	β_1
	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	−0.6313	0.8779	2.5459	−1.383	0.5561
	Probability	0.1354	0.9959	0.5279	0.3800	0.0109	0.1666	0.5781

(*Continued*)

Table 3. (*Continued*)

		August	**September**	**October**	**November**	**December**	α_1	β_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		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0222	−0.0009	−0.0112	0.0157	0.0365	−0.016	0.0145
	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
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0097	−0.0261	−0.0118	0.0259	−0.013	0.4374	0.3564
	Standard error	0.0230	0.0149	0.0156	0.0152	0.0325	0.2701	0.2869
	z-Statistic	−0.4207	−1.7584	−0.7558	1.7040	−0.407	1.6194	1.2424
	Probability	0.6740	0.0787	0.4498	0.0884	0.6836	0.1054	0.2141
FTSE AIM OG		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	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
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0185	0.0131	0.0037	−0.0352	−0.022	0.3563	0.5448
	Standard error	0.0196	0.0245	0.0197	0.0265	0.0295	0.1757	0.1891
	z-Statistic	0.9463	0.5358	0.1858	−1.3244	−0.755	2.0280	2.8806
	Probability	0.3440	0.5921	0.8526	0.1854	0.4501	0.042**	0.0040
AMEC		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	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
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0157	−0.0022	−0.0027	0.0155	−0.018	0.0678	0.8735
	Standard error	0.0220	0.0286	0.0183	0.0250	0.0255	0.0710	0.0856
	z-Statistic	0.7151	−0.0756	−0.1480	0.6218	−0.706	0.9549	10.202
	Probability	0.4746	0.9398	0.8823	0.5341	0.4797	0.3396	0.0000*
BG GROUP		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	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
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0174	0.0055	−0.0178	−0.0124	−0.002	−0.0772	0.5346
	Standard error	0.0268	0.0308	0.0173	0.0182	0.0190	0.0722	0.7583
	z-Statistic	−0.6516	0.1792	−1.0261	−0.6835	−0.110	−1.0688	0.7050
	Probability	0.5147	0.8578	0.3048	0.4943	0.9122	0.2852	0.4808

(*Continued*)

Table 3. (*Continued*)

BP		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0118	0.0045	−0.0088	0.0106	0.0189	−0.006	0.0065
	Standard error	0.0186	0.0132	0.0249	0.0151	0.0166	0.0201	0.0212
	z-Statistic	0.6345	0.3425	−0.3540	0.7054	1.1370	−0.333	0.3081
	Probability	0.5257	0.7320	0.7233	0.4806	0.2555	0.7385	0.7580
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0243	−0.0421	−0.0127	0.0510	−0.017	0.5463	0.1848
	Standard error	0.0198	0.0158	0.0189	0.0152	0.0401	0.2157	0.2707
	z-Statistic	−1.2270	−2.6575	−0.6741	3.3676	−0.429	2.5328	0.6830
	Probability	0.2198	0.0079*	0.5003	0.0008*	0.6674	0.011**	0.4946
CAIRN		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0442	−0.0382	−0.0018	0.0450	0.0321	0.0088	−0.0231
	Standard error	0.0303	0.0287	0.0568	0.0297	0.0589	0.0268	0.0593
	z-Statistic	1.4584	−1.3311	−0.0312	1.5152	0.5458	0.3283	−0.3895
	Probability	0.1447	0.1832	0.9751	0.1297	0.5852	0.7427	0.6969
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0006	0.0096	−0.0415	−0.0475	0.0320	0.0341	0.5523
	Standard error	0.0263	0.0566	0.0220	0.0285	0.0373	0.1084	0.4568
	z-Statistic	0.0232	0.1695	−1.8875	−1.6676	0.8584	0.3145	1.2090
	Probability	0.9815	0.8654	0.0591	0.0954	0.3907	0.7532	0.2267
DRAGON		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0279	0.0746	0.0491	0.0396	−0.0092	−0.077	0.0319
	Standard error	0.0339	0.0513	0.0337	0.0372	0.0332	0.0203	0.0178
	z-Statistic	0.8228	1.4546	1.4563	1.0662	−0.2785	−3.793	1.7914
	Probability	0.4106	0.1458	0.1453	0.2863	0.7807	0.0001*	0.0732
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0096	0.0232	−0.0520	0.0336	−0.019	0.5872	0.4351
	Standard error	0.0313	0.0477	0.0257	0.0224	0.0399	0.2921	0.2201
	z-Statistic	−0.3057	0.4870	−2.0259	1.4968	−0.495	2.0102	1.9765
	Probability	0.7599	0.6263	0.0428	0.1344	0.6206	0.044**	0.048**
FORTUNE		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0960	−0.1030	0.0505	−0.0361	0.0667	−0.027	−0.0145
	Standard error	0.0254	0.0362	0.0370	0.0326	0.0418	0.0399	0.0502
	z-Statistic	3.7838	−2.8421	1.3666	−1.1074	1.5981	−0.681	−0.2896
	Probability	0.0002*	0.0045*	0.1718	0.2681	0.1100	0.4956	0.7721
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0391	0.0672	−0.0211	0.0045	−0.045	−0.0731	0.5185
	Standard error	0.0503	0.0531	0.0406	0.0276	0.0583	0.0172	0.7418
	z-Statistic	−0.7775	1.2650	−0.5199	0.1643	−0.779	−4.2597	0.6989
	Probability	0.4368	0.2059	0.6031	0.8695	0.4355	0.0000*	0.4846
HUNTING		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0689	0.0354	0.0272	0.0781	−0.0298	−0.047	−0.0118
	Standard error	0.0134	0.0178	0.0177	0.0164	0.0148	0.0112	0.0108
	z-Statistic	5.1504	1.9935	1.5386	4.7462	−2.0092	−4.206	−1.0943
	Probability	0.0000*	0.0462**	0.1239	0.0000*	0.044**	0.0000*	0.2738

(*Continued*)

Table 3. (*Continued*)

		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0480	0.0422	−0.0133	0.0234	−0.010	0.2806	−1.0275
	Standard error	0.0108	0.0134	0.0117	0.0133	0.0186	0.0590	0.0234
	z-Statistic	4.4349	3.1587	−1.1420	1.7586	−0.545	4.7597	−43.932
	Probability	0.0000*	0.0016*	0.2534	0.0786	0.5851	0.0000*	0.0000*
PREMIER		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0215	0.0424	0.0075	0.0216	0.0222	−0.046	−0.0009
	Standard error	0.0453	0.0216	0.0480	0.0286	0.0279	0.0342	0.0308
	z-Statistic	0.4748	1.9677	0.1569	0.7581	0.7943	−1.364	−0.0279
	Probability	0.6349	0.0491	0.8753	0.4484	0.4270	0.1725	0.9778
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0463	−0.0219	−0.0229	0.0269	−0.002	0.4523	0.4092
	Standard error	0.0233	0.0244	0.0317	0.0216	0.0279	0.2459	0.2400
	z-Statistic	1.9910	−0.8948	−0.7203	1.2467	−0.103	1.8391	1.7050
	Probability	0.0465	0.3709	0.4714	0.2125	0.9179	0.0659	0.0882
RDSB		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0358	−0.0032	−0.0136	0.0012	0.0417	−0.019	0.0207
	Standard error	0.0196	0.0129	0.0152	0.0256	0.0246	0.0122	0.0137
	z-Statistic	1.8288	−0.2471	−0.8915	0.0457	1.6994	−1.627	1.5124
	Probability	0.0674	0.8048	0.3727	0.9635	0.0892	0.1037	0.1304
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0000	−0.0080	−0.0222	0.0154	−0.021	0.1234	0.8433
	Standard error	0.0210	0.0258	0.0185	0.0167	0.0360	0.0947	0.1283
	z-Statistic	0.0023	−0.3099	−1.2012	0.9257	−0.582	1.3024	6.5727
	Probability	0.9982	0.7567	0.2297	0.3546	0.5600	0.1928	0.0000*
TULLOW		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0281	−0.0007	0.0518	0.0494	−0.0245	0.0147	0.0361
	Standard error	0.0434	0.0299	0.0168	0.0427	0.0223	0.0268	0.0247
	z-Statistic	0.6486	−0.0222	3.0722	1.1552	−1.0955	0.5491	1.4573
	Probability	0.5166	0.9823	0.0021*	0.2480	0.2733	0.5829	0.1450
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0467	0.0113	0.0462	−0.0333	0.0240	0.3114	−0.3004
	Standard error	0.0252	0.0362	0.0271	0.0356	0.0367	0.1704	0.2587
	z-Statistic	−1.8558	0.3137	1.7064	−0.9343	0.6526	1.8277	−1.1612
	Probability	0.0635	0.7537	0.0879	0.3501	0.5140	0.0676	0.2456
AMINEX		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.1035	−0.0665	0.0415	0.0076	−0.0301	−0.114	−0.0038
	Standard error	0.0385	0.0446	0.0007	0.0455	0.0505	0.0395	0.0845
	z-Statistic	2.6894	−1.4930	58.3129	0.1668	−0.5964	−2.893	−0.0452
	Probability	0.0072*	0.1354	0.0000*	0.8675	0.5509	0.0038*	0.9640
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0540	0.0379	0.0068	−0.0056	−0.042	−0.0593	1.0810
	Standard error	0.0692	0.0654	0.0685	0.0510	0.0465	0.0204	0.0410
	z-Statistic	−0.7806	0.5798	0.0999	−0.1094	−0.904	−2.9102	26.355
	Probability	0.4350	0.5621	0.9204	0.9129	0.3660	0.0036*	0.0000*

(*Continued*)

Table 3. (*Continued*)

JKX O&G		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0070	−0.0198	0.0199	0.0415	0.0010	−0.054	−0.0309
	Standard error	0.0482	0.0401	0.0377	0.0795	0.0451	0.0400	0.0520
	z-Statistic	0.1442	−0.4934	0.5266	0.5222	0.0214	−1.350	−0.5941
	Probability	0.8853	0.6217	0.5985	0.6015	0.9829	0.1768	0.5524
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0077	−0.0598	−0.0103	0.0104	−0.028	0.4527	0.2376
	Standard error	0.0242	0.0485	0.0475	0.0440	0.0774	0.2215	0.2403
	z-Statistic	−0.3177	−1.2328	−0.2172	0.2374	−0.366	2.0434	0.9886
	Probability	0.7507	0.2177	0.8280	0.8123	0.7144	0.041**	0.3229
SOCO INTL.		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0011	0.0228	0.0591	0.0006	0.0101	−0.010	−0.0177
	Standard error	0.0039	0.0389	0.0249	0.0156	0.0403	0.0401	0.0230
	z-Statistic	0.2807	0.5848	2.3741	0.0352	0.2519	−0.269	−0.7697
	Probability	0.7789	0.5587	0.017**	0.9719	0.8011	0.7875	0.4415
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0438	0.0199	−0.0084	−0.0351	−0.017	−0.1010	1.0605
	Standard error	0.0389	0.0301	0.0290	0.0266	0.0398	0.0527	0.0410
	z-Statistic	1.1263	0.6593	−0.2904	−1.3234	−0.447	−1.9170	25.877
	Probability	0.2600	0.5097	0.7715	0.1857	0.6545	0.0552	0.0000*
WOOD GRP		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	−0.0043	0.0630	0.0386	0.0333	0.0076	−0.019	0.0386
	Standard error	0.0257	0.0281	0.0278	0.0425	0.0313	0.0200	0.0405
	z-Statistic	−0.1654	2.2405	1.3887	0.7825	0.2427	−0.955	0.9533
	Probability	0.8686	0.0251**	0.1649	0.4339	0.8082	0.3393	0.3404
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0289	0.0010	−0.0013	−0.0101	−0.006	0.3215	0.1257
	Standard error	0.0210	0.0298	0.0239	0.0345	0.0310	0.1795	0.3387
	z-Statistic	1.3764	0.0319	−0.0525	−0.2924	−0.217	1.7910	0.3712
	Probability	0.1687	0.9745	0.9581	0.7700	0.8278	0.0733	0.7105
AFREN		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0487	0.0684	0.0051	0.0737	−0.0252	−0.017	−0.0776
	Standard error	0.0925	0.0412	0.0574	0.0479	0.0572	0.0382	0.1045
	z-Statistic	0.5262	1.6618	0.0886	1.5379	−0.4405	−0.454	−0.7427
	Probability	0.5988	0.0966	0.9294	0.1241	0.6595	0.6497	0.4577
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0458	0.0243	−0.0018	0.0544	−0.012	0.2948	0.6667
	Standard error	0.0326	0.0498	0.0638	0.0613	0.0692	0.1751	0.1595
	z-Statistic	1.4056	0.4881	−0.0276	0.8882	−0.184	1.6833	4.1805
	Probability	0.1599	0.6255	0.9780	0.3744	0.8538	0.0923	0.0000*
HARDY O&G		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0317	0.0289	0.0698	0.0287	0.0688	0.0145	−0.0760
	Standard error	0.0606	0.0528	0.0471	0.0453	0.0413	0.0412	0.0913
	z-Statistic	0.5226	0.5478	1.4806	0.6346	1.6659	0.3509	−0.8329
	Probability	0.6013	0.5838	0.1387	0.5257	0.0957	0.7256	0.4049

(*Continued*)

Table 3. (*Continued*)

		August	**September**	**October**	**November**	**December**	α_1	β_1
	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*
RDSA		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	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	0.4386	0.2535	0.8530	0.0374	0.4398	0.4365
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0092	−0.0050	−0.0177	0.0145	−0.016	0.1855	0.7384
	Standard error	0.0186	0.0190	0.0269	0.0140	0.0196	0.1515	0.1952
	z-Statistic	0.4956	−0.2609	−0.6574	1.0342	−0.859	1.2247	3.7821
	Probability	0.6202	0.7942	0.5109	0.3010	0.3898	0.2207	0.0002*
PETROFAC		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0549	0.0179	0.0028	0.0897	−0.0071	−0.027	−0.0317
	Standard error	0.0477	0.0368	0.0245	0.0387	0.0695	0.0218	0.0374
	z-Statistic	1.1512	0.4879	0.1146	2.3206	−0.1028	−1.247	−0.8465
	Probability	0.2497	0.6256	0.9087	0.020**	0.9181	0.2122	0.3973
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0366	0.0521	0.0006	0.0163	−0.040	0.1448	0.7031
	Standard error	0.0245	0.0554	0.0352	0.0356	0.0243	0.1291	0.3062
	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**
SALAMANDER		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0505	0.0142	0.0477	0.0260	0.0429	−0.106	−0.0384
	Standard error	0.0806	0.0520	0.0882	0.0543	0.0316	0.0432	0.0759
	z-Statistic	0.6268	0.2726	0.5410	0.4794	1.3589	−2.459	−0.5058
	Probability	0.5308	0.7852	0.5885	0.6317	0.1742	0.013**	0.6130
		August	**September**	**October**	**November**	**December**	α_1	β_1
	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*
LAMPRELL		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.1146	−0.0120	0.0553	0.0028	0.1006	−0.138	0.0364
	Standard error	0.1298	0.0784	0.1626	0.2177	0.1474	0.0606	0.2057
	z-Statistic	0.8824	−0.1536	0.3401	0.0126	0.6824	−2.288	0.1769
	Probability	0.3776	0.8779	0.7338	0.9899	0.4950	0.022**	0.8596
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0326	0.0330	−0.0074	−0.1346	−0.145	−0.0375	0.5650
	Standard error	0.1073	0.1140	0.0814	0.0626	0.0704	0.0336	0.8210
	z-Statistic	−0.3038	0.2891	−0.0911	−2.1498	−2.061	−1.1190	0.6882
	Probability	0.7613	0.7725	0.9274	0.0316	0.039**	0.2632	0.4913

(*Continued*)

Table 3. (*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
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0896	−0.0710	−0.0152	−0.0173	−0.045	1.8223	0.4171
	Standard error	0.0959	0.0919	0.2581	0.1590	0.0508	0.6477	0.1062
	z-Statistic	−0.9345	−0.7732	−0.0590	−0.1087	−0.893	2.8135	3.9267
	Probability	0.3500	0.4394	0.9530	0.9134	0.3715	0.0049*	0.0001*
CADOGAN		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	−0.1548	0.0593	−0.0501	−0.0351	0.0487	0.0094	0.0253
	Standard error	0.0754	0.0564	0.0296	0.0710	0.1737	0.0790	0.1346
	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	0.7792	0.9056	0.8511
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0617	0.0045	−0.0708	−0.0346	0.0378	−0.0421	1.0149
	Standard error	0.0259	0.1504	0.0191	0.0140	0.0666	0.0236	0.0305
	z-Statistic	2.3805	0.0297	−3.7186	−2.4794	0.5676	−1.7875	33.238
	Probability	0.017**	0.9763	0.0002*	0.013**	0.5703	0.0738	0.0000*
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	0.0687	0.0571	0.0427	0.0415	0.0386	0.0508	0.0072
	z-Statistic	0.9558	0.5330	−0.0400	0.5950	−0.1073	−0.664	1.0497
	Probability	0.3392	0.5940	0.9681	0.5518	0.9146	0.5063	0.2938
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0365	−0.0331	0.0286	−0.0075	−0.050	−0.0984	0.9393
	Standard error	0.0585	0.0527	0.0509	0.0544	0.0884	0.0330	0.1496
	z-Statistic	0.6243	−0.6286	0.5606	−0.1372	−0.572	−2.9838	6.2772
	Probability	0.5325	0.5296	0.5751	0.8909	0.5669	0.0028*	0.0000*
KENTZ		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	0.0206	0.0599	−0.0206	0.0813	0.0356	−0.014	0.0050
	Standard error	0.0477	0.0565	0.0545	0.0540	0.0294	0.0372	0.0359
	z-Statistic	0.4315	1.0602	−0.3777	1.5057	1.2116	−0.381	0.1390
	Probability	0.6661	0.2890	0.7057	0.1321	0.2257	0.7032	0.8895
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0408	0.0572	−0.0095	−0.0437	0.0198	−0.0811	0.6528
	Standard error	0.0502	0.0339	0.0289	0.0256	0.0396	0.0434	0.5402
	z-Statistic	0.8129	1.6846	−0.3266	−1.7107	0.5013	−1.8693	1.2085
	Probability	0.4163	0.0921	0.7439	0.0871	0.6162	0.0616	0.2269
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	0.0805	0.0616	0.1061	0.0305	0.0392	0.0679	0.0613
	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

(*Continued*)

Table 3. (*Continued*)

		August	**September**	**October**	**November**	**December**	α_1	β_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	0.0032*	0.0000*
ENQUEST		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	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	0.8054	1.2023	−0.7768	−3.7927	5.4497	−15.91	−19.461
	Probability	0.4206	0.2293	0.4373	0.0001*	0.0000*	0.0000*	0.0000*
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0528	0.0003	0.0298	0.0350	0.0163	2.6344	0.0041
	Standard error	0.0112	0.0018	0.0019	0.0039	0.0085	0.6869	0.0041
	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		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	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	−3.7992	−2.7740	0.5702	0.0233	0.3569	0.0132	−3.0471
	Probability	0.0001*	0.0055*	0.5685	0.9814	0.7211	0.9894	0.0023*
		August	**September**	**October**	**November**	**December**	α_1	β_1
	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*	0.0001*	0.0048*	0.022**	0.0022*	0.0084*	0.7569
GENEL		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	−0.0407	0.0110	−0.0127	−0.0534	0.0170	0.0257	0.0039
	Standard error	0.0600	0.0471	0.0498	0.0429	0.0404	0.0592	0.0815
	z-Statistic	−0.6795	0.2340	−0.2549	−1.2450	0.4212	0.4342	0.0473
	Probability	0.4968	0.8150	0.7988	0.2131	0.6736	0.6641	0.9623
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	0.0413	−0.0344	0.0114	−0.0190	−0.045	−0.2309	1.1247
	Standard error	0.0374	0.0400	0.0402	0.0525	0.0330	0.1412	0.2198
	z-Statistic	1.1067	−0.8589	0.2838	−0.3621	−1.371	−1.6358	5.1167
	Probability	0.2684	0.3904	0.7766	0.7172	0.1702	0.1019	0.0000*
OPHIR		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	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	0.0991	0.0547
	z-Statistic	0.1468	−0.4389	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
		August	**September**	**October**	**November**	**December**	α_1	β_1
	Coefficient	−0.0015	−0.0064	0.0219	−0.0729	−0.086	−0.1503	0.7220
	Standard error	0.1670	0.0670	0.1045	0.1073	0.0575	0.2047	0.7078
	z-Statistic	−0.0090	−0.0948	0.2096	−0.6794	−1.502	−0.7343	1.0200
	Probability	0.9929	0.9245	0.8340	0.4969	0.1329	0.4628	0.3077

(*Continued*)

Table 3. (*Continued*)

RUSPETRO		**January**	**February**	**March**	**April**	**May**	**June**	**July**
	Coefficient	−0.1070	−0.2810	−0.2630	0.1984	−0.0823	−0.016	−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**	α_1	β_1
	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

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.

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.

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References

Al Ashikh, A. I. (2012). Testing the weak-form of efficient market hypothesis and the day-of-the-week effect in Saudi stock exchange: Linear approach. *International Review of Business Research Papers, 8*, 27–54.
Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics, 31*, 307–327.
Chang, E. C., Pinegar, J. M., & Ravichandran, R. (1993). International evidence on the robustness of the day-of-the-week effect. *Journal of Financial & Quantitative Analysis, 28*, 497–513.
Chien, C., Lee, C., & Wang, A. M. L. (2002). A note on stock market seasonality: The impact of stock price volatility on the application of dummy variable regression model. *The Quarterly Review of Economics and Finance, 42*, 155–162. http://dx.doi.org/10.1016/S1062-9769(00)00081-8
Clare, A. D., Psaradakis, Z., & Thomas, S. H. (1995). An analysis of seasonality in the UK equity market. *The Economic Journal,* 398–409. http://dx.doi.org/10.2307/2235499
Dicle, M., & Levendis, J. (2014). The day-of-the-week effect revisited: International evidence. *Journal of Economics & Finance, 38*, 407–437.
Dubois, M., & Louvet, P. (1996). The day-of-the-week effect: The international evidence. *Journal of Banking & Finance, 20*, 1463–1484.
Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica: Journal of the Econometric Society, 50*, 987–1007.
Fama, E. F. (1965). The behavior of stock-market prices. *The Journal of Business, 38*, 34–105. http://dx.doi.org/10.1086/jb.1965.38.issue-1
Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *Journal of Finance, 25*, 383–417.
Franses, P. H. (1993). A model selection procedure for time series with seasonality. *Statistics & Probability Letters, 16*, 253–258.
Guidi, F. (2010). Day-of-the-week effect and market efficiency in the Italian stock market: An empirical analysis. *IUP Journal of Applied Finance, 16*, 5–32.
Haroon, M. A., & Shah, N. (2013). Investigating day-of-the-week effect in stock returns: Evidence from Karachi stock exchange—Pakistan. *Pakistan Journal of Commerce & Social Sciences, 7*, 381–393.
Haugen, R. A., & Lakonishok, J. (1988). *The incredible January effect: The stock market's unsolved mystery*. Homewood, IL: Dow Jones-Irwin.
Jaffe, J., & Westerfield, R. (1985). The week-end effect in common stock returns: The international evidence. *The Journal of Finance, 40*, 433–454. http://dx.doi.org/10.1111/j.1540-6261.1985.tb04966.x
Mandelbrot, B. (1966). Forecasts of future prices, unbiased markets, and "Martingale" models. *The Journal of Business, 39*, 242–255. http://dx.doi.org/10.1086/jb.1966.39.issue-S1
Mookerjee, R., & Yu, Q. (1999). Seasonality in returns on the Chinese stock markets. *Global Finance Journal, 10*, 93–105. http://dx.doi.org/10.1016/S1044-0283(99)00008-3
Ogieva, O. F., Osamwonyi, I. O., & Idolor, E. J. (2013). Testing calendar effect on Nigerian stock market returns: Methodological approach. *Journal of Financial Management & Analysis, 26*, 39–64.
Qadan, M. (2013). The impact of the day-of-the-week on the VIX fear gauge. *International Journal of Economic Perspectives, 7*, 24–31.
Solnik, B., & Bousquet, L. (1990). Day-of-the-week effect on the Paris bourse. *Journal of Banking & Finance, 14*, 461–468.
Steeley, J. M. (2001). A note on information seasonality and the disappearance of the weekend effect in the UK stock market. *Journal of Banking & Finance, 25*, 1941–1956.
Yadav, P. K., & Pope, P. F. (1992). Intraweek and intraday seasonalities in stock market risk premia: Cash and futures. *Journal of Banking & Finance, 16*, 233–270.