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UK REITs Don't Like Mondays[1]

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Abstract

Purpose: The research examines whether REITs returns on the different days of the week differ from each other.

Design/methodology/approach: It uses EPRA/NAREIT UK Index daily closing values (GBP) and its two sub-indices FTSE EPRA/NAREIT UK REITs and Non-REITs as dependent variables. It employs Kruskal-Wallis (KW) tests and dummy-variable regression to test the hypothesis.

Findings: The overall findings provide evidence that return anomalies exist in the UK REITs.

Practical implications: Thought significant, the absolute returns differences are modest for investors to gain superior returns in UK REITs. However, by recognising the day-of-the-week effect, investors can buy/sell UK REITs more effectively.

Keywords: Anomaly, Calendar, REITs, Returns, UK.

[1] With apologies to Bob Geldof and the *Boomtown Rats*

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UK REITs Don't Like Mondays[3]

Introduction

Market commentators note that certain days-of-the-week perform better than others (see *inter alia*, Wang, 2010, and Cannold, 2013a; 2013b). Such assertions are also confirmed in a number of academic studies (see *inter alia*, Fama, 1965; Godfrey et al., 1964; Cross, 1973; French, 1980). What it suggests is that some predictability exists depending on time periods that occur at different moments throughout the year (Cho et al., 2007). These somewhat irregular patters of abnormal stock returns are known as 'Calendar anomalies' (French, 1980; Gibbons, and Hess, 1981; Ziemba, 2012; Nawaz and Mirza, 2012; Zhang and Jacobsen, 2013).

Calendar anomalies contradict the Efficient Market Hypothesis (EMH) which suggests that financial markets are information efficient (Fama et al., 1969). The principle behind EMH is random walk process. In his empirical study Fama (1970) demonstrated that day-to-day price changes and returns on common stocks follow a random walk with their autocorrelations being close to zero, implying that their future prices cannot be predicted based on past information. As such, prices of traded assets are well known in advance (Maier and Herath, 2009) and therefore investors cannot gain advantage in predicting future direction of these assets using publically available information (Cho et al., 2007). However, there is a body of knowledge suggesting just the opposite (Ding et al, 1993; Cho et al., 2007). Researchers are commenting that although EMH is plausible, there are number of issues related to it (Beechey et al., 2000; Maier and Herath, 2009; Shiller, 2014).

The most documented are the weekend effect (day-of-the-week effect), turn of the month effect, January effect and holiday effect (Olson, 2007). These variations in the performance of various assets has become a subject of extensive research not only in well-established equity markets, but also internationally (Demirer and Karan, 2002; Aly et al., 2004; Holdena et al., 2005; Namini et al., 2013).

However, in the listed real estate market there are only a few studies of the day-of-the-week effect and they generally are focused on listed Real Estate Investment Trusts (REITs) especially in the US (see *inter alia*, Redman et al., 1997; Connors et al., 2002; Hardin et al., 2005; Lee and Ou, 2010). It is important therefore to test whether the results in the US REITs are consistent across the rest of the world. This has promoted a few studies in global REIT markets (see *inter alia*,

[3] With apologies to Bob Geldof and the *Boomtown Rats*

Brounen and Ben-Hamo, 2009; Hepsen, 2009; Khaled and Keef, 2012; Hui et al., 2014; Mattarocci, 2014).

However, there is another form of listed real estate company, Real Estate Operating Companies (REOCs) that are common throughout much of the world, which operate in very different operational environments (see *inter alia*, Delcoure and Dickens, 2004 and Niskanen and Falkenbach, 2012). As such the results of previous REIT studies may not apply to REOCs. Yet as far as the authors are aware, no study has examined the day of the week affect in REOCs and REITs in the same country. This study therefore contributes to the previous literature by examining the day of the week affect in the UK using both REITs and REOCs index data.

The remainder of this paper is structured as follows. Section 2 reviews the previous studies on calendar anomalies in common stocks and REITs in particular. The data are presented in Section 3. Section 4 discusses empirical results. The final section concludes the study.

Previous Studies

Equities markets

It is considered that Bachelier (1900) was the first to recognise calendar related irregularities. In his thesis (cited in Davis and Etheridge, 2006), Bachelier (ibid.) examined whether the process generating stock returns operates continuously or only during active trading, i.e. Monday to Friday. According to French (1980), Bachelier's hypothesis suggested that if stocks are traded Monday to Friday and returns are generated continuously in calendar time, then returns will be different for each calendar day. Conversely, if stock returns are generated only in trading time, the distribution of returns will be equal for each calendar day. This idea of variance in stock returns attracted attention of some of the most notable researchers, including Fama (1965), Clark (1973), Brown and Warner (1985), French and Roll (1986), Gallant et al. (1992), and Thaler (2012), who investigated the behaviour of stock-market prices.

The so called 'Day-of-the-week effect', which is the basis of the calendar time hypothesis, contradicts the traditional assumption that returns on financial assets are identical across all days of the week, i.e. trading time hypothesis. The calendar time hypothesis suggests that the information flows continuously. It is therefore expected that returns on Monday are three times the expected returns any other weekday (French, 1980). According to study by Gibbons and Hess (1981), where authors assesses returns on S&P500, CRSP Value-weighted and CRSP Equal-weighted indices, the distribution of returns on various asset classes varied according day of the week they correspond with Monday being the most notable. The commentators observed that Monday's returns are a reflection of information

which comes to the market over three rather than one day. Therefore, variance is greater on Monday compared to other days of the week. These findings subsequently allowed researchers to conclude that 'the expected returns on common stocks and treasury bills are not constant across days of the week' (ibid., p.579). These conclusions were in line with Godfrey et al. (1964), Fama (1965) and Cross (1973) whose estimates suggested greater returns variance on Mondays. French's (1980) estimates for S&P composite portfolio of 500 largest companies suggested negative returns for Mondays.

Cho et al. (2007) provided with four explanations related to differences in expected returns across days of the week. According to the commentators, hypothesis one relates to data-snooping. Cho et al. (ibid.) commented on studies by Sullivan et al. (1998) and Hansen et al. (2005) that criticised the existence of calendar effect. Their statistical procedures, which controlled for calendar effects, suggested less pronounced calendar abnormalities. A more recent study by Zhang and Jacobsen (2013) also commented on issues of sample size and noise in the data.

The second explanation relates to market microstructure. According to Cho et al. (2007), market settlements, dividends and taxes create discrepancies in performance. The commentators pointed to French's (1980) calendar time hypothesis (see above). Pettengill (1993; 2003) however debated this cause of the variance in the market, noting (Pettengill, 2003) that there was a shift in the Monday effect in asset returns from negative to positive.

The third explanation has connections to how micro and macro information flows during the week. According to Steeley (2001) and Cho et al. (2007), bad news are normally delayed until the end of the week, with market-wide news coming in between Tuesday and Thursday into the UK stock market. Again, Pettengill (2003) noted limitations with this explanation.

The fourth group of explanations comes from the way market participants execute their trades. According to Cho et al. (2007) and Olson (2007), individual investors normally sell on Mondays while those, who go-short, sell on Friday. This hypothesis comes from Miller (1988) and Pettengill (1993) whose findings suggested that individuals take riskier bets on Fridays than on Mondays.

As such, day-of-the-week related variations in the performance of various assets have become a subject of extensive research. The existence of calendar abnormalities was debated not only in well-established equity markets, but also internationally, including Turkey (Demirer and Karan, 2002), Portugal (Balbina and Martins, 2002), Egypt (Aly et al., 2004), Thailand (Holdena et al., 2005), Iran (Namini et al., 2013) and Ukraine (Caporale et al., 2013). Researchers employed different data-sets and analytical techniques to perform their analyses.

Interestingly, this plethora of research on calendar anomalies has led to diverging findings. Empirical studies which suggest existence of calendar anomalies, including Lakonishok and Smidt (1988), Apolinario et al. (2006), Cho et al. (2007), and Narayan et al. (2014) were contradicted with the findings from Kamara (1997), Steeley (2001), Olson et al (2007) and Zhang and Jacobsen (2013), who commented on the disappearance or reversal of stock market anomalies.

US REITs

What's regarding REITs, there were fewer studies of the existence of the day-of-the-week effect compared to equity markets with the majority of the existing REITs studies concentrated around the US market. For instance, Redman et al. (1997) examined four calendar anomalies, including January effect, the turn-of-the-month effect, the day-of-the-week effect, and the pre-holiday effect, in US REITs. The authors employed dummy variable regression methodology. In case of day-of-the-week effect, their estimates suggested that REITs returns for Wednesday, Thursday and Friday were higher than the returns on Monday.

Connors et al. (2002) assessed Friday effect in US REITs market. Connors et al. (ibid.) employed dummy variable regression to control for each day of the week. The results of this study were in line with the existing literature. According to the commentators, Monday underperformed the rest of the week.

Hardin et al. (2005) employed regressions with dummy variables proposed in Redman et al. (1997) to test for the calendar anomalies in US REITs. In case of REIT value-weighted index, researchers estimated that returns on Monday, measured by the constant, were positive but not statistically significant. This was in contradiction to existing literature which suggested negative returns for Monday. The average returns on Friday were around 0.1 percent greater than on Monday (significant at 1 percent level). Although, insignificance of F-value indicated that daily returns could not be statistically differentiated across the week. Similar estimates were obtained for REIT equal-weighted index with Monday being positive but insignificant and Friday generating around 0.14 percent greater returns than Monday. However, significance of F-value suggested presence of the day-of-the-week effect in the latter series.

In a more recent study, Lee and Ou (2010) examined the day-of-the-week effect on the prices of Mortgage Real Estate Investment Trusts (MREITs) in the US. The result of this study suggested that returns on each day of the week were not equal to 0 and were uneven. The estimates suggested that returns for Wednesday were negative, while Tuesday and Friday exhibited positive performance.

International REITs

Brounen and Ben-Hamo (2009) analysed the price dynamics of international property shares for the ten most prominent markets from around the world plus South-Africa. The authors estimated that Friday returns tend to be the highest of the week, while Mondays are weakest. The researchers also found that these patterns were most prominent during the 1980s and early 1990s. The day-of-the-week effect appeared to be most pronounced among small and young firms that have little or no institutional investors. Large and long-established listed real estate firms with a large portion of loyal block-holders experienced no significant price patterns during the trading week.

Khaled and Keef's (2012) paper examined the magnitude of calendar anomalies in international REITs. The anomalies under the consideration were the prior day effect, the Monday effect, the turn-of-the-month effect and the January effect. The results were based on 14 countries. The corresponding stock index was used as the reference by which to gauge the anomalous behaviour of each REIT. The presence of the four calendar anomalies was apparent in the REITs and the stock indices. There was not sufficient evidence to show that the magnitudes of the Monday, the turn-of-the-month and the January anomalies differ between REITs and stock indices.

Hui et al. (2014) examined 27 international real estate securities indices from twenty countries and regions for calendar effects. Two methodologies were employed. The first was the standard approach which detects statistically significant anomalies via linear regression of returns. The second, new to the real estate securities literature, was tests for economically significant effects. It encompassed two tests specifically designed to compare multiple forecasts to a benchmark, including White's Reality Check test (White, 2000) and Hansen's Superior Predictive Ability test (Hansen, 2005). The standard approach told that while some effects have disappeared over time, statistically significant calendar anomalies persist. However, the tests of White and Hansen suggested that they are not economically significant and thus should not be the basis of an investor's trading strategy nor be considered as a challenge to market efficiency, as has been claimed previously.

Mattarocci (2014) analysed calendar anomalies in the European REIT industry. The author commented on the issue of market (in)efficiency. He suggested that, in case of real estate markets (which is considered as being a market with low trading volume), not all information is reflected in asset prices. This inefficiency therefore creates opportunities for investment strategies. As such, the commentator examined the role of weekly, monthly and yearly calendar anomalies in European REITs markets.

To test his hypotheses, Mattarocci (ibid.) employed daily REIT rate of return for Belgium, France, Germany, Italy, the Netherlands, Turkey and the UK. The sample period covered 2003 – 2012 period. The existence of calendar anomalies was tested through a buy and hold strategy, i.e. overall time period was divided into profitable and non-profitable periods identified by the anomaly. As the results suggested, day-to-day performance of REITs was in line with the weekend effect theory. Friday generated the highest average performance and Monday – the lowest.

Data

Although REIT structures vary across the world, they generally allow for the company to avoid paying income tax in exchange for distributing most, if not all, of its income to shareholders through dividend payments and have restrictions on their trading and development activities. In contrast, REOCs, like any other company, are subject to income tax but are unrestricted in their ability to trade and develop assets (Graff, 2001; Benz, 2012; Brounen, and de Koning, 2012).

Due to the taxable status non-REITs aim to lower their tax bill by using the tax shield benefits of high levels of debt. As REITs pay no income tax, the deductibility of interest costs is lost, effectively diminishing the benefits of leverage. Consequently, REITs tend to have much lower leverage than their taxable counterparts. Again due to their taxable status non-REITs aim to offer investors greater returns through capital appreciation by increasing the value of their portfolio rather than paying dividends. As a consequence, the dividend yields for non-REITs are generally lower than REITs; as they are more inclined to retain cash flow for development and debt service. In other words, REITs and REOCs operate in very different operational environments. REITs have the benefits of tax efficiency, whereas REOCs have more operational freedom and flexibility (see Delcoure and Dickens (2004) and Niskanen and Falkenbach (2012) for more details).

The current study uses EPRA/NAREIT UK Index daily closing values (GBP) and its two sub-indices FTSE EPRA/NAREIT UK REITs and Non-REITs Indices. The UK REITS index is a constituent part of FTSE/EPRA Global Real Estate Index Series which represent general trends in eligible real estate equities worldwide (FTSE, 2014). It is a collaborative product between EPRA (European Public Real Estate Association) (Belgium), FTSE (UK) and NAREIT (National Association of Real Estate Investment Trusts) (US). This index, as any other EPRA/NAREIT indices, is designed to track the performance of listed real estate companies and REITs in the country. Both REITs and Non-REITs indices give investors the capability to view each constituent's classification within the EPRA/NAREIT universe according to REIT legislation. They also allow for a

more granular assessment of the performance characteristics of UK REITs (EPRA, 2014).

The EPRA/NAREIT UK Index data is available starting at 29 December 1989 in various currencies including GBP, USD, EUR, JPY and AUD. As of April 2014, the FTSE EPRA/NAREIT UK Index contained 30 companies with 42,586 GBPm net market capitalisation in total.

Both FTSE EPRA/NAREIT UK REITs and Non-REITs Indices are available from 02 January 2007 as the UK REIT market only started on 1st January 2007 when eight REOCs (property companies) converted to REITs (Baum and Devaney, 2008). They comprise 15 companies each. The total market capitalisation of REITs based index is £35,706m and it is £7,886m of Non-REITs index. The largest constituents of REITs index are Land Securities Group, British Land Co, Hammerson, Segro and Intu Properties with a combined market capitalisation of £24,422m, making up 57% of all index value. The five biggest companies within the Non-REITs index are Capital & Counties Properties, Grainger, Unite Group, St. Modwen Properties PLC and F&C Commercial Property Trust with a combined market capitalisation of £5,133m, making 65% percent of the whole index. In other words, the companies that have chosen to become REITs in the UK are considerable larger than their non-REIT counterparts. This implies that UK-REITs are probably more transparent and to be traded more frequently than non-REITs, i.e. non-REITs shares are not traded in every consecutive interval that can induce autocorrelation in observed price changes even though price innovations are serially independent, which can have serious implications for testing herding behaviour (McAllister et al., 2008; Hott, 2012; Matysiak et al., 2012; Shiller, 2013).

Figure 1 presents EPRA/NAREIT UK all three index daily change series over 01 January 1990 - 27 May 2014 period. Table 1 summarises the key statistical properties of these series.

- Figure 1 -

- Table 1 -

Figure 2 presents sample size distribution for EPRA/NAREIT UK index by the day of the week and expected returns. As it is seen, the sample is well redistributed across the week with a minor difference of 4 days (0.11 percent) between Monday/Friday and Wednesday.

However, when it comes to daily returns, the visual analysis suggests that Monday generates negative numbers with Wednesday being the most positive, following Tuesday, Friday and Thursday. An average return for Monday is -0.028 percent, for Tuesday and Wednesday – 0.014 percent, Thursday – 0.003 percent, and Friday – 0.005 percent.

- Figure 2 -

Methodology

To study the potential calendar effects on daily returns, this research project considers the full sample and also pre- and post-2007 periods. This particular separation allows testing index performance pre and post UK REITs regime (Baum and Devaney, 2008).

The study employs a multi strand approach to examine day-of-the-week effect in more detail what allows assessing the daily return seasonality with relatively large sample sizes, while still being able to detect any trends and persistent patterns over time. Both parametric and non-parametric tests are employed. The latter is Kruskal-Wallis (KW) tests (Redman et al, 1997). The KW test is a commonly used algorithm to examine more than two independent samples (Sheskin, 2003).

The null hypothesis is that all of the days-of the week have the same returns. The alternative hypothesis is that at least one day has a different distribution. The null and alternative hypotheses are defined as follows:

$$H_0: \pi_1 = \pi_2 = \pi_3 = \pi_4 = \pi_5$$
$$H_1: Not\ all\ \pi_i \text{ are equal}$$

Where π_i is the return for the *i*th day of the week.

The mechanics behind Kruskal-Wallis test (Kruskal and Wallis, 1952) is a one-way analysis of variance by ranks. The test is an extension of Mann-Whitney *U* test involving more than two independent samples. To proceed with this test it is important that data is transformed into rank-order as it is the only format in which scores are available (Sheskin, 2003). Once data points are ranked, the following equation is estimated:

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{R_j^2}{n_j} - 3(n+1) \quad (1)$$

Where *k* is the number of groups, n_j is the size of the *j*th group, R_j is the rank sum for the *j*th group and *N* is the total sample size. The final estimates are then compared against critical value:

$$H \sim \chi^2(k-1) \tag{2}$$

In terms of parametric test, the joint significance of parameters D_2 to D_5 from the following regression equation is examined:

$$R_t = \alpha_1 + \alpha_2 D_{2,t} + \alpha_3 D_{3,t} + \alpha_4 D_{4,t} + \alpha_5 D_{5,t} + \varepsilon_t \tag{3}$$

Where R_t is the daily continuously compounded index returns, D_2 to D_5 denote dummy variables for Tuesday to Friday. The constant parameter α_1 is the average return for Monday, and the coefficient estimates α_2 to α_5 represent the differences between Monday returns and the returns in other days and ε_t is the error term. If returns for each day of the year are the same, the parameters α_2 to α_5 should be jointly insignificant.

Before regression is performed, all series are tested for stationarity. The estimates for a unit-root are presented in Table 2 below.

- Table 2 -

Results

Table 3 below reports the mean returns, standard deviations and KW estimates for each sample period. The overall KW values do not reject the hypothesis. As tempting as it could look from the Returns (%) column in Table 2, as well as Figure 4 below, there is just not enough evidence to confirm the claim that certain days of the week generate greater/poorer returns. The visual analysis does indicate that returns on Tuesday and Wednesday for all three indices are greater than returns during the rest of the week-days with Monday being the least profitable. However, the KW test estimates disprove existence of the day-of-the-week in UK REITs.

- Table 3 -

Table 4 contains coefficient estimates and P-values based on Newey-West (1987) standard errors for each day of the week. The use of Newey-West procedure allows correcting for the standard errors as well as obtaining a more accurate statistical inference. As above, the study considers the full sample results and pre- and post-2007 sub-periods.

- Figure 3 -

The intercept for EPRA/NAREIT UK Index for Monday shows the average daily returns that are estimated through the sample periods. For the Total and Post 2007 periods, the returns were both negative. The Total period Monday returns were -0.028%. For the Post 2007 period returns were -0.097%. The Post 2007 returns are significant, suggesting that in the majority of time returns on Mondays were below 0, as well as that daily returns varied through the week. This therefore implies that returns on Tuesday and Wednesday are greater than returns on Monday. Thursday and Friday were both positive but insignificant.

Similar estimates are obtained for EPRA/NAREIT UK REITs Index. As is seen from the table below, Monday generated -0.112 returns, while Tuesday and Wednesday returns were 0.154 and 0.128 respectively with coefficients being statistically significant.

- Table 4 -

However, it is not the case for non-REITs series. Neither of the coefficients were significant for the EPRA/NAREIT UK Index Pre-2007 (or pre-REITs) period and EPRA/NAREIT UK Non-REITs Index. Although average Monday returns for EPRA/NAREIT UK Non-REITs Index were in line with other estimates, insignificance of the coefficients did not reject research hypothesis. The suggestion is that non-REITs series may not necessarily experience day-of-the-week calendar anomaly.

On the over hand, regression estimates provide evidence of a day-of-the-week effect in UK REITs. The significance of the coefficients for certain days of the week allows hypothesising that the UK REITS returns are generally higher in the middle of the week and are negative on Monday.

These findings agree with the traditional day-of-the-week hypothesis, which suggests negative returns for Monday. The estimates are also in line with prior studies on the subject, although to some extent contradicts to Connors et al. (2002), Harding et al. (2005) and Hui et al. (2014) empirics. According to Connors' et al. (2002) estimates, Friday produced the highest returns during the week with Monday being positive and not much different from returns on Tuesday and Wednesday. Harding et al. (2005) also estimated positive (although insignificant) average returns on Monday, implying that there was little support for the accepted perception that REITs returns on Monday are lower than those during the rest of the week. Hui et al. (2014), as noted above, rejected calendar effects.

What is also apparent from the regression estimates is that they differ for REITs and non-REITs series. As noted above, REITs showed evidence of day-of-the-

week effect. Here, Monday returns were negative and significant while Tuesday and Wednesday returns were positive and significant. This was however not the case for Non-REITs series, i.e. EPRA/NAREIT UK Non-REITs index and EPRA/NAREIT UK pre-2007 index values. The insignificant regression estimates imply that there is no statistical difference between returns for each day of the week in REOCs (non-REITs) series.

These estimates are in line with Leone's (2011) findings. According to Leone (ibid.), UK property companies which adopted REITs regime acquired similar performance attributes to equities and commercial property backed assets. This therefore explains why estimates for the UK REITs correspond to day-of-the-week hypothesis. Although it is important to bear in mind the opposite findings presented by Hoesli and Oikarinen (2012, p.2), whose study suggested that a 'long-run REIT market performance is much more closely related to the direct real estate market than to the general stock market'.

Impact of outliers on results

Calendar anomalies attract the attention of practitioners and academics because they open up the possibility of predicting, at least in part, the dynamics of security prices and so allow investors to potentially develop trading strategies that achieve abnormal returns. But if it can be shown that any significant calendar anomaly results are driven by only a few outliers this would imply that any trading strategy would not be economically viable. For instance, Maberly and Pierce (2004) show that if only two outliers (October 1987 and August 1998) were accounted for the so-called Halloween effect identified by Bouman and Jacobsen (2002) proved to be insignificant. Significance of outliers in the data also connotes with Taleb's (2008) 'Black Swan' theory. According to Taleb, financial markets are prone to an impact of the highly improbable events. His estimates suggested that by removing the ten biggest one-day corrections from the S&P 500 index values over the fifty-year period, the returns doubled compared to an original series. This therefore suggests that it is important to test the day of the week effect identified for UK REITs after removing the effect of outliers.

In order to control for outliers, Equation 3 is modified by inserting set of dummies. Dummy one is for minimum value for Monday. Dummy two and three are maximum values for Tuesday and Wednesday. Dummy four is holiday dummy. The latter dummy controls for holidays which occur on Mondays during the sample period. These days include traditional holidays such as Easter Monday, Early May Bank Holiday (first Monday of May), Spring Bank Holiday (last Monday of May), and Summer Bank Holiday (last Monday of August). Occasional holiday days which appear on Mondays are also controlled for. These are Christmas Bank Holiday (1992; 1993; 1998; 1999; 2004; 2009; 2010), Boxing Day (1994; 2005; 2011), Christmas Day (1995; 2000; 2006), Golden Jubilee Bank

Holiday (2002), New Year's Day (1996; 2001) and New Year's Day Holiday (1990; 1994; 1995; 2000; 2005; 2006; 2011; 2012):

$$R_t = \alpha_1 + \alpha_2 D_{2,t} + \alpha_3 D_{3,t} + \alpha_4 D_{4,t} + \alpha_5 D_{5,t} + \alpha_6 D_{out,t} + \alpha_6 D_{hol,t} + \varepsilon_t \quad (4)$$

In addition to that, both REIT series residuals are tested for serial correlation. Although visual analysis and testing for stationarity suggests that all three series are covariance-stationarity, it is however possible that residuals from the regression are correlated with their own lagged values. This is a common occurrence in time-series as all observations are ordered over time, which is why neighbouring error terms can be correlated. If residuals are correlated, then standard assumptions of regression theory become invalid. This may lead to a number of inaccuracies. Estimated standard errors and t-statistics values become invalid. Coefficient may also be biased. It is therefore recommended to perform an additional statistical inference to correct for serial correlation if it is present (IHS, 2013).

In the current case a general Breusch (1978) - Godfrey (1978) test for serial correlation in the residuals is computed (Hatemi-J, 2004). The null hypothesis is that there is no serial correlation in the residuals (HIS, ibid.). Breusch-Godfrey test results are presented in Table 5 below. As it is evident, residuals are serially correlated in series EPRA/NAREIT UK and EPRA/NAREIT UK Non-REITs, which is likely to be due to the thin trading in the non-REIT data.

- Table 5 -

To correct for serial correlation and validate the estimates, an AR(1) term is introduced into the equation.

$$R_t = \alpha_1 + \alpha_2 D_{2,t} + \alpha_3 D_{3,t} + \alpha_4 D_{4,t} + \alpha_5 D_{5,t} + \alpha_6 D_{out,t} + \alpha_6 D_{hol,t} + R_{t-1} + \varepsilon_t \quad (5)$$

An updated Breusch-Godfrey test results are presented in Table 6 below.

- Table 6 -

Once series passed statistical muster, equation 5 is re-estimated. Table 7 presents updated results.

- Table 7 -

As it is seen, controlling for outliers provided with a dual outcome. On one hand, it removed the day-of-the-week effect from the broad EPRA/NAREIT UK (%) series. Contrary to expectations, there is no statistically significant difference between returns for each day of the week. Estimates for EPRA/NAREIT UK Non-REITs (%) series remained the same - with no evidence of the day-of-the-week effect.

On the other hand, strong evidences of the day-of-the-week effect were found for REITs specific series. The empirical estimates suggest negative returns for Monday and positive returns for Tuesday and Friday for EPRA/NAREIT UK REITs (%) series. The appearance of Friday as a positive and significant day is in line with the previous studies on the subject, including Redman et al. (1997), Connors et al. (2002) and Lee and Ou (2010). The slightest difference is that Friday is not the most positive day of the week in UK REITs series. Tuesday generates highest returns throughout the week in the current case. The results are also in accord with the arguments of Leone (2011) who suggests that UK property companies, which adopted REITs status, were the largest and most traded property companies and so acquired similar performance attributes to other stocks. This therefore may explain why UK REIT data also correspond to the day-of-the-week hypothesis found in the market as a whole.

Thought significant, the absolute returns differences are modest for investors to gain superior returns in UK REITs. As it is seen from the Figure 4 below, the maximum investor can gain is 0.154 by buying EPRA/NAREIT UK REITs on Monday (which on average is -0.112) and selling on Tuesday (which on average is +0.042). This is however not enough even to cover stamp duty of 0.5% on the transaction (Gov.UK, 2014) and likely to make one's stockbroker rich only (Cox, 2006) or even jeopardise one's wealth (Barber and Odean, 2000).

- Figure 4 –

Nevertheless, by recognising the day-of-the-week effect, individual investors as well as professional money managers can use these findings to buy/sell UK REITs more effectively. Portfolio managers are subject to frequent, periodic evaluations which shorten their investment horizon. Individual investors have their liquidity needs (Lee at al., 1991). What is more, investing is a risky and uncertain business. It is afflicted with systemic and idiosyncratic risks (Graham and Dodd, 1940; Mallaby, 2011). In addition to that, markets are noisy (Black, 1986) with irrational

noise traders swaying asset prices and returns achieved by rational participants (De Lond, et.al., 1990). As such, and in periods when little information enters the market, informed investors are advised to buy UK REITs on Mondays when index returns are lowest and sell their holdings on Tuesdays or Fridays when index returns are greatest, *ceteris paribus*. The difference in returns this strategy generates is certainly limited. However, considering the difficulty in appreciating market moves (Fama, 1965a; 1965b; 1970) and an impact noise traders may have on asset price dynamics (De Lond, et.al., ibid.), even the marginal spread the proposed strategy may generate can be helpful or as the popular saying goes 'every little helps'[4].

Conclusion

The presence of calendar anomalies has been documented in financial markets. The acknowledgement that return anomalies exist in the trading of various assets contradicts the Efficient Market Hypothesis. As such, these variations in the performance of various assets have become a subject of extensive research programme internationally. However, there were few studies examining calendar effects for REITs with the majority of them investigating the US market. This research study was therefore set to tests variations in the performance of UK REITs series.

The study examined so called day-of-the-week effect. The suggestion is that returns on financial assets are not identical across days of the week. To assess this hypothesis this current study employed parametric and non-parametric tests. The former is Kruskal-Wallis (KW) tests, which is a commonly used algorithm to examine more than two independent samples. The latter is dummy-variable regression with Newey-West standard errors adjustment. A set of dummies was also introduced into equation to control for the outliers in the series. What is more, residuals were tested for correlation to test whether the thin trading in the non-REIT series had an impact on the regression results.

The study selected EPRA/NAREIT UK Index daily closing values (GBP) and its two sub-indices FTSE EPRA/NAREIT UK REITs and Non-REITs Indices. It is generally accepted that EPRA/NAREIT indices best represent the performance of UK listed real estate companies and REITs.

As the results of the study suggested, the overall KW values have not rejected the hypothesis. Although visual analysis indicated difference between returns for each day of the week for each index series. The KW estimates disproved the claim that certain days of the week generate greater/poorer returns.

[4] With thanks to Tesco

The regression estimates however were different. The study provided evidence of a day-of-the-week effect in UK REITs. The coefficients were significant for Monday, Tuesday and Wednesday suggesting that the UK REITS returns are greater in the middle of the week and are negative on Monday. Modified estimates also supported these findings. In addition to that, UK REITs series developed Friday effect, what was in line with previous studies on the subject. Although day-of-the-week effect was not evident in non-REITs series, the results of this research support the idea that return anomalies exist in the UK REITs. Taken together, it can be suggested that inefficiencies are present in the UK REITs market. An implication of this study is the possibility for investors to trade more effectively. In other words, investors should buy UK REITs on Monday and sell their REITs holdings on Tuesday or Friday, *ceteris paribus*.

There is also a considerable scope for further research addressing the following questions. First, the current study looked into an overall index performance - future research could test whether day-of-the week effect exists among individual UK REIT companies. In addition to that, an inquiry into day-of-the-week anomaly among individual REIT companies and their size would be worthwhile investigating (as per Brounen and Ben-Hamo, 2009). Second, it would be interesting to explore UK REITs / non-REITS market efficiency. Given their liquid nature, and under the EMH hypothesis, REITs' prices should reflect all available information and hence be unpredictable. However, the current study has shown just the opposite. As such, a greater appreciation of the form and the variant of the EMH UK REITs fall into would provide further guidance regarding their performance.

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Table 1. EPRA/NAREIT Indices summary statistics

Summary statistics	Average	St.Dev.	Range	Min.	Max.	N
EPRA/NAREIT UK	1293	497	2779	459	3237	6356
EPRA/NAREIT UK (%)	0.002	0.54	8.42	-4.36	4.06	6355
EPRA/NAREIT UK REITs	457	167	819	186	1005	1926
EPRA/NAREIT UK REITs (%)	-0.01	0.81	8.84	-4.64	4.20	1925
EPRA/NAREIT UK Non-REITs	396	205	886	139	1026	1926
EPRA/NAREIT UK Non-REITs (%)	-0.02	0.69	8.91	-5.02	3.89	1925

Table 2. Unit-root test results for the dependent and explanatory variables

Series	Test results for REITS series			
	ADF	DF-GLS[1]	PP	ERS[2]
EPRA/NAREIT UK	-76.368	-76.102	-76.455	-0.010
EPRA/NAREIT UK REITs	-42.734	-41.904	-42.768	0.002
EPRA/NAREIT UK Non-REITs	-42.875	-28.125	-42.964	-0.027

Note: The test critical values (significance is at 1, 5 and 10 percent level respectively) are as follows:
1) Augmented Dickey-Fuller (ADF) test: -3.431; -2.862; -2.567.
2) Dickey-Fuller GLS (ERS) test: -2.565; -1.941; -1.617.
3) Phillips-Peron (PP) test: -3.431; -2.862; -2.567.
4) Elliott-Rothenberg-Stock (ERS) test: 1.990; 3.260; 4.480.
[1]MacKinnon (1991, p.275)
[2] Elliott-Rothenberg-Stock (1996, p.825)

Table 3. Kruskal-Wallis test results

Period	Start	End	Trading days	Returns (%)	Std. Dev.	KW
EPRA/NAREIT UK						
Total	01/01/1990	27/05/2014	6355	0.002	0.487	0.575
Pre 2007	01/01/1990	29/12/2006	4429	0.009	0.403	0.998
2007 onwards	02/01/2007	27/05/2014	1926	-0.015	0.764	0.151
EPRA/NAREIT UK REITs						
2007 onwards	03/01/2007	27/05/2014	1925	-0.015	0.813	0.084
EPRA/NAREIT UK Non-REITs						
2007 onwards	03/01/2007	27/05/2014	1925	-0.017	0.693	0.447

*significant at 5% level

Table 4. Regression estimates for each day of the week for various sample periods

Regression estimates			EPRA/NAREIT UK	EPRA/NAREIT UK REITs	EPRA/NAREIT UK Non-REITs
	Total	Pre 2007	2007 onwards	2007 onwards	2007 onwards
Monday	-0.028	0.003	-0.097	-0.112	-0.052
	(0.057)	(0.841)	(0.010*)	(0.005*)	(0.141)
Tuesday	0.042	0.004	0.128	0.154	0.061
	(0.047*)	(0.810)	(0.023*)	(0.011*)	(0.238)
Wednesday	0.042	0.011	0.113	0.128	0.037
	(0.050*)	(0.561)	(0.040*)	(0.030*)	(0.436)
Thursday	0.031	0.012	0.074	0.089	0.031
	(0.156)	(0.539)	(0.179)	(0.137)	(0.517)
Friday	0.033	0.005	0.096	0.115	0.047
	(0.111)	(0.805)	(0.061)	(0.033)	(0.374)

NB: Probability is in parentheses
* significant at 5% level

Table 5. Breusch-Godfrey serial correlation LT test results

Series	F-stats	Obs.R-sq.	Prob.F	Prob.Chi-sq.(1)
EPRA/NAREIT UK	7.188	14.368	0.001*	0.001*
EPRA/NAREIT UK REITs	0.936	1.881	0.392	0.390
EPRA/NAREIT UK Non-REITs	4.508	9.025	0.011*	0.011*

Table 6. Breusch-Godfrey serial correlation LT test results corrected for AR(1)

Series	F-stats	Obs.R-sq.	Prob.F	Prob.Chi-sq.(1)
EPRA/NAREIT UK	0.069	0.070	0.792	0.792
EPRA/NAREIT UK Non-REITs	0.306	0.308	0.580	0.579

Table 7. Updated regression estimates for each day of the week

Regression estimates	Series		
	EPRA/NAREIT UK	EPRA/NAREIT UK REITs	EPRA/NAREIT UK Non-REITs
Monday	-0.028	-0.105	-0.047
	(0.068)	(0.011*)	(0.179)
Tuesday	0.039	0.139	0.046
	(0.070)	(0.021*)	(0.361)
Wednesday	0.040	0.116	0.026
	(0.070)	(0.054)	(0.582)
Thursday	0.031	0.084	0.026
	(0.165)	(0.166)	(0.583)
Friday	0.031	0.111	0.035
	(0.130)	(0.043*)	(0.504)
(D)Mon.	-2.200	-2.039	-2.759
	(0.000*)	(0.000*)	(0.000*)
(D)Tues.	3.064	3.025	2.916
	(0.000*)	(0.000*)	(0.000*)
(D)Wed.	1.943	1.936	2.060
	(0.000*)	(0.000*)	(0.000*)
D(M.hol)	0.030	-0.050	0.015
	(0.448)	(0.673*)	(0.849)
AR(1)	0.045		0.028
	(0.052)		(0.473)

NB: Probability is in parentheses
* significant at 5% level

Figure 1. EPRA/NAREIT UK Index daily returns (%, log scale)

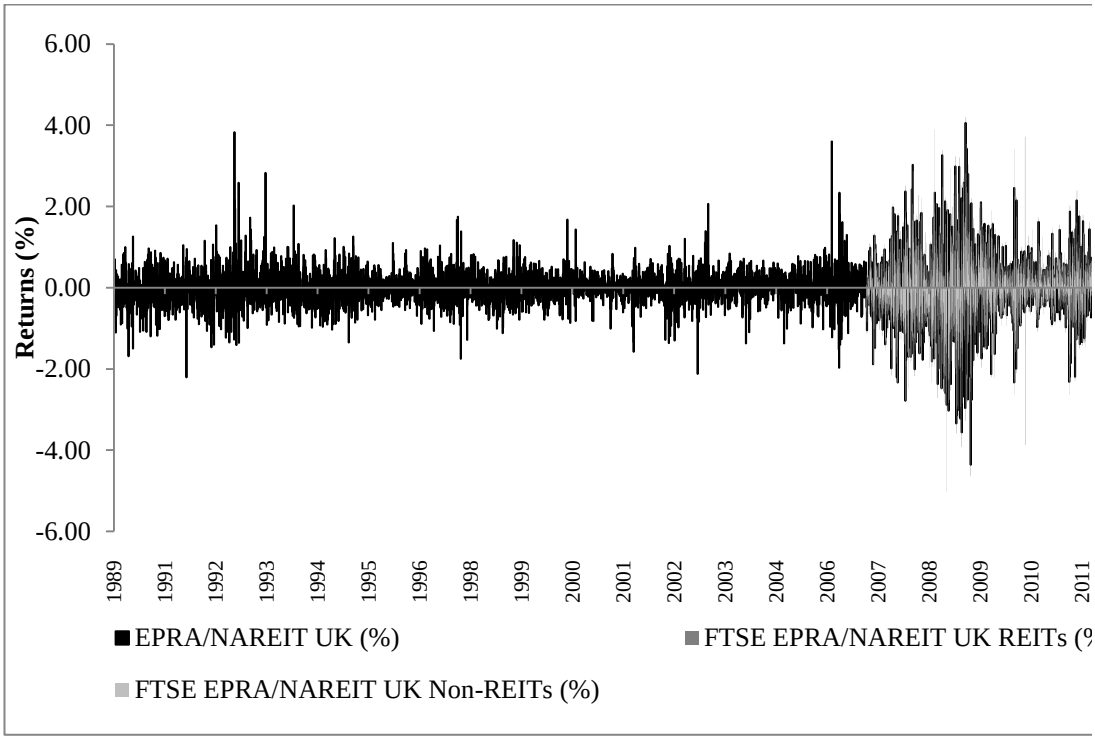

Figure 2. EPRA/NAREIT UK Index daily returns (%)

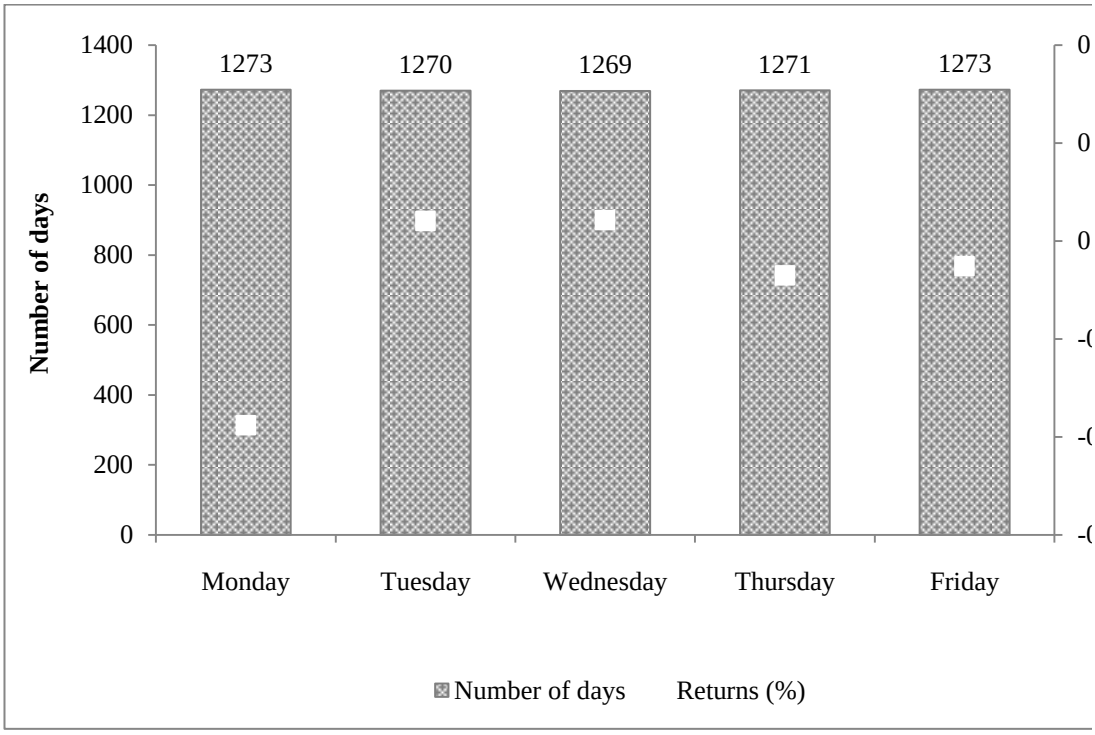

Figure 3. EPRA/NAREIT UK Indices returns through the week-days

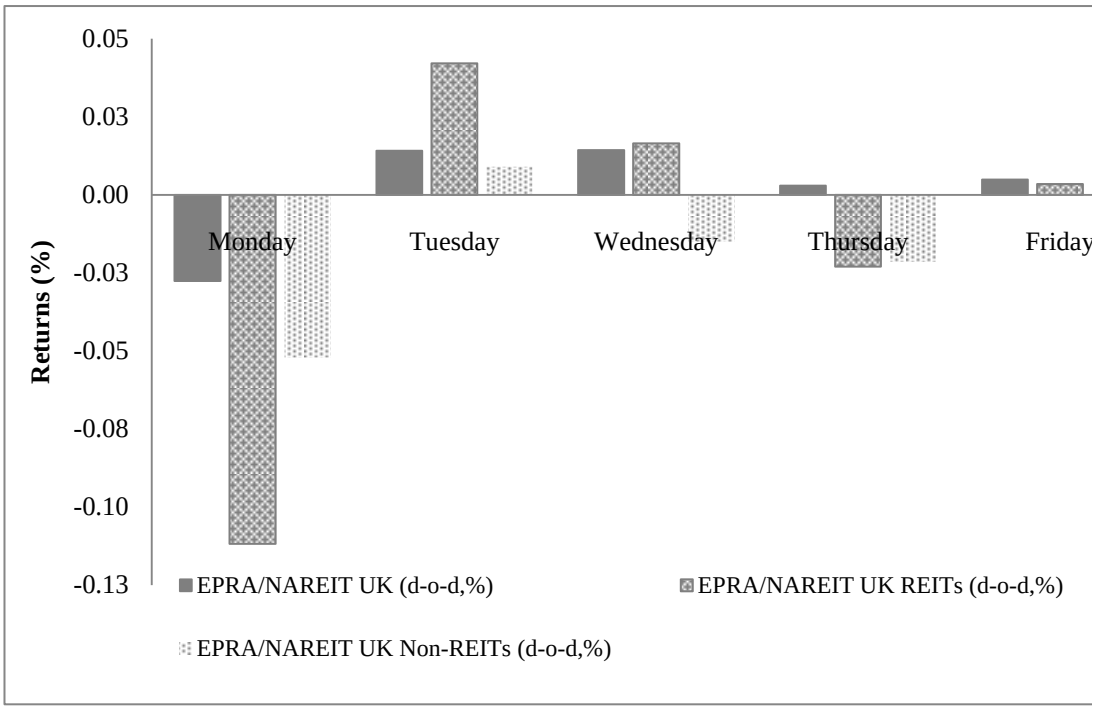
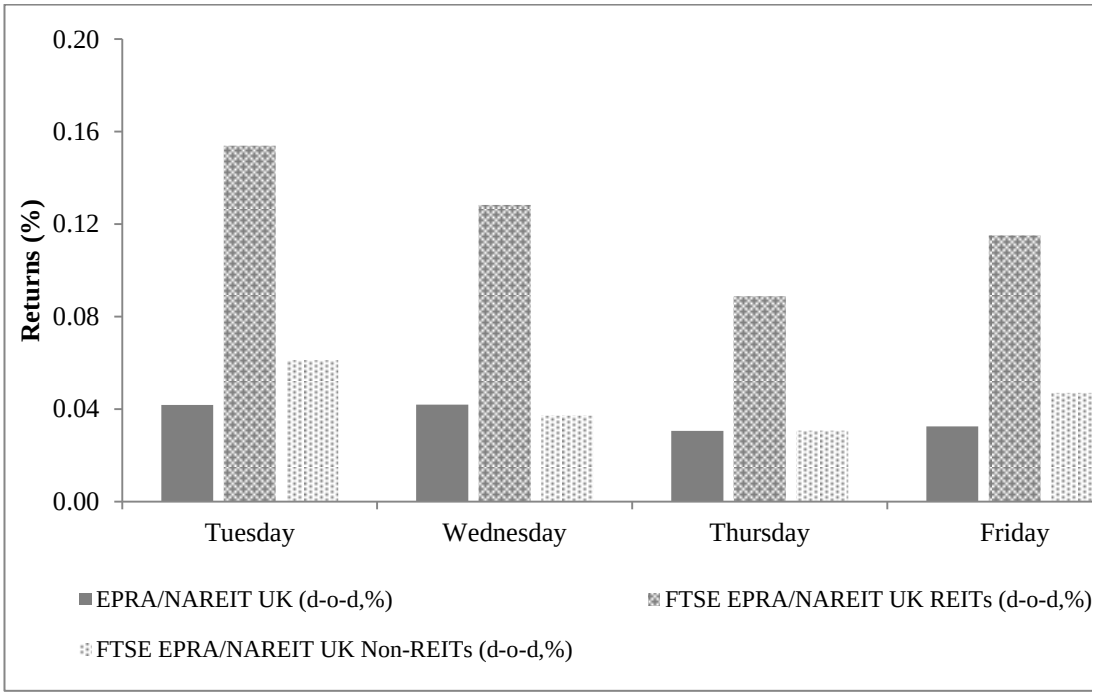
Figure 4. EPRA/NAREIT UK series absolute returns compared to Monday