The Quarterly Review of Economics and Finance 67 (2018) 273–281

Contents lists available at ScienceDirect

The Quarterly Review of Economics and Finance

journal homepage: www.elsevier.com/locate/qref

Seasonality in the Saudi stock market: The Hajj effect

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ARTICLE INFO

Article history:
Received 7 September 2016
Received in revised form 7 July 2017
Accepted 12 July 2017
Available online 19 July 2017

JEL classifications:
G1
G110
C580
G120

Keywords:
Stock markets
Investor behavior
GARCH
Market anomalies

ABSTRACT

This study focuses on the influence of the Hajj pilgrimage on the Saudi stock market. Stock returns data of the Tadawul All-Shares Index (TASI) and several sector indices from January 2010 to August 2014 are used to examine the impact of the Hajj pilgrimage on the return and volatility of the stock indices. Using the ARMA(p,q)-GARCH(1,1) model, the results show that while the Hajj period has an insignificant negative influence on the mean return of the TASI and the sector indices, a significant increase in volatility is observed for the TASI and all the sector indices, except for the retail, agriculture and food and the petrochemical sectors. The increase in volatility is contrary to what has been found in prior studies but is consistent with the expectation that reduced participation due to religious beliefs and sentiments increases volatility of returns. This study contributes to the scant literature on cultural/religious anomalies in Islamic stock markets. The result being contrary to prior studies indicate that a deeper understanding of this stock market anomaly and the sentiments behind it is required.

1. Introduction

Over the past four decades, studies on behavior and trends in stock markets worldwide have put forward the idea that stock returns are predictable and influenced by investor sentiment and behavior (Seyyed, Abraham, & Al-Hajji, 2005). Wright and Bower (1992) suggest that investor judgment tends to stem from their mood, whereby investor optimism (pessimism) tends to be a result of good (bad) mood. This is contrary to claims by proponents of the Efficient Market Hypothesis (EMH) that stock prices follow a random walk and are unpredictable (Fama, 1970). Often examined are calendar anomalies such as the day of the week effect, the January effect and the holiday effect (Cross, 1973; Drogalas, Athianos, Bakas, & Elekidis, 2007; French, 1980; Tinic & West, 1984). Increasingly more studies have started looking at the impact of religious events on stock market returns (Al-Khazali, 2014; Abbes & Abdelhédi-Zouch, 2015; Hussain, 1998; Ramezani, Pouraghajan, & Mardani, 2013; Seyyed et al., 2005). Moods and emotions associated with religious events are believed to be able to influence investor decision-making process and hence their stock market behavior.

Despite the increasing volume of studies carried out on stock return predictability, there is limited work examining this issue for capital markets in Islamic countries which are still at the development stage with most being either emerging markets or frontier markets. The importance of the Islamic capital market can be viewed via its growth of between 12 to 15% annually with a current estimated asset value of $230 billion (Fah, Mahat, & Razak, 2012). This growth is spurred by the increasing wealth and capacity of both Muslim and non-Muslim investors. Therefore, there is a need to explore the stock markets in Islamic countries further, especially around religious events such as the Ramadan fast (a month of compulsory fasting, or abstaining from vice, for Muslims) and the Hajj pilgrimage (a religious journey to the Holy cities of Mecca and Medina in Saudi Arabia that Muslims perform). The Ramadan fast and the Hajj pilgrimage are two of the five pillars of Islam, which every Muslim must do. The Ramadan fast occurs once a year for a month while the Hajj pilgrimage is a must for every able-bodied and financially-capable Muslim to perform at least once in his/her lifetime (Hanandeh, 2013). Both these events are marked by increased devotion to acts of piety, prayers and charity (Seyyed et al., 2005). The Ramadan month is "dominated by positive valence as Muslims exercise their faith in anticipation of reaping the blessings of the month and forgiveness of their past sins" (Al-Ississ, 2010, p. 6).

To date, the Ramadan effect has been given the most attention in studies on seasonality in capital markets of Islamic countries with most studies confirming the presence of the anomaly in

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https://doi.org/10.1016/j.qref.2017.07.007

selected Islamic markets around the world (Al-Ississ, 2010; Al-Khazali, 2014; Ramezani et al., 2013; Seyyed et al., 2005). Another major Islamic event, the Hajj pilgrimage, has however been largely ignored especially with respect to its impact on the stock market of the country in which it is performed, Saudi Arabia. The Hajj pilgrimage is an annual event with around 2 million Muslims performing the Hajj (Long, 2013). Its significance can be seen from various perspectives. From the economic perspective, it is the main non-oil-industry contributor to the GDP of Saudi Arabia with a total annual economic impact estimated to be around $30 billion, representing around 7% of the total Saudi economy (Mahajan, 2012). From the religious perspective, it enhances spirituality and increases the devotion of the pilgrim to God (Allah) and strengthens their faith in Allah's last messenger, the Prophet Muhammad. It teaches the values of mercy and forgiveness and symbolizes humility (Abbes & Abdelhédi-Zouch, 2015). From the social perspective, it "helps to integrate the Muslim world, leading to a strengthening of global Islamic beliefs. . ." (Clingingsmith, Khwaja, & Kremer, 2009, pp. 1135). The month of Dhul Hijjah, the 12th month in the Hijri calendar and the month in which the Hajj pilgrimage takes place, virtually affects the entire population of Saudi Arabia "whether directly in its administration, its service industry, as a purveyor of personal goods and services, or indirectly by observing it on television" (Long, 2013).

This study therefore investigates the impact of the Hajj pilgrimage on the return and volatility of the Saudi stock market (also known as the Tadawul All-Share Index, or TASI). Past literature related to calendar anomalies, especially those related to cultural and religious beliefs are discussed and hypotheses are formulated in the next section. A discussion on the procedures for data collection is then presented followed by an explanation of the methodology employed in this research. Data analysis is then carried out and the results are discussed. The final section concludes the study and includes limitations of this study and provides suggestions for further research.

2. Literature review and hypothesis development

Stock prices are hypothesized to be unpredictable and follow a random walk according to the Efficient Market Hypothesis (EMH) proposed by Fama (1970). Until the late 1970s, tests of the EMH have provided consistent evidence of the applicability of the theory and there was unwavering belief in the EMH. However, in his 1978 paper, Jensen highlights inconsistencies with the EMH as a result of the growing evidence of the existence of anomalies in financial markets across the world. The evidence against the EMH has grown since with numerous studies documenting return predictability.

Seasonality in stock markets in the form of important calendar anomalies such as the turn on the week effect, the turn of the month effect, the turn of the year effect and the holiday effect has been found to exist in a comprehensive study of the Dow Jones Industrial Index (DJIA) over 90 years by Lakonishok and Smidt (1988). Studies by Ariel (1990), Cadsby and Ratner (1992), Drogalas et al. (2007) and Dodd and Gakhovich (2011), among others, conclude that stock prices and returns tend to increase prior to public holidays compared to other trading days. The existence of anomalies in stock markets suggests the presence of irrational sentiment-driven investors who cause the deviation of prices away from fundamental values (Abbes & Abdelhédi-Zouch, 2015). Contrary to the claim of investor rationality by the proponents of EMH, an increasing number of studies in the past two decades have documented the influence of investor sentiments on stock market movements (Baker & Wurgler, 2006; Ho & Hung, 2009; Lee, Jiang, & Indro, 2002). Investigations related to anomalies commonly focus on fixed calendar anomalies with relatively few focusing on moving calendar anomalies such as those occurring around the time of religious/cultural holidays or events. Examples of religious/cultural events studied so far include Chinese New Year (Yuan & Gupta, 2014), the Jewish holy days of Rosh Hashana and Yom Kippur (Frieder & Subrahnmayam, 2004), Christmas (Eckett, 2014), Easter (Pantzalis & Ucar, 2014), Diwali (Chougule & Khamborkar, 2014), Ashoura (Al-Ississ, 2010) and the Ramadan fast (Al-Hajieh, Redhead, & Rodgers, 2011; Al-Ississ, 2010; Al-Khazali, 2014; Białkowski, Etebari, & Wisniewski, 2012; Husain, 1998; Seyyed et al., 2005). Most of these studies have mainly focused on the conventional markets with relatively few but an increasing number now studying Islamic markets. Although the effect of the Ramadan fast on stock markets in Islamic countries has been studied quite extensively, so far however only two studies have investigated the impact of the Hajj pilgrimage on stock market performance. Abbes and Abdelhédi-Zouch (2015) focus on the influence of investor sentiment mainly on the returns of the Saudi stock market while Wasiuzzaman's (2017) preliminary study finds the influence of religious sentiments on the stock return and volatility. The present study uses the ARMA-GARCH methodology used by Wasiuzzaman (2017) but extends the analysis to the sectoral indices of the Saudi stock exchange while also providing a more in-depth analysis of the anomaly and the possible reason(s) for the existence of the anomaly.

A common theme in most studies on moving calendar anomalies is the influence of moods/emotions/sentiments on stock returns. The sentiment connected to the particular religious/cultural event is usually used to explain the results found in the studies. For example, Frieder and Subrahmanyam (2004) argue that optimism and/or increased investor confidence causes higher stock returns prior to St. Patrick's Day and Rosh Hasanah while lower stock returns prior to Yom Kippur is a result of the occasion being a solemn one. Similarly, Al-Ississ (2010) associates the "negative valence" of Ashoura to the observation of negative stock returns over this holy day whereas the Ramadan month is associated with "positive valence" and positive stock returns. Seyyed et al. (2005) however present more practical and economic reasons for the increase in stock returns during the Ramadan month, i.e. change in daily routine and increased consumer spending and other socio-religious activities after sundown.

Various arguments can be made with regards to the influence of the Hajj pilgrimage on the returns of the Tadawul stock exchange. One argument is that the Hajj pilgrimage is one of the largest annual religious tourism events in Saudi Arabia (Hanandeh, 2013) when around 2 million tourists (or pilgrims) visit the country, particularly Mecca and Medina. "Pilgrims usually arrive 1–3 weeks earlier and may stay behind after the completion of the acts of Hajj to visit other significant places" (Hanandeh, 2013, pp. 53). There is therefore increased economic activity via increased consumer spending with the pilgrims spending their money on food, transport, lodgings and souvenirs to be brought back home. This will therefore benefit certain industries or sectors and result in increased job opportunities. Additionally, the Hajj pilgrimage is a period of increased religious devotion and piety where Muslims are urged to devote themselves to acts of prayers and piety and abstain from prohibited activities to bring them closer to Allah. Hence, according to Abbes and Abdelhédi-Zouch (2015), this generates positive mood resulting in the tendency of investors to be "less discriminating in relation to their stock market investments" thus investment in the Saudi stock market will increase during this period (Abbes & Abdelhédi-Zouch, 2015, pp. 139). These positive outcomes should influence the stock returns positively.

However, it can be argued that the Hajj has been prescribed to Muslims so that they can be purified from their worldly sins and misdeeds. Increased piety and devotion to Allah mean reducing the connection to worldly gains and riches. During this period,

acts of charity are encouraged rather than profiting from a trade. Also, many Muslims may refrain from participating in speculative trading activities in the stock market as it is considered a form of gambling (Husain, 1990). It would then be expected that during this period of increased spirituality, religiously observant investors may reduce their participation in the stock market reducing trading volume. Trading volume has been documented to have a positive relationship with stock returns (Chen, Firth, & Rui, 2001; Hsieh, 2014; Karpoff, 1987) and the relationship is stronger in markets where more noise trading occurs (Pfleiderer, 1984). Since the Saudi market is dominated by individual investors who tend to be noise traders (Rahman, Chowdhury, & Sadique, 2015), reduced trading volume would thus result in lower stock returns.

Based on the arguments above, the following alternate hypothesis (H1) is formulated with respect to the Hajj effect on the returns of the TASI index:

H1. The Hajj pilgrimage has a significant influence on the returns of the TASI index.

Studies on the Ramadan effect argue that stock market volatility is expected to be lower during the month due to the fact that Muslims abstain from vice activities and devote their time to acts of piety and charity, thus reducing involvement in speculative trading activities as it is considered a form of gambling (Seyyed et al., 2005). Additionally, margin based or interest-based trading is also expected to decline due to the prohibition of Riba (or interest) in Islam. This argument is also applied to the Hajj pilgrimage.

However, reduced participation in the stock market during the Hajj period makes it illiquid. When liquidity is low, volatility is high and this is especially true for the case of riskier securities (Brunnermeier & Pedersen, 2009). Reduced liquidity disables speculators from taking positions to smooth price fluctuations (Garleanu & Pedersen, 2011). Therefore, this argument indicates a positive impact of the Hajj pilgrimage on the volatility of the TASI index (Wasiuzzaman, 2017). Alternatively, Al-Hajieh et al. (2011) argue that social mood gives rise to trends in financial markets resulting in an increased synchronization of opinions thus resulting in herding behavior. They argue that higher levels of stock volatility can be expected during the Ramadan month because the month is being associated with positive mood and therefore is accompanied by positive emotions such as optimism and happiness. Increased social interaction during this month influences the decision making process and results in increased synchronization of opinions, hence leading to higher volatility. Increased social interaction is also observed during the Hajj pilgrimage. Clingingsmith et al. (2008) find that the Hajj pilgrimage inspires feelings of unity among the pilgrims and with the worldwide Muslim community. Hence, it is expected that the volatility of the TASI index would be higher during the Hajj period.

The following hypothesis (H2) is thus formulated based on the arguments above:

H2. The Hajj pilgrimage has a significant influence on the volatility of the TASI index.

3. Data

Daily prices of the Saudi stock market, also known as the Tadawul All-Share Index (TASI), are collected from 2 January, 2010 to 31 August, 2015 for the purpose of testing the above hypotheses, resulting in a total of 1415 observations for the TASI index. Wasiuzzaman's (2017) study was for a longer period, i.e. from year 2007 to year 2016, but this study considers a shorter period, mainly after the financial crisis, to confirm the persistence of the anomaly over the years. Seasonality in stock markets diminish over time as the market discovers it but it is expected that despite the discovery

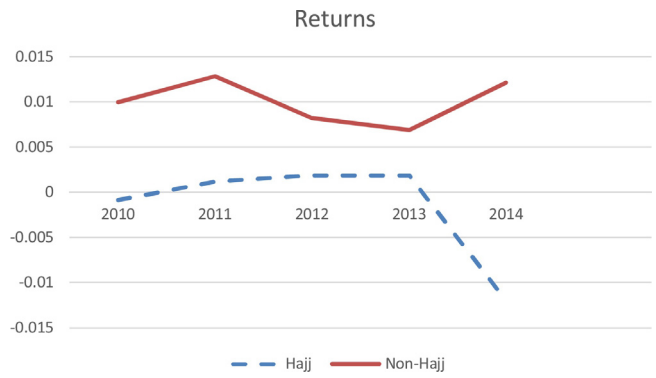

Fig. 1. Mean return during Hajj vs non-Hajj period.

of the anomaly, its persistence is a result of the religious sentiment associated with it.

The data are collected from the Bloomberg Professional Services database. Although the daily prices are available from year 2007 onwards, this study only considers from year 2010 mainly to avoid the Hajj pilgrimage happening twice in one year, as happened in year 2007, and to avoid the dates of the Hajj pilgrimage coinciding with the end of the Gregorian calendar hence avoiding the end of the year effect happening simultaneously. The dates are initially based on the Gregorian calendar and are then adjusted to be compatible to the Islamic Hijri calendar, corresponding to the Islamic dates of 17 Muharram 1431 to 17 Dhul-Qaidah 1436. Muharram is the 1st month of the Hijri calendar and Dhul-Qaida the 11th month. The Islamic calendar is lunar based, which means every month is either 29 or 30 days, resulting in a total of 354 or 355 days a year. The actual dates of the Hajj pilgrimage are between the 8th and 12th Dhul-Hijjah every year. However, the stock market in Saudi Arabia is closed for 10 days during the Hajj pilgrimage therefore the Hajj effect cannot be tested on these dates. Previous study on the Hajj effect by Abbes and Abdelhédi-Zouch (2015) considers 15 days before market close and 15 days after the opening of the market. Since doing this may result in the Hajj effect possibly coinciding with the end-of-the-year effect (based on the Hijri calendar) as the Islamic new year falls 18 days after the end of the Hajj pilgrimage, therefore, this study tests the Hajj effect by taking a period of only 5 trading days before the market closes and 5 trading days after it reopens.

The mean returns for the TASI index during the Hajj and the non-Hajj periods for the years 2010 to 2014 are presented in Fig. 1. Since the Hajj pilgrimage took place after 31 August in year 2015, the mean return and trading volume for the Hajj period cannot be calculated for that year and therefore year 2015 is excluded from the graphs. It is observed that the mean return is always lower during the Hajj period compared to the non-Hajj period. Non-parametric tests (Mann–Whitney U test) carried out on the returns during the Hajj and non-Hajj periods for each year yields insignificant results implying no significant difference in the returns during the two periods. Results are provided in Table 1. The mean trading volume for the TASI Index during the Hajj and non-Hajj periods for the years 2010–2014 are presented in Fig. 2. Similar to the mean return, the mean trading volume is always lower during the Hajj period, except in year 2011 when it is only slightly higher during the Hajj period.

Further, prices for the same period are collected for eight sector indices, namely, the Retail Index (RETAIL), Agriculture and Food Industries Index (AGRI & FOOD), Petrochemical Index (PETROCHEM), Banking Index (BANKING), Investment Index (INVESTMENT), Cement Index (CEMENT), the Telecommunications Index (TELECOM) and the Construction Index (CONSTRUCTION) so that the Hajj effect can also be tested for each sector. Although there are other sector indices in the Saudi market, only those available in

Table 1
Independent t-tests for difference in mean during Hajj and non-Hajj periods.

	Hajj	Non-Hajj	Mann–Whitney test (sig value)
2010	−0.00083	0.009978	0.232
2011	0.001171	0.012835	0.914
2012	0.001902	0.008204	0.540
2013	0.00189	0.006891	0.784
2014	−0.012	0.012128	0.164
2015		0.014993	

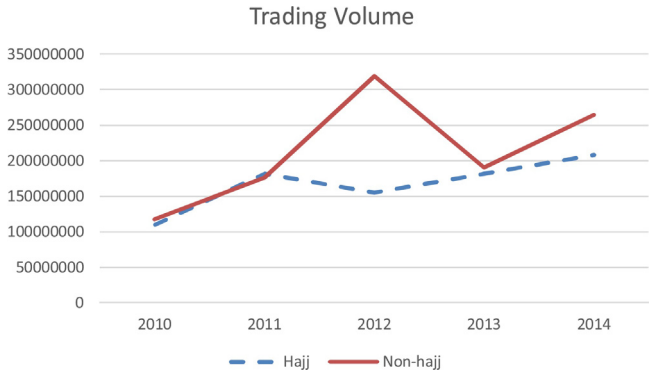

Fig. 2. Mean trading volume during Hajj vs non-Hajj period.

the Bloomberg database are included in this study. It is noted that the number of observations for some sectors differ slightly due to missing data. It is expected that the Hajj effect would be consistent across sectors although it may be possible to find sectors that are affected differently.

The descriptive statistics for the returns of the TASI and the sector indices are presented in Table 2. The descriptive statistics include the mean, median, maximum value, the minimum value, standard deviation, skewness and kurtosis. The mean return for the TASI index and for most of the sector indices is positive, except for the PETROCHEM, TELECOM and CONSTRUCTION sectors. The returns are negatively skewed indicating the tendency of the returns to be less than the mean. The kurtosis values for all the return series are greater than 3, with the lowest kurtosis value being 12.65745 for the TELECOM industry hence a fat-tailed distribution is observed. The Jarque–Bera statistic values for the TASI index return series and for each sector series indicate that all the data series are not normally distributed.

The Ljung–Box test statistics for serial correlation of the returns series, Q(36) and the ARCH-LM test statistics are also calculated for all the return series to test for the presence of autocorrelation and heteroscedasticity in the series. Results of the Q(36) values and ARCH-LM test statistic (in Table 2) for all return series indicate the presence of autocorrelation (dependence of current returns on past returns) and constant variance (heteroscedasticity), respectively, in the TASI and each sector returns.

Table 2 also presents the mean and standard deviation of returns during the Hajj and the non-Hajj periods. The mean returns are mostly higher for the non-Hajj return series compared to the Hajj return series for all sectors, with the mean being negative during the Hajj period. However, although the return is lower during the Hajj period compared to the non-Hajj period, the difference is not significant based on the t-test results for all the datasets. On the other hand, the standard deviation is found to be higher during the Hajj period compared to the non-Hajj period for all cases.

Two other features of the data to be tested are the randomness and stationarity of the series. Randomness of the data series is tested using the Wald–Wolfowitz Runs test (Wald & Wolfowitz, 1940) while stationarity is tested using the Augmented Dickey–Fuller (ADF) test in two forms—with intercept only and with trend and intercept. Results of both these tests are reported in Table 3.

The Z-values obtained from the Wald–Wolfowitz Runs test for each series indicate that the null hypothesis of a random walk is rejected at the 1% level for all the series. Hence all the series are not random. For all sectors, except for the RETAIL, BANKING and CEMENT sectors, the number of positive returns is greater than the number of negative returns. The t-statistic values obtained via the ADF test (with intercept only and with trend and intercept) suggest that the null hypothesis of a unit root can be rejected at the 1% level of significance for all the data series. Hence, the return series for all the indices are confirmed to be stationary, thereby confirming usability of the data series without the need for any transformation.

4. Methodology

The features of the data series above violate the assumptions of the Ordinary Least Squares (OLS) regression technique and therefore make it an inappropriate method for this study. Therefore, as done in most studies on seasonality, ARMA(1,1)-GARCH(1,1) model is used instead to observe the impact of the Hajj pilgrimage on the return of the TASI index and the individual sector indices. Similar to Wasiuzzaman (2017), the ARMA(1,1)-GARCH(1,1) model is found to be an appropriate model for all the data series. Specifically, the model used is:

$$R_t = c + \omega_1 R_{t-1} + \varepsilon_t + \eta_1 \varepsilon_{t-1} + \lambda_t D_{Hajj} \quad (1)$$

where

$$\varepsilon^2{}_t \mid \Omega_{t-1} \sim N(0,\ \sigma^2{}_t)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (2)$$

Return, R_t, in Eq. (1) depends on its past value, R_{t-1}, and past shocks, ε_{t-1}. ε_t represents the error term while c is the constant term and ω_1, η_1 and λ are coefficients of R_{t-1}, ε_{t-1}, and the dummy variable, D_{Hajj}, respectively. The dummy variable D_{Hajj} is used to represent the Hajj period, which is 5 trading days before the market closes and 5 trading days after it resumes trading. D_{Hajj} takes on the value 1 if the day falls within the Hajj period and 0 otherwise. Ω_{t-1} is the information set variable at time $t-1$ and $\varepsilon_t{}^2$ is a GARCH process. The conditional variance $\sigma^2{}_t$ in Eq. (2) is a linear function of the last period's squared errors (the ARCH term, $\varepsilon_{t-1}{}^2$) and its own lagged-one conditional variance (the GARCH term, $\sigma_{t-1}{}^2$); α_0 is the constant intercept term, while the estimated parameters are represented by α_1 and β_1 which capture the presence of heteroscedasticity in the daily index return series. It is important that the estimated parameters α_1 and β_1 are non-negative so that positive conditional variances can be obtained. Additionally, $\alpha_1 + \beta_1$ must be less than 1 to ensure that the conditional variance is stationary, i.e. the shocks to the current volatility are temporary. If $\alpha_1 + \beta_1 = 1$ or close to 1, then the conditional variance is non-stationary and the time series is said to exhibit presence of strong persistence and permanent shocks to volatility (Seyyed et al., 2005).

Table 2
Descriptive statistics.

	TASI	RETAIL	AGRI & FOOD	PETROCHEM	BANKING	INVESTMENT	CEMENT	TELECOM	CONSTRUCTION
Mean	0.000143	0.0008173	0.000489	−0.000049	0.000073	0.000207	0.000248	−0.000146	−0.000270
Median	0.000720	0.00058	0.000561	0.000349	−0.000055	0.000665	0.000018	0.000029	0.000760
Maximum	0.085470	0.06721	0.085878	0.092818	0.084734	0.096795	0.075764	0.086785	0.089200
Minimum	−0.075470	−0.08639	−0.090685	−0.098175	−0.066207	−0.105996	−0.090337	−0.077651	−0.097300
Stand dev	0.011065	0.113019	0.012574	0.014697	0.011118	0.014335	0.010058	0.012654	0.001369
Skewness	−0.943869	−0.742125	−0.595194	−0.587507	−0.074747	−1.221078	−0.415840	−0.630817	−1.632763
Kurtosis	17.29707	14.49528	13.30432	14.00854	13.38644	14.90462	16.46868	12.65745	15.21662
Jarque–Bera	12252.89	8959.95	6334.71	7221.34	6357.14	8701.05	10728.55	5592.68	9421.34
Q(36)	50.388	95.431	52.592	42.366	65.427	73.443	36.682	82.767	66.791
LM test statistic	92.246	113.34	130.64	74.93	139.80	88.29	47.71	60.10	54.86
Mean (Hajj)	−0.001575	−0.001057	−0.000054		−0.002245	−0.002179	−0.001830	−0.001231	−0.003215
Mean (non-Hajj)	0.0002086	0.000886	0.0005087		0.000159	0.000289	0.000323	−0.000104	−0.000162
p-Value	0.2629	0.2323	0.7709		0.2258	0.2631	0.1957	0.5214	0.1777
Stdev (Hajj)	0.01379	0.01438	0.013393		0.01371	0.01518	0.01146	0.01210	0.01558
Stdev (non-Hajj)	0.01095	0.01117	0.012542		0.01100	0.01430	0.00999	0.01267	0.01360
No of observations	1415	1416	1413		1414	1414	1414	1415	1414

Table provides descriptive statistics for daily returns on the TASI Index and nine sector indices. The mean, median, maximum, minimum, standard deviation, skewness and kurtosis values are reported for each return series. The Jarque–Bera test statistic is used to test the normality of the data series, i.e. the null hypothesis of the data series being normally distributed. Q(36) is the Ljung–Box test statistic for serial correlation of returns of order 36 with the null hypothesis of serial independence. The LM-test statistic denotes the ARCH-LM test for the null hypothesis of no heteroscedasticity.

Table 3
Runs and unit root tests.

Index	Runs test					Unit root test	
	Positive returns	Negative returns	Total no. of runs	Expected runs	Z-value	ADF t-stat (with intercept only)	ADF t-stat (with trend and intercept)
TASI	771	644	634	702.80	−3.64	−33.93***	−33.93***
RETAIL	688	728	664	708.44	−2.36	−33.94***	−33.93***
AGRI & FOOD	722	691	654	707.16	−2.83	−35.76***	−35.75***
PETROCHEM	735	679	660	706.89	−2.50	−34.02***	−34.05***
BANKING	701	713	620	707.95	−4.68	−33.40***	−33.39***
INVESTMENT	743	671	642	706.17	−3.42	−34.15***	−34.16***
CEMENT	679	735	663	706.89	−2.34	−34.52***	−34.59***
TELECOM	731	684	681	707.72	−1.42	−33.95***	−34.01***
CONSTRUCTION	799	615	598	696.03	−5.31	−33.55***	−33.55***

Table presents the runs and unit root tests for the returns series of the TASI index and nine sector indices. Under the runs test for randomness of the data series, the number of positive runs, negative runs, the total number of runs, the expected runs and the significance of the runs are calculated. Also calculated is the ADF t-statistics (with intercept only and with trend and intercept) to test for the stationarity of the data series.
*** Indicates significance at 1% level.

It is found that these conditions are satisfied for all the data series, except for the data series for the PETROELUM index.

5. Data analysis and discussion of results

Table 4 reports the results of the ARMA(1,1)-GARCH(1,1) model for both the mean and the conditional variance equations simultaneously for the TASI index and the individual sector indices. Panel A reports the estimates of the mean equation modeled as a general ARMA process while Panel B reports the estimates of the conditional variance equation modeled as a GARCH process. Column (i) reports the results for the overall market, i.e. the TASI Index and columns (ii) to (ix) report the results for each sector. The coefficient for the dummy variable for Hajj, D_{Hajj}, in Panel A is found to exert a statistically significant negative influence on the returns for all indices except for the AGRI & FOOD, PETROCHEM and BANKING indices. In general, this implies that the daily returns are negative during the Hajj period. This result contradicts the results of Abbes and Abdelhédi-Zouch (2015) who find positive weekly returns during the Hajj-pilgrimage and negative returns during the non-Hajj period. They explain the positive mood to be a result of the rituals of the Hajj pilgrimage which leads to investors increasing their investments hence resulting in a positive effect on the stock prices (Abbes & Abdelhédi-Zouch, 2015). Instead, in this case, the negative impact of the Hajj period on the returns of the TASI index and the sector indices seems to indicate the reduced participation of the religiously observant investors in the stock market due to increased spirituality hence resulting in reduced trading volume. According to Hsieh (2014), a positive contemporaneous relationship exists between trading volume and returns, therefore, the reduced trading volume results in lower stock returns. The result is consistent with the findings of Wasiuzzaman (2017) although there is increased significance of the impact of the Hajj effect on the returns, confirming the persistence of the anomaly over the years.

To confirm the claim of reduced participation, the average and standard deviation of the trading volume during the Hajj and the non-Hajj period are calculated and reported in Table 5. Using non-parametric Mann–Whitney U test for differences in mean of two independent samples, the mean trading volume is found to be lower for all indices during the Hajj period compared to the non-Hajj period. The difference is significant for all industries, except for the AGRI & FOOD, and PETROCHEM industries. The standard deviation of the trading volume is lower in all cases. However, significance could not be tested for the standard deviation of the trading volume. Reduction in the average trading volume and its volatility indicates a less liquid market during the Hajj period as was suspected earlier.

Table 4
Estimates of the ARMA(1,1)-GARCH(1,1) model.

	TASI (i)	RETAIL (ii)	AGRI & FOOD (iii)	PETROCHEM (iv)	BANKING (v)	INVESTMENT (vi)	CEMENT (vii)	TELECOM (viii)	CONSTRUCTION (ix)
Panel A: mean equation									
c	0.00097***	0.00119***	0.00115***	0.00057**	0.00035	0.00076**	0.00022	0.00058*	0.00062
	(0.00030)	(0.00029)	(0.00033)	(0.00024)	(0.00028)	(0.00036)	(0.00029)	(0.00034)	(0.00039)
ω_1 (AR(1))	0.56437***	−0.08791	−0.02802	0.09613	0.16505	0.33842	0.73672***	0.18384	0.45974***
	(0.14533)	(0.28278)	(0.36976)	(0.26867)	(0.17416)	(0.20805)	(0.14432)	(0.31307)	(0.16878)
η_1 (MA(1))	−0.54218***	0.20484	0.10724	−0.01062	0.01306	−0.22169	−0.66368***	−0.10704	−0.31292*
	(0.156857)	(0.27534)	(0.36680)	(0.27120)	(0.17840)	(0.21815)	(0.15944)	(0.31907)	(0.17840)
D_{Hajj}	−0.00183***	-0.00409***	−0.00056	−0.00015	−0.0011	−0.00280***	−0.00200***	−0.00247***	−0.00402***
	(0.00061)	(0.00081)	(0.00123)	(0.00133)	(0.00096)	(0.00090)	(0.00065)	(0.00075)	(0.00093)
Panel B: conditional variance equation									
α_0	0.000004***	5.65E − 06***	1.03E − 05***	3.45E − 06***	5.33E − 06***	4.83E − 06***	5.24E − 06***	6.49E − 06***	1.35E − 05***
	(0.00000)	(5.57E − 07)	(1.31E − 06)	(1.19E − 06)	(7.67E − 07)	(6.12E − 07)	(5.57E − 07)	(6.33E − 07)	(1.44E − 06)
α_1 (ARCH)	0.17102***	0.140407***	0.17809***	0.10430***	0.15839***	0.10963***	0.20309***	0.09854***	0.17342***
	(0.01450)	(0.01183)	(0.01611)	(0.02328)	(0.01744)	(0.01229)	(0.01528)	(0.01139)	(0.01746)
β_1 (GARCH)	0.82099***	0.82675***	0.76811***	0.89620***	0.81044***	0.87655***	0.78150***	0.85993***	0.76793***
	(0.01164)	(0.01220)	(0.01921)	(0.01746)	(0.01786)	(0.01164)	(0.01414)	(0.01241)	(0.01997)
Goodness of fit									
AIC	−6.57976	−6.41773	−6.1969	−6.25106	−6.49435	−6.02234	−6.60711	−6.2043	−6.05987
SIC	−6.55373	−6.39174	−6.17086	−6.22132	−6.46833	−5.99632	−6.58109	−6.17829	−6.03384
No of observations	1415	1416	1413	1414	1414	1414	1414	1415	1414

Table provides results of the ARMA(1,1)-GARCH(1,1) model. The variable of interest is the dummy variable, D_{Hajj}, in the mean equation. The null hypothesis tested in the study is no Hajj effect in the returns of the TASI index and nine sector indices. Significance of the coefficient of D_{Hajj} results in the rejection of the null hypothesis, i.e. the Hajj effect is present in the stock indices. AIC (Akaike Information Criterion) and SIC (Schwartz Information Criterion) test the goodness of fit of the models, with smaller residual errors in the models preferred. Standard errors are in parenthesis.

*** Indicates significance at 1% level.
** Indicates significance at 5% level.
* Indicates significance at 10% level.

Table 5
Differences in trading volume between Hajj and non-Hajj periods.

Index	Mean			Standard deviation	
	Hajj	Non-Hajj	p-Value	Hajj	Non-Hajj
TASI	167527660.3	218863309.7	0.003	49002754.75	117014655
RETAIL	3384223.5	4789193.221	0.001	1969937.17	3163756.106
AGRI & FOOD	9074268.4	10919688.59	0.199	5730763.247	7962851.617
PETROCHEM	31202728.22	36360438.65	0.134	16214841.04	22249976.23
BANKING	21627949.76	29429606.38	0.001	13288068.96	19806950.37
INVESTMENT	8335968.82	10579791.08	0.076	3960978.795	6630885.211
CEMENT	3176074.26	5922151.902	0.000	2571538.906	5126134
TELECOM	14505895.9	25072567.99	0.026	9786138.682	29723761.3
CONSTRUCTION	7784894.82	11956983.8	0.001	3100263.719	8503983.797

Table provides the mean trading volume of the TASI index and nine sector indices during the Hajj and the non-Hajj periods and the corresponding test for significance in the difference in means between these two periods. In most cases (except RETAIL and AGRI & FOOD sectors) the mean is significantly higher during the non-Hajj period. Table also provides the standard deviation of the trading volume for the TASI index and nine sector indices during the Hajj and the non-Hajj periods.

Further testing is carried out to ensure that the change in the returns during the Hajj period is actually because of the sentiments surrounding that period and not simply because of the conditional risk of the market, the ARMA(p,q)-GARCH(1,1)-M model is used.

$$R_t = c + \omega_1 R_{t-1} + \varepsilon_t + \eta_1 \varepsilon_{t-1} + \lambda_t D_{Hajj} + \rho\sigma_t \quad (3)$$

where

$$\varepsilon^2{}_t \mid \Omega_{t-1} \sim N(0,\ \sigma^2{}_t)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \theta_t D_{Hajj} \quad (4)$$

Mean Eq. (3) is similar to mean Eq. (1) except for the inclusion of σ_t which represents the conditional market risk. The variance Eq. (4) is a result of including the dummy variable, D_{Hajj}, in Eq. (2) in order to test the effect of the Hajj period on the stock volatilities. D_{Hajj} is introduced in both the mean and conditional variance equations in order to estimate the impact on both the return and volatility simultaneously. Results of this test are provided in Table 6.

Inclusion of the conditional market risk and the dummy variable in the variance equation yields some interesting results. First, it is found that in all cases, except for the RETAIL industry, the Hajj effect becomes insignificant in the mean equation, implying that there is no significant influence of the Hajj pilgrimage on the returns of the TASI Index and all sector indices except for the RETAIL index. The retail sector benefits during the Hajj season due to an increase in buying activity hence the returns of the retail sector are expected to increase during the Hajj period. However, it is found that the returns are lower during the Hajj period. A possible explanation to this could be that the retail sector consists of only 11 firms and any reduction in trading activity during the Hajj period reduces trading volume significantly and thus this results in lower stock returns (Al-Ississ, 2010).

Second, it is found that the conditional market risk is insignificant for all the indices except for the CEMENT index, where it is significant only at 10% level. The conditional market risk coefficient being insignificant confirms that the change in returns during the Hajj period is not a result of the inherent market risk.

Third, it is found that there is a significant increase in volatility during the Hajj period for all indices, except for the RETAIL, AGRI & FOOD and PETROCHEM indices. The increase in volatility during

Table 6
Estimates of the ARMA(p,q)-GARCH(1,1)-M model.

	TASI (i)	RETAIL (ii)	AGRI & FOOD (iii)	PETROCHEM (iv)	BANKING iv)	INVESTMENT (vi)	CEMENT (vii)	TELECOM (viii)	CONSTRUCTION (ix)
	Panel A: mean equation								
c	0.00017	0.000214	−0.00045	0.00058	−0.00093	−7.82E − 05	−0.00114	0.00101	0.00102
	(0.00075)	(0.00101)	(0.00113)	(0.00066)	(0.00093)	(0.00109)	(0.00084)	(0.00115)	(0.00136)
ω_1 (AR(1))	0.62894***	0.11242***	0.07444**	0.08623***	0.17389***	0.11814***	0.70235***	0.08071***	0.49788***
	(0.14894)	(0.03145)	(0.03668)	(0.02378)	(0.02815)	(0.03196)	(0.16974)	(0.03017)	(0.15534)
η_1 (MA(1))	−0.52111***						−0.62896***		−0.34223**
	(0.15771)						(0.18469)		(0.16411)
D_{Hajj}	−0.00105	−0.00406**	−0.00072	−0.00016	−0.00091	−0.00226	−0.00203	−0.00166	−0.0036
	(0.00163)	(0.00163)	(0.00145)	(0.00156)	(0.00135)	(0.00222)	(0.00137)	(0.00226)	(0.00289)
ρ	0.11739	0.11542	0.16507	0.00029	0.1578	0.07847	0.18328*	−0.04467	0.07847
	(0.10844)	(0.11639)	(0.11459)	(0.06189)	(0.11340)	(0.10527)	(0.11109)	(0.11288)	(0.10527)
	Panel B: conditional variance equation								
α_0	4.38E − 06***	5.76E − 06***	1.12E − 05***	3.24E − 06***	5.66E − 06***	4.72E − 06***	5.01E − 06***	6.33E − 06***	1.43E − 05***
	(3.99E − 07)	(5.69E − 07)	(1.40E − 06)	(1.18E − 06)	(8.22E − 07)	(6.19E − 07)	(6.03E − 07)	(6.03E − 07)	(1.54E − 06)
α_1 (ARCH)	0.18985***	0.13937***	0.18850***	0.10514***	0.16151***	0.10710***	0.19134***	0.10137***	0.18202***
	(0.01616)	(0.01164)	(0.01733)	(0.02332)	(0.01856)	(0.01194)	(0.01464)	(0.01164)	(0.01888)
β_1 (GARCH)	0.79759***	0.82550***	0.75194***	0.89304***	0.80226***	0.87762***	0.78748***	0.85658***	0.75233***
	(0.01308)	(0.01231)	(0.02091)	(0.01780)	(0.01906)	(0.01167)	(0.01445)	(0.01238)	(0.02137)
D_{Hajj}	1.61E-05***	2.07E − 06	4.51E − 06	9.16E − 06	4.16E − 06***	5.96E − 06**	8.17E − 06***	7.74E − 06***	1.39E − 05***
	(2.63E − 06)	(4.13E − 06)	(3.83E − 06)	(7.43E − 06)	(2.24E − 06)	(2.67E − 06)	(3.09E − 06)	(2.83E − 06)	(5.07E − 06)
	Goodness of fit								
AIC	−6.58907	−6.41707	−6.19733	−6.25077	−6.4954	−6.02157	−6.60842	−6.20593	−6.06103
SIC	−6.55561	−6.38737	−6.16757	−6.21731	−6.46565	−5.99182	−6.57496	−6.17620	−6.02757
No of observations	1415	1416	1413	1414	1414	1414	1414	1415	1414

Table provides results of the ARMA(p,q)-GARCH(1,1) model. The variable of interest is the dummy variable, D_{Hajj}, in the mean and variance equations. The null hypothesis tested in the study is no Hajj effect in both the returns and volatility of the TASI index and nine sector indices. Significance of the coefficient of D_{Hajj} results in the rejection of the null hypothesis, i.e. the Hajj effect is present in the stock indices even after controlling for market risk. AIC (Akaike Information Criterion) and SIC (Schwartz Information Criterion) test the goodness of fit of the models, with smaller residual errors in the models preferred. Standard errors are in parenthesis.

*** Indicates significance at 1% level.

** Indicates significance at 5% level.

* Indicates significance at 10% level.

the Hajj period confirms the observation in the descriptive statistics (Table 2) and is consistent with the findings of Wasiuzzaman (2017). This is however contrary to what has been found in most studies on religious anomalies in stock markets of Islamic countries. For example, Husain (1998) and Seyyed et al. (2005) argue for an increase in returns and a decrease in volatility during the Ramadan month as a result of reduced involvement in speculative trading activities and margin-based trading, which are prohibited in Islam. However, in Table 5 it is found that the average trading volume and its standard deviation are lower during Hajj, implying lower and less volatile trading activity, i.e. fewer investors are buying and selling, hence lower liquidity. Reduced liquidity disables speculators from taking positions to smooth price fluctuations (Garleanu & Pedersen, 2011) and therefore volatility is high especially in the case of riskier securities (Brunnermeier & Pedersen, 2009). Although the Saudi market is the most liquid in the GCC region, there are only approximately 170 companies listed with each sector having approximately 15–20 listed companies, except for the TELECOM index where only 4 companies are listed. The Tadawul lacks liquidity in general and around 95% of its trading volume is driven by individual retail investors (Rahman et al., 2015). The lack of professional institutional investors "contributes to occasional bouts of volatility in the market" (The Report: Saudi Arabia, 2013, pp. 69). Retail investors, who are most likely to be noise traders and those who engage in speculative trading based on non-fundamental information dominate the stock market in Saudi (Rahman et al., 2015). Rahman et al. (2015) "find strong evidence of pervasive herding among the market participants" in the Saudi stock market. Both herding behavior and noise traders tend to increase the volatility or risk associated with financial securities (Bikhchandani & Sharma, 2001; De Long, Shliefer, Summers and Waldmann, 1990).

The volatility of the RETAIL, AGRI & FOOD and the PETROCHEM sector indices is not significantly affected by the Hajj period. It was found in Table 5 that although the trading volume was lower for the AGRI & FOOD and PETROCHEM industries during the Hajj and Non-Hajj periods, the difference was not significant. This provides consistency to the argument that the Hajj effect is a result of the reduced participation of the investors in the market during that period. However the decrease being insignificant is consistent with an insignificant impact of the Hajj period on the return and the volatility of both industries. On the other hand, although there is an insignificant impact on the volatility of the RETAIL index, the Hajj effect is found in the returns.

6. Conclusion

This study examines the effect of the Hajj pilgrimage on the return and volatility of the Tadawul All-Shares Index (TASI) and the sector indices in Saudi Arabia. Because the stock market is closed for 10 days during the Hajj pilgrimage, analysis on the impact of the Hajj pilgrimage on the Saudi stock market is carried out on the period just before and after the Hajj pilgrimage. Specifically, the stock prices 5 trading days before the market closes and 5 trading days after the market reopens is considered. Using the ARMA(p,q)-GARCH(1,1) model for all the indices, the study finds insignificant negative influence of the Hajj pilgrimage on the returns of all indices except the retail index, implying that the stock returns are lower during the Hajj pilgrimage although the reduction is not significant. On the other hand, the TASI experiences a significant increase in volatility during the Hajj pilgrimage. A similar result is found for most of the sector indices except for the retail, agriculture and food and the petrochemical sectors, where an insignificant increase in volatility is observed. The increase in volatility can be explained

through the reduced participation in the stock market by the religiously observant investors as participation in the stock market is considered a form of gambling. Since the Saudi market is a small market with around 170 listed companies, the reduced participation reduces trading volume thus resulting in lower returns and higher volatility as speculative traders find it difficult to execute trades. Hence, religious sentiment can be seen as playing an important part in influencing the volatility of the Saudi stock market during the Hajj pilgrimage. Although this study is consistent with that of Wasiuzzaman (2017), the results found are not in line with most prior studies on the issue of religious sentiments in Islamic markets but confirm the role of sentiments on stock market behavior.

The results of this study have important implications for investors and fund managers in Islamic markets. It confirms the notion that the investors are not rational and are guided by their sentiments and moods. The impact of moving calendar anomalies on the volatility of the Saudi stock market allows investors and fund managers to formulate trading strategies in order to control risk exposure and to generate better risk-adjusted performance. The significance of culture and/or religion in influencing investor behavior adds to the increasing number of studies which on stock predictability and investor irrationality.

This study however has some limitations. The data taken for this study is only over 6 years, i.e. from 2010 to 2015. Although the Tadawul market was established in 1984, data for some of the sectors were only available from year 2007 onwards in the Bloomberg database. Also, it was found that the use of data before year 2007 required the use of more complicated models and the ARMA(1,1)-GARCH(1,1) model was inappropriate in most of the cases. Only when the data was taken from year 2007 onwards that the ARMA(1,1)-GARCH(1,1) was an appropriate model for all indices. Additionally, the market went through a lot of development and changes and only in year 2007 the Tadawul was formally established as a joint-stock company from a mutually-owned organization. However, due to issues as mentioned earlier, this study only considers data from year 2010 onwards. Future studies may want to consider earlier years and more complicated econometric models to confirm the results of this study.

The Hajj period in this study was taken to be 5 days before and 5 days after the Hajj pilgrimage. However, there was no attempt to separate the period before and after although it is expected that moods/emotions/sentiments may be different before and after the Hajj pilgrimage, therefore the effect may be different for both periods especially on the volatility. It is therefore recommended that the period before and after the Hajj pilgrimage be separated in order to thoroughly understand the impact of religious sentiments on the return and volatility of stock markets in Islamic countries.

This study also did not consider crisis situations such as the Arab Spring when protests broke out in Tunisia, Egypt, Bahrain, Jordan, Kuwait and Saudi Arabia. The Arab Spring influenced the economic and financial activities in Saudi Arabia with foreign investment leaving the country. The Arab Spring had resulted in extreme volatility in an already volatile stock market. The conditional risk factor and the risk premium may therefore be affected by major financial events such as the Arab Spring. Therefore, the influence of the Arab Spring should be incorporated in the model via structural breaks so that it can be observed whether the Hajj effect is consistent over the years or is affected by major financial events.

References

Abbes, M. B., & Abdelhédi-Zouch, M. (2015). Does hajj pilgrimage affect the Islamic investor sentiment? *Research in International Business and Finance*, *35*, 138–152. http://dx.doi.org/10.1016/j.ribaf.2015.02.011

Al-Hajieh, H., Redhead, K., & Rodgers, T. (2011). Investor sentiment and calendar anomaly effects: A case study of the impact of Ramadan on Islamic Middle Eastern markets. *Research in International Business and Finance*, *25*(3), 345–356. http://dx.doi.org/10.1016/j.ribaf.2011.03.004

Al-Ississ, M. (2010). *The Impact of Religious Experience on Financial Markets*. Cambridge: Harvard University., doi=10.1.1.497.3950&rep=rep1&type=pdf. http://citeseerx.ist.psu.edu/viewdoc/download?

Al-Khazali, O. (2014). Revisiting fast profit investor sentiment and stock returns during Ramadan. *International Review of Financial Analysis*, *33*, 158–170. http://dx.doi.org/10.1016/j.irfa.2014.02.003

Ariel, R. A. (1990). High stock returns before holidays: Existence and evidence on possible causes. *The Journal of Finance*, *45*, 1611–1626. http://dx.doi.org/10.1111/j.1540-6261.1990.tb03731.x

Baker, M., & Wurgler, J. (2006). Investor sentiment and the cross-section of stock returns. *The Journal of Finance*, *61*(4), 1645–1680. http://dx.doi.org/10.1111/j.1540-6261.2006.00885.x

Białkowski, J., Etebari, A., & Wisniewski, T. P. (2012). Fast profits: Investor sentiment and stock returns during Ramadan. *Journal of Banking and Finance*, *36*(3), 835–845. http://dx.doi.org/10.1016/j.jbankfin.2011.09.014

Bikhchandani, S., & Sharma, S. (2001). Herd behavior in financial markets. *IMF Staff Papers*, *47*(3), 279–310. http://dx.doi.org/10.5539/ibr.v6n6p31

Brunnermeier, M. K., & Pedersen, L. H. (2009). Market liquidity and funding liquidity. *Review of Financial Studies*, *22*(6), 2201–2238. http://dx.doi.org/10.1093/rfs/hhn098

Cadsby, C. B., & Ratner, M. (1992). Turn-of-month and pre-holiday effects on stock returns: Some international evidence. *Journal of Banking & Finance*, *16*(3), 497–509.

Chen, G., Firth, M., & Rui, O. (2001). The dynamic relation between stock returns, trading volume, and volatility. *The Financial Review*, *38*(3), 153–174.

Chougule, A., & Khamborkar, A. (2014). A study of seasonality in stock market: With special reference to diwali effect. *Journal of Business Management & Social Sciences Research*, *3*(6), 26–29.

Clingingsmith, D., Khwaja, A. I., & Kremer, M. (2009). Estimating the impact of the Hajj: Religion and tolerance in Islam's global gathering. *The Quarterly Journal of Economics*, *124*(3), 1133–1170. http://dx.doi.org/10.1162/qjec.2009.124.3.1133

Cross, F. (1973). The behavior of stock prices on Fridays and Mondays. *Financial Analysts Journal*, *29*(6), 67–69.

De Long, B., Shleifer, A., Summers, L., & Waldmann, R. (1990). Noise trader risk in financial markets. *Journal of Political Economy*, *98*(4), 703–738. http://dx.doi.org/10.1086/261703

Drogalas, G., Athianos, S., Bakas, G., & Elekidis, G. (2007). Seasonalities in stock markets: The day of the Week effect. In *Management of international business and economics systems (MIBES)*. pp. 579–593. Larissa. Retrieved from: http://mibes.teilar.gr/proceedings/2007/poster/Drogalas-Athianos-Bakas-Elekidis.pdf

Eckett, S. (2014). *The UK stock market almanac 2015* (8th ed.). Hampshire: Harriman House.

Fah, C. F., Mahat, F., & Razak, N. H. A. (2012). *Issues in Islamic banking and finance*. Selangor: UPM Press.

Fama, Eugene F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, *25*(2), 383–417. JSTOR, www.jstor.org/stable/2325486

French, K. R. (1980). Stock returns and the Wednesday effect. *Journal of Financial Economics*, *8*(1), 55–69.

Frieder, L., & Subrahmanyam, A. (2004). Nonsecular regularities volume Laura Frieder and Avanidhar Subrahmanyam. *Financial Analysts Journal*, *60*(4), 29–34.

Hanandeh, A. El. (2013). Quantifying the carbon footprint of religious tourism: The case of Hajj. *Journal of Cleaner Production*, *52*, 53–60. http://dx.doi.org/10.1016/j.jclepro.2013.03.009

Ho, C., & Hung, C. H. (2009). Investor sentiment as conditioning information in asset pricing. *Journal of Banking and Finance*, *33*(5), 892–903. http://dx.doi.org/10.1016/j.jbankfin.2008.10.004

Hsieh, H.-C. S. (2014). The causal relationships between stock returns, trading volume, and volatility. *International Journal of Managerial Finance*, *10*(2), 216–240.

Husain, F. (1998). A seasonality in the Pakistani equity market: The Ramadhan effect. *Pakistan Development Review*, *37*(1), 77–81.

Jensen, M. C. (1978). Some anomalous evidence regarding market efficiency. *Journal of Financial Economics*, *6*(2/3), 95–101.

Karpoff, J. M. (1987). The relation between price changes and trading volume: A survey. *Journal of Financial & Quantitative Analysis*, *22*(1), 109–126.

Lakonishok, J., & Smidt, S. (1988). Are seasonal anomalies real? A ninety-year perspective. *The Review of Financial Studies*, *1*(4), 403–425. http://dx.doi.org/10.1093/rfs/1.4.403

Lee, W. Y., Jiang, C. X., & Indro, D. C. (2002). Stock market volatility, excess returns, and the role of investor sentiment. *Journal of Banking and Finance*, *26*(12), 2277–2299. http://dx.doi.org/10.1016/S0378-4266(01)00202-3

Long, D. E. (2013). *The Hajj and its impact on Saudi Arabia and the Muslim world*. Saudi-US Relations Information Service (SUSRIS). Retrieved from http://susris.com/2013/10/13/the-hajj-and-its-impact-on-saudi-arabia-and-the-muslim-world-david-e-long/

Mahajan, V. (2012). *The Arab world unbound: Tapping into the power of 350 million consumers*. San Francisco: Jossey-Bass.

Pantzalis, C., & Ucar, E. (2014). Religious holidays, investor distraction, and earnings announcement effects. *Journal of Banking and Finance*, *47*(1), 102–117. http://dx.doi.org/10.1016/j.jbankfin.2014.05.020

Pfleiderer, P. (1984). *The volume of trade and the variability of prices: A framework for analysis in noisy rational expectations equilibria*. Graduate School of Business, Stanford University.

Rahman, M. A., Chowdhury, S. S. H., & Sadique, M. S. (2015). Herding where retail investors dominate trading: The case of Saudi Arabia. *Quarterly Review of Economics and Finance*, *57*, 46–60. http://dx.doi.org/10.1016/j.qref.2015.01.002

Ramezani, A., Pouraghajan, A., & Mardani, H. (2013). Studying impact of Ramadan on stock exchange index: Case of Iran. *World Sciences Journal*, *1*(12), 46–54.

Seyyed, F. J., Abraham, A., & Al-Hajji, M. (2005). Seasonality in stock returns and volatility: The Ramadan effect. *Research in International Business and Finance*, *19*(3), 374–383. http://dx.doi.org/10.1016/j.ribaf.2004.12.010

Tinic, S. M., & West, R. R. (1984). Risk and return: January vs. the rest of the year. *Journal of Financial Economics*, *13*(4), 561–574.

Wald, A., & Wolfowitz, J. (1940). On a test whether two samples are from the same population. *The Annals of Mathematical Statistics*, *11*(2), 147–162.

Wasiuzzaman, S. (2017). Religious anomalies in Islamic stock markets: The Hajj effect in Saudi Arabia. *Journal of Asset Management*, *18*(3), 157–162. http://dx.doi.org/10.1057/s41260-016-0028-1

Wright, W. F., & Bower, G. H. (1992). Mood effects on subjective probability assessment. *Organizational Behavior and Human Decision Processes*, *52*(2), 276–291. http://dx.doi.org/10.1016/0749-5978(92)90039-A

Yuan, T., & Gupta, R. (2014). Chinese lunar new year effect in Asian stock markets, 1999–2012. *The Quarterly Review of Economics and Finance*, *54*(4), 529–537. http://dx.doi.org/10.1016/j.qref.2014.06.001