QUARTERLY JOURNAL
OECONOMIA
COPERNICANA

2016 VOLUME 7 ISSUE 4, DECEMBER

p-ISSN 2083-1277, e-ISSN 2353-1827
www.oeconomia.pl

Akbalik, M., & Tunay, L. B. (2016). An Analysis of Ramadan Effect by GJR-GARCH Model: Case of Borsa Istanbul. *Oeconomia Copernicana*, 7(4), 593-612. DOI: http://dx.doi.org/10.12775/OeC. 2016.033

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An Analysis of Ramadan Effect by GJR-GARCH Model: Case of Borsa Istanbul

JEL Classification: *C22; G11; G12*

Keywords: *stock returns; anomalies; Ramadan effect; GJR-GARCH*

Abstract: *Although there are a lot of studies testing the calendar effect in BIST, there are limited numbers of studies testing the Ramadan effect. In this study, the period of 05 August 1997–24 October 2014 is tested by the GJR-GARCH(1,1) model on the basis of BIST 30, 100, all, second national, sectors and sub-sectors. In some of the models, the dummy variable of Ramadan did not have significant coefficients. In the models that provide significant value of the dummy variable of Ramadan, coefficients of this variable are negative. This shows that, in the Ramadan, return rates of the second national index, chemistry, and manifacturing, textile, trust companies sectors are affected negatively. Any significant result could not be found whether Ramadan has effect upon other sector indices. Findings are in the direction that even if the month of Ramadan generally doesn't increase the*

Date of submission: May 17, 2016; date of acceptance: November 3, 2016
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average return, it makes a positive impact on the market by reducing the volatility of returns.

Introduction

Today, it is considered that the traditional finance theories are insufficient to explain the structure of financial markets. Behavioral finance which consists of composition of psychology, sociology and finance is emerging as an alternative theory to explain these shortcomings. Stock market anomalies can be classified as calendar, cross-section and price anomalies. In the literature, although there are numerous studies on the classification of calendar anomalies such as January, week day, holiday anomaly in the literature (see Borowski, 2016), the number of studies on Ramadan anomaly which is accepted as Islamic calendar effect are very low.

In Muslim countries, Ramadan is one of the most celebrated and important religious rituals. Like Christmas in the Christian world, the religious rituals are considered to be able to have impact on investor behavior in the month of Ramadan. In some studies whose details are given in the literature section, stock returns during Ramadan was found to be higher than in the rest of the year. However, it is observed that these findings are slightly changing from country to country. Many factors, such as structure and size of economy, volume and deepening of stock market, investors' interest in stock market may be effective on these differentiations. To accurately analyze the Ramadan effect on stocks' returns traded on Muslim Countries' stock market, the structure and volume of the stock market to do sampling is also important. Istanbul Stock Exchange (BIST) has a prominent place in Muslim countries' stock markets in terms of structure, trading volume and deepening. Therefore, in the study, in addition to Istanbul Stock Exchange National 100 (BIST 100) and national 30 (BIST 30) indices, the daily stock data over 4 main and 17 sub-sectors indices in the period of October 2014 and August 1997 were analyzed. As analysis method, GJR-GARCH has been used for analyzing the Ramadan effect on stock returns. This method is preferred, since it is a more convenient analysis tool for the effect of stock anomalies such as Ramadan effect. We believe that this study researching whether there is Ramadan anomaly in Istanbul Stock Exchange's sectors and sub-sectors is the first and the only study and will satisfy the need in the field. We also think that this study will contribute to the field, by widening the time period (1997–2014) of the studies that were made for Istanbul Stock Exchange national index in the past, and by re-

searching through GJR-GARCH model the effects of Ramadan before and after the study's time periods.

Literature Review

Studies analyzing the Ramadan effect on capital markets of Islamic countries are divided into two groups as addressing a single country and addressing several countries. Hussain (1998), Oğuzsoy and Güven (2004), Abraham and Al-Hajji (2005), Mustafa (2011), İkbal *et al.* (2013), Bialkowski *et al.* (2013), Kaya and Kılınç (2014), Halari *et al.* (2015) are the studies analyzing the Ramadan effect in a particular country's capital market. On the other hand, Hajieh *et al.* (2011), Amudhaf (2012), Bialkowski *et al.* (2012) have analyzed the Ramadan effect in a large number of countries. These studies are also varied in terms of the frequency of data (daily, weekly, etc.), to be in the basis of index (national, sectoral, etc.) or stocks.

Pakistan is the subject in the important part of the studies analyzing a specific country. Hussain (1998) has studied the average profitability and profit volatility of the stocks of Pakistan's stock market in the months of Ramadan during 1989–1993 periods. Analysis based on the GARCH method indicated that there is no change in average return, but there is a statistically significant decrease in profit volatility in Ramadan days in the studied period. Mustafa (2011), İkbal *et al.* (2013) Karaçi have analyzed the effect of Islamic calendar on Stock Exchange. Mustafa (2011) has analyzed the effects of Islamic months by using daily data of 1991–2010 periods with the help of ordinary least squares / OLS technique and has found that there is Ramadan effect. Findings of Ikbal *et al.* (2013) that analyze the 1992–2011 period by using the same technique OLS, are in a similar direction. İkbal *et al.* have analyzed the effects of day of the week, month of the year, month-end, half month and Islamic month for daily and weekly data. Their findings show that Ramadan effect is statistically significant. Halari *et al.* (2015) has also analyzed the Karachi Stock Exchange for approximately the same period with the two previous studies. However the findings show some differences. The effect of the Islamic month has been analyzed by TGARCH method in terms of the 106 stocks traded in the market during 1995–2011 periods. The findings show that there are very few monthly anomalies in average return, but high volatility in securities returns.

Turkey is one of the most studied countries in terms of Ramadan effect. This can be attributed to being one of the leading stock market in Islamic countries in terms of trading volume, deepening, variety of products and transactions. Oğuzsoy and Güven (2004) have analyzed the Ramadan effect

on stocks in the Istanbul Stock Exchange for 1988–1999 periods by OLS with dummy method including dummy variables.[1] They have found statistically significant that Istanbul Stock Exchange 100 Index (ISE 100) shows higher returns two days before Feast of Ramadan and the returns of the 17 of 30 stocks in the index of Istanbul Stock Exchange 30 (ISE30) are seven times higher in two days before Feast of Ramadan compared to other day's returns.

Bialkowski *et al.* (2013) have analyzed whether fund managers who invested in stocks in Turkey are taking advantage of the Ramadan effect during the period 2000–2011 by GJR-GARCH methods. They found that national institutional funds, hybrid funds, risk- adjusted returns of foreign Turkish funds are higher in Ramadan month in comparison to rest of the year. However, the national index funds could not obtain higher returns since it is affected adversely from money flow in the month of Ramadan.

Kaya and Kılınç (2014) have analyzed the Ramadan effect on BIST 100 index and the sector indices in 2007: 7–2014: 3 period by using weekly data with time-series techniques such as Granger causality tests and Johansen-Juselius cointegration tests. Ramadan and BIST 100 index was determined to be statistically significant negative relationship, but there was no significant correlation between Ramadan and the sector index.

In the literature, findings of a few studies addressing a number of countries show the existence of Ramadan effect and its significant effects on stock returns. Al-Hajieh *et al.* (2011) have anlyzed the Ramadan effect on Middle Eastern Islamic countries stock markets by the run test for 1992–2007 periods. They attribute the statistically significant and robust effects of Ramadan, usually to investors' positive mood and feelings in the month of Ramadan. Amudhaf (2012) has analyzed the Islamic calendar effect on stock markets of 12 countries for 1996–2007 periods by OLS method. He found that in Jordan, Kuwait, Pakistan and Turkey, stocks have positive and statistically significant returns during Ramadan. Bialkowski *et al.* (2012) have studied the stock returns in the month of Ramadan for 1989-2007 periods in fourteen countries where the majority of Muslims live by t tests. They determined that the stock returns in the month of Ramadan are nine times higher and they are less volatile compared to other months.

Although the findings of the studies addressing a single country or number of countries usually indicate that Ramadan has important effects on stock returns, some studies demonstrate that average returns are not affected in Ramadan, but there is a significant reduction in volatility.

[1] Before the stock exchanges in the capital market in Turkey were gathered under the name of Borsa İstanbul (BIST) in December 30, 2012, Istanbul Stock Exchange was the most important market.

Findings of Hussain (1998) and Halari *et al*. (2015) for Pakistan and findings of Seyyed, Abraham and Al-Hajji'nin (2005) for Saudi Arabia are in this direction.[2] In summary, stocks in the stock market of Islamic countries are generally open to Ramadan effect. But it doesn't affect average returns of some stocks. However, by reducing the volatility of stock returns, it still has positive effect on the market.

Research Methodology

As a method of analysis, GJR-GARCH method developed by Glosten *et al.* (1993). GJR-GARCH is one of the commonly used methods for analyzing the anomalies effecting stock returns.[3] According to empirical observations, negative shocks in t-1 times has affected variance in the t times compared to positive shocks more powerfully. GJR-GARCH model can detect those better than GARCH model. This asymmetry named as leverage effect is based on the idea that the increase in the risk arises from the negative shocks increasing the leverage. The efficient coefficient associated with a negative shock is ($\alpha + \gamma$). Yet, in the financial times series, γ reflects the negative shocks and is statistically significant. (Glosten *et.al*., 1993; Zakoian, 1994; Rapach & Wohar, 2008, p. 387).

In the basis of GJR-GARCH model, there is a return series ($r_t = \mu_t + \varepsilon_t$) consisting of expected return series (μ_t) and zero-mean white noise term (ε_t). $\mu_t = E(r_t|F_{t-1})$ is conditional mean of the time series r_t given the information set F_{t-1} and $\sigma_t^2 = Var(r_t|F_{t-1})$ is the conditional variance. ε_t is the iid innovations with mean zero and variance 1. Although ε_t is serially uncorrelated, it doesn't need to be serially independent. For example, conditional heteroscedasticity may be present. GJR-GARCH model assumes that there is a specific form for this conditional heteroscedasticity. If it is accepted $\varepsilon_t=\sigma_t z_t$ with z_t variance which is assumed as standard Gaussian, it can be said $\varepsilon_t \sim$ GJR-GARCH. This will lead us to the following model:

[2] Abraham ve Al-Hajji who analyzed the data of the returns of Saudi Arabian stok market by GARCH method indicated that average returns are not affected in the month Ramadan but there is a significant decrease in volatility.

[3] Balaban *et al.* (2001), Choudry (2001), Alagidede and Panagiotidis (2006), Li *et al.* (2007), Boujelbene Abes *et al.* (2009), Ayodeji (2010), Dumitriu and Stefanascu (2013), Bampinas *et al.* (2015) are some of the studies that this method were applied to stock anomalies.

$$\sigma_t^2 = \omega + (\alpha + \gamma I_{t-1})\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \tag{1}$$

$$I_{t-1} = \begin{cases} 0 & \text{if } r_{t-1} \geq \mu \\ 1 & \text{if } r_{t-1} < \mu \end{cases}$$

All parameters of model (1), (μ, ω, σ, γ, β) can be estimated with maximum likelihood (ML) estimator simultaneously. Except leptocurtic returns, similar to GARCH Model, GJR-GARCH Model includes stylized facts that reflect the financial time series like volatility clustering. If volatility is high in time t-1, it will likely be higher in time t. Because of this, a shock in time t-1 effects the variance in time t. However, if $\alpha + (\gamma/2) + \beta < 1$, volatility itself returns average (mean reverting) and fluctuates around the square root of the unconditional variance (σ). Unconditional variance can be defined as follows:

$$\sigma^2 := Var(r_t) = \frac{\omega}{1 - \alpha - \frac{\gamma}{2} - \beta} \tag{2}$$

Here, multiplying γ' by ½ comes from the normality assumption of z_t.. Conditional distribution of returns are assumed to be symmetrical around μ.

To explain Ramadan effect on volatility of stock returns, following GJR-GARCH model is estimated:

$$\mu_t = E(r_t \,|\, F_{t-1}) = \lambda_0 + \lambda_1 D_t + \sum_{i=1}^{k} \phi_i (r_{t-i} - \mu_{t-i}) + \sum_{j=1}^{l} \theta_j \varepsilon_{t-j} + \varepsilon_t \tag{3}$$

$$\sigma_t^2 = \omega + \delta D_t + \sum_{i=1}^{p} (\alpha_i + \gamma I_{t-i})\varepsilon_{t-i}^2 + \sum_{j=p+1}^{q} \beta_j \sigma_{t-j}^2 \tag{4}$$

In equation (3), autoregressive moving average process of *k* and *l* order, respectively is modelled. D_t is dummy variable which is 1 in Ramadan period. Return series (r_t) is generally defined as first difference of natural log of stock prices (P_t): $r_t = \ln(P_t') - \ln(P_{t-1})$, where P_t' shows that the stock price is adapted to the capital change in time t (e.g. dividend, rights issues, etc.). Similar to this, conditional variance equation (4) is a linear function of squared errors and variances of p and q order. In this equation D_t reflects the Ramadan effects. All parameters of GJR-GARCH model, where in the equations (3) and (4), estimates simultaneously with ML estimator. But

Quasi-Maximum Likelihood (QML) estimator can be a more accurate choice, even if the true distribution is different, that is still consistent.

Results

The study analyzed the Ramadan effect on the daily stock returns out of 4 main and 17 sub-sector indices in addition to Istanbul Stock Exchange national 100 and national 30 indices in the period of 5 August 1997–24 October 2014. In the first step of the analysis, descriptive statistics of daily stock returns were calculated and presented in Table 1. When variables are positively skewed or skewed to the right, textile, insurance and second national index is negatively skewed or skewed to the left. Additionally, it is seen that variables exhibit leptocurtic distribution. Jarque-Bera tests indicate that all the variables are not normally distributed.

In the second step of the analysis, the stationary of the variables has been tested. For this aim, Dickey-Fuller unit root tests were used and the results are presented in Table 2. It is seen that all variables are stationary.

The third step of the analysis is the estimation of GJR-GARCH model for each variable separately. Basing on this, and by considering the parsimonious principle, GJR-GARCH(1,1) models of variables were estimated separately. Additionally, when deciding mean equations, ARMA(p,q) have been searched and chosen that produces the most significant coefficient value.

Results are presented in Table 3. Conditional normality is not enough to explain high leptocurtosis. Therefore, robust standart errors and quasi-maximum likelihood estimator were implemented (Bollerslev & Wooldridge, 1992).

Since GJR-GARCH model is a special form of GARCH model, validity conditions are highly similar. In addition to well-known conditions such as $\omega > 0$, $\alpha \geq 0$, $\gamma \geq 0$ and $\beta \geq 0$ and $(\alpha + \beta) < 1$, $(\delta + \alpha + \beta) < 1$ it is also analyzed the condition $(\alpha + (\gamma/2) + \beta) < 1$ (See. Table 4).

The provision of this condition shows that volatility in the related model returned to average (mean reversion) and fluctuates around the standard deviation. All models prodive these validity conditions.

Table 1. Descriptive Statistics for Returns

	Mean	**Median**	**Max.**	**Min.**	**Std. Dev.**	**Skewness**	**Kurtosis**	**Jarque-Bera**	**Probability**
BIST 100	0.0012	0.0011	0.1945	-0.1811	0.0252	0.2337	9.0735	6744.01	0.000
BIST 30	0.0013	0.0008	0.1930	-0.1818	0.0265	0.3190	8.4489	5470.25	0.000
BIST Services	0.0011	0.0007	0.1893	-0.1752	0.0236	0.3545	10.5373	10416.87	0.000
BIST Financial	0.0014	0.0009	0.1907	-0.1881	0.0281	0.2758	7.8464	4324.17	0.000
BIST Industrial	0.0011	0.0014	0.1978	-0.1649	0.0219	0.0440	11.1972	12214.01	0.000
BIST All	0.0012	0.0012	0.1934	-0.1787	0.0243	0.1869	9.4508	7588.47	0.000
Sub Sector Indices of BIST									
Banking	0.0015	0.0008	0.1884	-0.1908	0.0300	0.3571	7.3658	3556.87	0.000
Electricity	0.0005	0.0000	0.2152	-0.1800	0.0284	0.3767	9.6354	8105.45	0.000
Leasing	0.0010	0.0003	0.1869	-0.1681	0.0267	0.0888	8.0876	4709.99	0.000
Food Industry	0.0013	0.0012	0.2013	-0.1746	0.0239	0.1031	10.0779	9112.84	0.000
Holding Comp.	0.0013	0.0007	0.1966	-0.1826	0.0276	0.1874	7.9355	4452.79	0.000
Second Nation.	0.0009	0.0006	0.1702	-0.1431	0.0245	-0.0492	8.1787	4876.04	0.000
Paper Industry	0.0011	0.0006	0.1717	-0.1522	0.0254	0.0353	7.9253	4409.97	0.000
Chemistry	0.0011	0.0006	0.2057	-0.1694	0.0252	0.3189	9.0209	6662.56	0.000
Metal.	0.0015	0.0009	0.2192	-0.1874	0.0287	0.2211	7.9526	4493.55	0.000
Manufacturing	0.0013	0.0011	0.1933	-0.1697	0.0256	0.0792	9.0772	6716.98	0.000
Insurance	0.0015	0.0011	0.1882	-0.1955	0.0285	-0.0285	8.1117	4749.66	0.000
Stone Industry	0.0011	0.0013	0.1854	-0.1611	0.0200	0.0600	11.8515	14242.55	0.000
Commerce	0.0014	0.0008	0.1949	-0.1843	0.0249	0.4154	10.5356	10446.07	0.000
Textile	0.0008	0.0016	0.1949	-0.1759	0.0225	-0.3853	11.9239	14581.59	0.000

Table 1 continued

	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Commerce	0.0014	0.0008	0.1949	-0.1843	0.0249	0.4154	10.5356	10446.07	0.000
Textile	0.0008	0.0016	0.1949	-0.1759	0.0225	-0.3853	11.9239	14581.59	0.000
Tourism	0.0008	-0.0003	0.2195	-0.1771	0.0326	0.5906	9.6919	8392.56	0.000
Transportation	0.0013	0.0008	0.2078	-0.1673	0.0279	0.2153	7.5183	3744.21	0.000
Trust Comp.	0.0009	0.0006	0.1951	-0.1775	0.0239	0.2029	12.2641	15628.33	0.000

Descriptive statistics for rate of return of the variables were performed by Eviews 8.1 software.

Source: own calculation.

Table 2. Augmented Dickey Fuller Unit Root Tests for Return Series

	With Constant		With Constant and Trend	
	t Statistic	**Lag***	**t Statistic**	**Lag***
BIST 100	-64.987	0	-65.042	0
BIST 30	-65.135	0	-65.195	0
BIST Services	-64.939	0	-64.986	0
BIST Financial	-64.504	0	-64.503	0
BIST Industrial	-64.463	0	-64.508	0
BIST All	-64.992	0	-65.047	0
Sub Sectors Indices of BIST				
Banking	-64.501	0	-64.555	0
Electricity	-63.172	0	-63.181	0
Leasing	-60.830	0	-60.838	0
Food Industry	-65.959	0	-65.999	0
Holding Comp.	-43.868	1	-43.934	1
Second Nation.	-43.270	1	-62.180	0
Paper Industry	-63.551	0	-63.617	0
Chemistry	-65.468	0	-65.507	0
Metal	-65.472	0	-65.485	0
Manufacturing	-63.119	0	-63.148	0
Insurance	-62.572	0	-62.631	0
Stone Industry	-29.942	3	-62.919	0
Commerce	-65.015	0	-65.054	0
Textile	-61.143	0	-61.144	0
Tourism	-59.423	0	-59.441	0
Transportation	-43.566	1	-43.567	1
Trust Comp.	-60.497	0	-60.531	0
Critical Values:	% 1 -3.431		% 1 -3.960	
	% 5 -2.862		% 5 -3.410	
	% 10 -2.567		% 10 -3.127	

(*) Automatic based on Schwarz information criterion.
(**) MacKinnon (1996) one-sided p values.
Unit root tests were performed with Eviews 8.1 software.

Source: own estimation.

Table 3. GJR-GARCH(1,1) Model Estimations

	$r_t = \lambda_0 + \lambda_1 D_t + \sum_{i=1}^{k} \phi_i r_{t-i} + \sum_{j=1}^{l} \theta_j \varepsilon_{t-j} + \varepsilon_t$					$\sigma_t^2 = \omega + \delta D_t + \sum_{i=1}^{p} (\alpha_i + \gamma I_{t-i}) \varepsilon_{t-i}^2 + \sum_{j=p+1}^{q} \beta_j \sigma_{t-j}^2$				
	λ_0	λ_1	ϕ_1	ϕ_2	θ_1	ω	δ	α_1	γ	β_1
BIST 100	0.001082	0.001094	0.034681			0.000006	-0.000003	0.052221	0.890383	0.079412
	(0.000)	(0.291)	(0.038)			(0.000)	(0.491)	(0.021)	(0.000)	(0.000)
BIST 30	0.001087	0.001314	0.029384			0.000006	-0.000003	0.044554	0.901337	0.072043
	(0.001)	(0.245)	(0.078)			(0.000)	(0.374)	(0.032)	(0.000)	(0.000)
BIST Services	0.000776	0.000966	0.021419			0.000005	-0.000002	0.068571	0.874498	0.090862
	(0.002)	(0.285)	(0.207)			(0.000)	(0.464)	(0.019)	(0.000)	(0.000)
BIST Financial	0.001087	0.001475	0.037261			0.000008	-0.000005	0.038710	0.904268	0.070148
	(0.002)	(0.236)	(0.025)			(0.000)	(0.244)	(0.048)	(0.000)	(0.000)
BIST Industrial	0.001180	0.000388	0.048172	0.033995		0.000007	-0.000002	0.089792	0.841152	0.109228
	(0.000)	(0.625)	(0.007)	(0.063)		(0.000)	(0.530)	(0.011)	(0.000)	(0.000)
BIST All	0.001084	0.001025	0.036759			6.13E-06	-2.46E-06	5.66E-02	8.83E-01	8.39E-02
	(0.000)	(0.298)	(0.028)			(0.000)	(0.491)	(0.017)	(0.000)	(0.000)
Sub Sector Indices of BIST										
Banking	0.001086	0.00203	0.034118			8.68E-06	-5.85E-06	3.57E-02	9.16E-01	5.96E-02
	(0.005)	(0.156)	(0.043)			(0.001)	(0.222)	(0.044)	(0.000)	(0.000)
Electricity	0.000369	-0.00047	0.052134	-0.044092		1.52E-05	-1.56E-05	8.93E-02	8.20E-01	1.46E-01
	(0.272)	(0.182)	(0.005)	(0.029)		(0.001)	(0.001)	(0.010)	(0.000)	(0.000)

Table 3 Continued

	λ_0	λ_1	ϕ_1	ϕ_2	θ_1	ω	δ	α_1	γ	β_1
Leasing	0.001023	0.000213	0.056439	0.031414		2.76E-05	-2.76E-07	4.86E-02	7.85E-01	1.69E-01
	(0.002)	(0.837)	(0.004)	(0.092)		(0.000)	(0.985)	(0.183)	(0.000)	(0.000)
Food Industry	0.001078	0.00016	-0.006924			1.48E-05	3.75E-06	3.12E-02	8.42E-01	1.22E-01
	(0.000)	(0.873)	(0.704)			(0.000)	(0.607)	(0.288)	(0.000)	(0.000)
Holding Comp.	0.00108	0.000326	0.032829	0.030183		9.52E-06	-2.39E-06	4.47E-02	8.66E-01	1.06E-01
	(0.001)	(0.767)	(0.062)	(0.081)		(0.000)	(0.623)	(0.062)	(0.000)	(0.000)
Second National	0.000738	-0.00156	0.080072			1.36E-05	-1.27E-05	7.56E-02	8.29E-01	1.29E-01
	(0.011)	(0.042)	(0.000)			(0.001)	(0.003)	(0.010)	(0.000)	(0.000)
Paper Industry	0.0008	2.96E-05	0.0651			1.54E-05	-7.62E-06	9.64E-02	8.19E-01	0.1246
	(0.011)	(0.977)	(0.001)			(0.000)	(0.116)	(0.003)	(0.000)	(0.000)
Chemistry	0.001021	0.000572	0.539577		-0.519184	1.15E-05	-9.42E-06	0.050616	0.860091	0.102353
	(0.001)	(0.549)	(0.010)		(0.014)	(0.000)	(0.005)	(0.039)	(0.000)	(0.000)
Metal	0.001278	0.00146	0.022812			1.07E-05	-7.11E-07	0.046385	0.867724	1.04E-01
	(0.000)	(0.251)	(0.184)			(0.000)	(0.911)	(0.067)	(0.000)	(0.000)
Manufacturing	0.000969	2.48E-05	0.97259	-0.043872	-0.905141	9.21E-06	-6.24E-06	0.086158	8.60E-01	0.092817
	(0.009)	(0.980)	(0.000)	(0.042)	(0.000)	(0.000)	(0.060)	(0.003)	(0.000)	(0.000)
Insurance	0.001136	-0.00026	0.057842			6.44E-06	-4.09E-07	3.70E-02	8.78E-01	0.10357
	(0.001)	(0.796)	(0.001)			(0.000)	(0.941)	(0.108)	(0.000)	(0.000)

Table 3 Continued

	λ_0	λ_1	ϕ_1	ϕ_2	θ_1	ω	δ	α_1	γ	β_1
Stone Industry	0.000946	0.000811	8.70E-01		-0.820371	1.04E-05	-2.84E-06	8.71E-02	0.788638	1.58E-01
	(0.001)	(0.387)	(0.000)		(0.000)	(0.000)	(0.393)	(0.032)	(0.000)	(0.000)
Commerce	0.001125	-0.00119	9.95E-01		-0.999504	7.65E-06	-6.40E-07	6.00E-02	0.896064	6.35E-02
	(0.000)	(0.213)	(0.000)		(0.000)	(0.000)	(0.872)	(0.023)	(0.000)	(0.000)
Textile	0.00082	-9.36E-05	8.43E-02	0.036249		1.36E-05	-6.55E-06	9.62E-02	0.789873	1.54E-01
	(0.004)	(0.904)	(0.000)	(0.067)		(0.000)	(0.067)	(0.013)	(0.000)	(0.000)
Tourism	2.87E-04	-4.66E-05	0.056519			1.29E-05	-5.00E-06	4.06E-02	8.71E-01	1.08E-01
	(0.441)	(0.966)	(0.003)			(0.000)	(0.479)	(0.125)	(0.000)	(0.000)
Transportation	7.44E-04	2.48E-03	0.039872			2.16E-05	-8.10E-06	4.82E-02	8.76E-01	7.66E-02
	(0.043)	(0.044)	(0.026)			(0.000)	(0.231)	(0.024)	(0.000)	(0.000)
Trust Comp.	4.40E-04	8.96E-04	0.084594			1.08E-05	-9.18E-06	2.80E-02	0.844125	1.43E-01
	(0.119)	(0.221)	(0.000)			(0.002)	(0.010)	(0.438)	(0.000)	(0.000)

p values are given in parentheses. In the estimation process was used QML estimators with robust standart errors (Bolleslev and Wooldridge, 1992). Estimates were performed with Eviews 8.1 software.

Source: own estimation.

Table 4. Validity of Models

	$\omega > 0$	$\alpha \geq 0$	$\beta \geq 0$	$\gamma \geq 0$	$(\alpha + \beta) < 1$	$(\delta + \alpha + \beta) < 1$	$\left(\alpha + \frac{\gamma}{2} + \beta\right) < 1$
BIST 100	✓	✓	✓	✓	0.1316	0.1316	0.5768
BIST 30	✓	✓	✓	✓	0.1166	0.1166	0.5673
BIST Services	✓	✓	✓	✓	0.1594	0.1594	0.5967
BIST Financial	✓	✓	✓	✓	0.1089	0.1089	0.5610
BIST Industrial	✓	✓	✓	✓	0.1990	0.1990	0.6196
BIST All	✓	✓	✓	✓	0.1405	0.1405	0.5822
Sub Sector Indices of BIST							
Banking	✓	✓	✓	✓	0.0953	0.0953	0.5533
Electricity	✓	✓	✓	✓	0.2357	0.2357	0.6456
Leasing	✓	✓	✓	✓	0.2178	0.2178	0.6103
Food Industry	✓	✓	✓	✓	0.1528	0.1528	0.5737
Holding Comp.	✓	✓	✓	✓	0.1508	0.1508	0.5835
Second Nat.	✓	✓	✓	✓	0.2043	0.2043	0.6188
Paper Industry	✓	✓	✓	✓	0.2210	0.2210	0.6304
Chemistry	✓	✓	✓	✓	0.1530	0.1530	0.5830
Metal	✓	✓	✓	✓	0.1507	0.1507	0.5846
Manifacturing	✓	✓	✓	✓	0.1790	0.1790	0.6091
Insurance	✓	✓	✓	✓	0.1405	0.1405	0.5798
Stone Indus.	✓	✓	✓	✓	0.2449	0.2449	0.6392
Commerce	✓	✓	✓	✓	0.1235	0.1235	0.5716
Textile	✓	✓	✓	✓	0.2504	0.2504	0.6454
Tourism	✓	✓	✓	✓	0.1483	0.1483	0.5838
Transportation	✓	✓	✓	✓	0.1248	0.1248	0.5626
Trust Comp.	✓	✓	✓	✓	0.1707	0.1707	0.5927

Source: own estimation.

A diagnostic checking to estimation results was made, and the findings are presented in Table 5. In this context, Ljung-Box tests and Lagrange Multiplier tests were applied to standardized residuals. These tests which are conducted to test whether there are remains of ARCH effect in the estimated model's residuals show that the existence of ARCH effect on return series of Food, Textile, Transportation indices maintains.

In the estimation results presented in Table 3, Ramadan effects were determined on Electricity, Second National, Chemistry, Manifacturing, Textile, Trust Company indices. In all sector's variance equations mentioned above except for the transportation the coefficient reflecting Ramadan effect is significant. However, Ramadan effect coefficient in the mean equations is significant solely in the second national.

Almost all the significant coefficients reflecting Ramadan effects (excluding the coefficient in the mean equations of Transportation model) took negative and near zero (quite small) values.

It can be said that the month of Ramadan has negative effects on stock returns of certain sectors. Generally, these coefficents are being negative and a significant show that month of Ramadan doesn't have any effect. As findings of the researchers such as Hussain (1998), Seyyed *et al*. (2005) and Halari *et al*. (2015) revealed, this situation can be attributed to the fact that the month of Ramadan is reducing the return volatility and lowering the risk. Thus, Ramadan plays a role as a positive shock at time t-1 and reduces the variance in the time t. In the BIST case, the Ramadan effect is usually insignificant in mean equation, whereas being negative and significant in variance equation can mean that although this effect doesn't increase the average returns, it reduces the volatility. Thus, it can be implicitly said that Ramadan effect has a positive reflection on stock returns. As Hajieh *et al.* (2011) stated, this positive effect can be connected to positive mood and feelings of the market participants in Islamic countries in Ramadan. It is highly possible that local market participants stay away from risky trading with these feelings.

However, foreign investors have an important weight in Istanbul Stock Exchange. Sometimes the proportion of foreign investors in the market is able to find 70%. Local market participants retain the stocks quite short time compared to foreign investors. While foreign investors retain a paper traded on Istanbul Stock Exchange on average 350 days, this ratio is about 30-35 days for local investors. It is believed that local investors extend the average stock holding period by concerning to move away from speculative transactions.And this explains why the revenue volatility at least in the analyzed sector stocks decreasres in the market where foreigners have great importance in the month of Ramadan.

Table 5. Diagnostic Checking

	Ljung-Box Tests				LM Tests			
	For standardized residuals		For squared standardized residuals					
	Statistic	p-value	Statistic	p-value	F Statistic	p-value	T*R^2	p-value
BIST 100	18.911	0.026	6.133	0.804	0.612	0.805	6.125	0.805
BIST 30	16.146	0.064	6.138	0.804	0.609	0.808	6.097	0.807
BIST Services	12.882	0.168	13.820	0.181	1.390	0.178	13.887	0.178
BIST Financial	18.797	0.027	6.876	0.737	0.707	0.719	7.078	0.718
BIST Industrial	16.591	0.035	7.723	0.656	0.765	0.663	7.655	0.663
BIST All	20.774	0.014	6.539	0.768	0.654	0.768	6.544	0.768
Sub Sector Indices of BIST								
Banking	14.588	0.103	10.660	0.385	1.082	0.372	10.821	0.372
Electricity	9.483	0.303	10.563	0.393	1.055	0.394	10.551	0.394
Leasing	22.366	0.004	7.006	0.725	0.699	0.726	7.000	0.725
Food Industry	4.487	0.877	19.823	0.003	1.912	0.039	19.085	0.039
Holding Comp.	19.120	0.014	6.635	0.759	0.656	0.766	6.569	0.765
Second Nat.	27.926	0.001	7.615	0.666	0.777	0.652	7.773	0.651
Paper Industry	15.997	0.067	14.614	0.147	1.427	0.161	14.262	0.161
Chemistry	20.383	0.009	9.744	0.463	0.917	0.516	9.173	0.516

Table 5 continued

	Ljung-Box Tests							
	For standardized residuals		For squared standardized residuals		LM Tests			
	Statistic	p-value	Statistic	p-value	F Statistic	p-value	T*R^2	p-value
Metal	17.959	0.036	10.520	0.396	1.022	0.422	10.218	0.422
Manifacturing	16.152	0.024	7.451	0.682	0.708	0.718	7.083	0.718
Insurance	20.539	0.015	15.455	0.116	1.501	0.132	14.995	0.132
Stone Indus.	33.962	0.000	13.282	0.208	1.316	0.215	13.155	0.215
Commerce	11.191	0.191	6.647	0.758	0.663	0.760	6.634	0.760
Textile	13.860	0.085	17.245	0.069	1.774	0.060	17.713	0.060
Tourism	30.187	0.000	12.404	0.259	1.185	0.296	11.845	0.296
Transportation	16.716	0.020	22.031	0.015	2.105	0.021	21.001	0.021
Trust Comp.	30.394	0.000	8.848	0.547	0.870	0.561	8.708	0.560

Tests were performed with Eviews 8.1 software.

Source: own calculation.

Conclusions

Although there are a lot of studies on stock anomalies in the capital market literature, the number of studies on Ramadan anomalies which can be described as Islamic calendar effect is very low. The findings of the studies on this issue reveal that the month of Ramadan is effective on returns of stock prices. In some countries in certain periods or certain stocks, it is observed that Ramadan effect doesn't affect the average returns but still has a positive impact by reducing the return volatility.

In the study, The Istanbul Stock Exchange which has a prominent place among the Muslim countries' stock markets in terms of trading volume and deepening was addressed. In addition to national 100 (BIST 100) and national 30 (BIST 30), 4 main and 17 sub-sector indexes were analyzed for the period of October 2014 and August 1997 in the basis of daily returns. As an analysis method, GARCH technique was used since it is considered to better reflect stock anomalies.

There has been no evidence of the existence of the Ramadan effect on National 100 (BIST100) and national 30 (BIST30) indices. Ramadan effect has been determined in the indices of Electricity, Second National, Chemistry, Manifacturing, Textile, Trust Company. This effect usually observed in variance equation.

However, the existence of Ramadan effect on the mean equations of Second National and Transportation sectors was also observed. Dummy variable reflecting the Ramadan effect gives negative coefficient values in almost all the variance equations and in mean equations except transportation sub- sectors. On the other hand, banking sector model couldn't pass the diagnostic test. Negative coefficient values show that month of Ramadan doesn't have any effect on stock returns. But, as indicated by some earlier research findings, these coefficient values to be significant can be connected to Ramadan's reducing the return volatility and lowering the risk. Thus, the month of Ramadan plays a role as positive shock in time t-1 and decreases the variance in time t. In BIST case, Ramadan effect to be insignificant in mean equation whereas to be negative and significant in variance equation indicates that this effect doesn't increase the average returns but it dicreases the volatility. Actually, by reducing the volatility, Ramadan affects the stock returns indirectly.

It is believed that the decrease of the volatility of sector stocks, as empirical analysis reveals, is because Ramadan has positive effects on the local market participants' good mood and their distance from the speculative actions. In fact, the Istanbul Stock Exchange is a market driven by foreign investors. Foreign weight of the markets is sometimes able to reach

approximately 70%. However, their average stock holding period is quite long compared to local investors. In other words, local investors are acting speculative and making a significant contribution to the market volatility. In the Ramadan, at least in some stock sectors, as local investors stay away from speculations, average time of holding stocks lasts longer. Thus, the volatility of stocks decreases.

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