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Ramadan effect and indices movement estimation: a case study from eight Arab countries

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Abstract

Purpose – This study aims to investigate the Ramadan effect anomaly on the stock markets' indices and estimate the movement of these indices in the light of the phenomenon.

Design/methodology/approach – Stock market indices are used as financial indicators to show the Ramadan effect. To validate this effect, eight Arab countries, which comprises Jordan, Saudi Arabia, Oman, Qatar, United Arab Emirates, Bahrain, Kuwait and Egypt, are adopted. A linear regression with R^2, error, F-value and p-value is considered to analyze and understand the effect of Ramadan on the aforementioned Arab countries.

Findings – Results found that Ramadan has a strong effect on estimating and predicting the performance of stock market indices in all studied Arab countries, except Kuwait. Results found that the majority of the Ramadan effect occurred after the second 10 days of Ramadan, where the direction of stock indices is opposite of Ramadan variables in all aforementioned cases.

Originality/value – This study is considered as an enrichment of the existing literature review with regard to the Ramadan effect. The study presents a new methodology that can be followed to improve the predictions of stock market indices by using a weight least square method with linear regression. This study presents the most affected periods of time that could decrease or increase the stock prices. Finally, the study proves the capability of the weight least square method in building a predictive model that takes the date into consideration in predicting stock market indices.

Keywords Ramadan effect, Stock market prediction, Arab countries, Weight least square

Paper type Research paper

1. Introduction

Several decades ago, traditional finance theories were raised. Studies of these theories have been developed day by day. As time has passed, the traditional finance assumptions have been criticized, as more studies provided various evidence against the sufficiency and efficiency of these theories (Ackert, 2014). Traditional finance comprises many theories; first, Modern Portfolio Theory (MPT) was pioneered by Harry Markowitz in 1958, whereas Rom and Ferguson in 1991 created Post MPT. They depend on the risk-return concept of

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decision-making (Chhatwani, 2019), in which risk-averse investors can create portfolios to improve the expected return based on a certain level of risk (Li, 2019). As studies increased, strong evidence rose to place MPT assumptions under the spotlight, and Zhu *et al.* (2019) proposed a portfolio strategy that significantly outperforms others in extensive evaluation criteria. Chao *et al.* (2019) found that MPT has a special value in the domestic A-share market while it has limitations.

The second theory is the efficient market hypothesis (EMH) developed by Fama in the early 1960s. Then, in 1970, he extended and refined EMH with a definition of three forms of market efficiency, which comprise weak, semi-strong and strong markets. EMH theory discusses the availability of information and its reflection in stock markets, assuming that no time interval has been observed and any costs or restrictions on trading have not existed. The idea of stock market efficiency has caused a huge dispute among investors, as according to (EMH) theory, investors cannot earn any abnormal return in any efficient market, and this assumption contradicts with the reality of having an abnormal return in efficient financial markets. Recent papers have proven the innovation of adaptive market hypotheses (AMH), which provides better financial modeling than EMH (Dhankar, 2019). Although EMH proves that certain levels of expected return can be achieved by bearing an adequate degree of risk, AMH indicates that the ratios of risk/reward may vary by time (Akhter and Yong, 2019). Many researchers have proven the validity of AMH in various markets (Trung and Quang, 2019; Obalade and Muzindutsi, 2020). AMH has a clearer implication for all financial market participants compared with classical EMH, and that AMH clarifies the behavior of calendar effect compared with traditional EMH (Shahid *et al.*, 2019).

With the increasing criticism of many traditional financing theories, as proven by various risk-adjusted returns than expected, behavioral finance has become an important model. Many researchers attempted to solve the puzzle of the link between behavioral and traditional finance (Sedlarski and Georgieva, 2018). One of the interesting points was introduced by Sonjaya and Wahyudi (2016), who considered traditional finance as the core of behavioral finance, while psychology is the expansion of it. Costa *et al.* (2019) discussed that behavioral finance focuses on the study of judgment errors on investment decision-making. Gill *et al.* (2018) defined behavioral finance as open-minded finance, including sociology, psychology and finance.

According to several studies, investors faced a deviation between observed and theoretically expected return, which are known later as anomalies (Ali *et al.*, 2017). Anomalies may happen only once and would vanish, whereas others occur frequently, or continuously. There are plenty of anomalies. The number of noticed anomalies is large and continues to grow.

Scholars have been spending years to capture the answers of why these anomalies do affect the expected returns. Therefore, no clear understanding of which model can interpret or control the effect of these anomalies and what effect these anomalies may have on the expected returns has been observed. This is because market anomalies may change with regard to the economic climate, stock markets, selected sample and time periods which vary among different sectors and so forth (Hasbullah and Masih, 2016).

Behavioral finance provides an explanation of these anomalies and abnormalities using identified psychological, emotional and other social biases (Mnif *et al.*, 2020). Academics mentioned that if one can take an advantage of such anomalies, he/she can earn a superior return (Li *et al.*, 2020). While others have warned investors about this result, these anomalies can be used to outperform the market. Investors should keep in mind that the anomalies may go away and come back with virtually no warnings (Lo, 2019).

Finally, although most researchers consider anomalies as an indicator of inefficient markets, others argued that this conclusion is inappropriate because the problem may take place due to the incorrect equilibrium model used. There are plenty of market anomalies; one

of the most common is the Calendar Anomaly. Calendar anomalies examples include the January Effect, Weekend Effect, October Effect and Ramadan Anomaly, which we are focusing on within this paper.

The Ramadan Anomaly could have a strong effect on market return among various Islamic countries (Munusamy, 2019). Thus, this study is essential, as it provides an opportunity for decision-makers to take the Ramadan effect into account while specifying the investing time. Therefore, as Ramadan has a negative effect, decision-makers could suggest multiple techniques to provide an investor more flexibility in selling and buying stocks, or change the concerned working hours that will improve the trading accessibility for the investors. Moreover, this article may attract higher attention for international and national researchers.

Our contributions in this research are explained as follows:

- lack of studies that take the effect of Ramadan in Gulf countries, Egypt and Jordan into consideration;
- the study presents a new methodology that can be followed to improve predicting a stock market index by using the weight least square method with linear regression;
- the study presents the most affected periods of time (i.e., before, after or within Ramadan) that could decrease or increase stock prices; and
- the study proves the capability of the weight least square method in building a predictive model that can consider the date in predicting a stock index.

This study has seven sections. Section 2 presents the literature review. Section 3 describes the methodology. Section 4 explains the results and discussion, and Section 5 provides the implications. Finally, Section 6 discusses the conclusion and Section 7 discusses the limitations and possible further studies.

2. Literature review

The financial market index is one of the essential macroeconomic indicators that play a vital role in economies. The collaboration between economic and non-economic factors may lead to a strong fluctuation in the stock market index, which makes the prediction of market indices a complicated task (Assous and AL-Najjar, 2021; AL-Najjar and Assous, 2021).

According to the puzzle of the investors' abnormal return, it is considered as an interesting field for researchers. Many studies were conducted to understand the anomalies and the investment decisions related to them thoroughly. Researchers noticed that the investors' behavior among anomaly periods may change over time as the concerned market performance varies. Others have shown that anomalies do not hold up in various sample periods. The Ramadan effect is the most important anomaly compared with other anomalies.

Ramadan is the 9th month of the Islamic calendar, and it is considered as the most important holy month for Muslims, in which fasting and special worship rituals should take place. Ramadan fasting increases humanity's manners, social responsibilities and community services, which are supposed to generate positive moral yields for individuals and society. Ramadan generates an affirmative effect on health and mood, which may increase the tendency to invest and stimulate a profound optimism toward financial market sentiment, where the rational analysis may take a break or at least has low importance among these days (Fernando, 2019). Tan (2017) argued that studying investment decisions based on religious practices and mood is important for economic growth and integration.

Researchers investigated the Ramadan effect on stock return using various levels, wherein some studies were directed to the firm level or index level of one stock market

(Munusamy, 2019; Ahmad and Utami, 2019). Other scholars concentrated on the sectors' level in one stock market (Tan, 2017; AKbalik and Tunay, 2016), whereas most academics were interested in studying the Ramadan effect return among Islamic countries and compared it with other months over time. (Sonjaya and Wahyudi, 2016; Gavriilidis *et al.*, 2016; AL-khazali *et al.*, 2017; AL-Najaf *et al.*, 2018; Andrikopoulos *et al.*, 2020).

By studying many Islamic countries' markets, the Ramadan effect varies among various countries. Sonjaya and Wahyudi (2016) justified this result, by the influential factors that affect one country and do not affect another, examples of these influential factors are the economic status and crisis. The Ramadan effect deviates among countries as the efficiency levels of their markets vary; this makes the opportunities open to achieve probable abnormal returns. Gabbouri (2018) argued that the level of uncertainties has been amplified during the global economic crisis and Arab spring where the investors' behavior seemingly has deviated from rationality Ali *et al.* (2017) found that stock markets are less risky during Ramadan days. Moreover, the Ramadan effect differs according to the size of the firm, as small firms' returns were much higher during Ramadan.

Researchers have studied the Ramadan effect in a specific way, which started by subgrouping Ramadan into three equal periods (10 days each) to understand the effect of each group on stock market returns (Wasiuzzaman and Al-Musehel, 2018; Munusamy, 2019). Stock market activity declines in Ramadan's first days and increases in the last days, The first 10 days showed a negative effect on stock return (Tan, 2017). The explanation for this result is that Muslims, in the early days of Ramadan, need to adapt to fasting, which may outshine the positive emotions aroused by the holy period (Tan and Özlem, 2018). Moreover, the second 10 days have the most negative return compared with the first ones (Al-Hajieh *et al.*, 2011). This may happen due to the daily routine that needs extra time to be finalized and the exhausted physical conditions accompanied by fasting. The last 10 days of Ramadan are the holiest part (Wasiuzzaman and Al-Musehel, 2018; Munusamy, 2019) because Laylat Al-Qadr is included in the past 10 days of Ramadan. Laylat Al-Qadr is considered as the most important day of Ramadan due to the revelation of the *Qur'an* to the Prophet Mohammad (Tan and Özlem, 2018). In addition, Eid Al-Fittir is a Muslim three-day festivity that marks the end of Ramadan and it is the time to give charities to those who are in need and to celebrate the completion of Ramadan with family and friends. Studies found that days after Ramadan would have a positive return (Al-Hajieh *et al.*, 2011; Sonjaya and Wahyudi, 2016; Ali *et al.*, 2017; Tan, 2017; Hassan and Sarker, 2018).

Moving to the Ramadan effect as one month instead of 10-day segregations, researchers have obtained various results in analyzing the whole month effect. These results can be classified into five tracks. First, there is no Ramadan effect on stock market return (Alhor, 2012; Ahmad and Utami, 2019; Hassan and Kaiser, 2019) Second, a significant relationship among Ramadan, stock market return and volatility was observed (Tan, 2017). Third, a positive and significant effect of Ramadan on stocks' returns was observed (Halari *et al.*, 2019; Andrikopoulos *et al.*, 2020). Other researchers found a positive effect on the sectors' index returns, which are tourism, electricity, chemical industry, transportation and services (Tan, 2017). Fourth, many scholars found that returns were smaller in Ramadan days than in other months (Akbalik and Tunay, 2016). Fifth, the working days after Ramadan – which starts after Eid Al-fittir – proved a positive effect on stock returns (Mustafa, 2011; Ali *et al.*, 2017; Tan, 2017; Hassan and Sarker, 2018).

Ramadan has been taken under consideration by many researchers who discussed the consumers' behavior in light of various Islamic marketing strategies. Sandikci and Omeraki (2007) indicated that investment/consumption patterns changed significantly during Ramadan. Odabasi and Argan (2009) found that the month of Ramadan has a profound

social, cultural and economic effect on the daily life of Muslims in Turkey. Kurt and Ozgen (2013) discussed how investment/consumption patterns may differ between urban and rural consumers in the new year and holy feasts and recommended that vendors must work hard for designing good marketing communication strategies. Their results revealed that marketing efforts in rural areas did not show good outcomes, whereas marketing campaigns were fruitful in both urban and rural areas. Krisjanous *et al.* (2021) investigated the challenges accompanied by choosing the successful marketing strategy to be implemented as a solution for special Islamic clothes.

The investors' behavior in financial markets during Ramadan and the whole year depends heavily on the financial decision-making process. Communications are considered as one of the most important aspects, as it involves understanding the complicated financial operational definitions (Hoque *et al.*, 2018; Fang, 2016).

In financial markets, brokerage companies and financial service enterprises have to concentrate on marketing communications activities and communicational channels (i.e. online media, websites) (Kotler *et al.*, 2015) to help investors in their decision-making process from investors' point of view (Petersen *et al.*, 2015; Fang, 2016), and increase the current and potential investors' base from the institutions' point of view (Csikosová *et al.*, 2016). Moreover, when making financial decisions, investors need a wide range of information with regard to the type of securities and financial services available in the market. Having well-informed investors will increase the level of financial service awareness that assists them in taking the correct decision (Petersen *et al.*, 2015). Hoque *et al.* (2018) discussed how financial aspects of Islamic banks (i.e. investors' risk and profit-loss sharing) using various communication channels and marketing strategies may influence the investors' financial decisions.

Petersen *et al.* (2015) mentioned that the investors' financial decisions can be directed through two following types: prevention-focused and promotion-focused. The first type investors' main goal is to mitigate losses and in the second type, the main concern is to maximize their profits. Petersen *et al.* (2015) revealed that investors perceive the marketing of asset and savings accounts to avoid losses as a promotion-focused type, whereas financial marketing efforts are exerted toward inducing customers to adopt or increase the use of liability and spending products as a prevention-focused type.

Moreover, many scholars focused on the importance of financial service marketing and Islamic marketing from many aspects (Kadirov *et al.*, 2020; Butt *et al.*, 2018; Floren *et al.*, 2019; Abbas *et al.*, 2019; Assous *et al.*, 2020). Floren *et al.* (2019) found that Islamic marketing has a significant influence on the main characteristics of Muslim consumers' behavior. Abbas *et al.* (2019) revealed that the customers' satisfaction is affected by Islamic marketing ethics. Kadirov *et al.* (2020) investigated the concept of causality in Islamic marketing. Butt *et al.* (2018) investigated the uniqueness in financial service marketing. Their results indicated that within the target group, the manipulation did result in further favorable attitudes toward the advertisement and attitudes toward the brand of the financial service with medium intensity of religious cues. Abdullahi (2019) investigated the effect of Zakah as one of the social marketing tools.

3. Research methodology

The research methodology is divided into three subsections, which include data description, data collection and multiple linear regression with the weight least square method given in the following subsection.

3.1 Data description

To study Ramadan's effect on Stock Exchange index predictions, eight Arab countries, which comprise Jordan, Saudi Arabia, Oman, Qatar, United Arab Emirates (UAE), Bahrain, Kuwait and Egypt, have been considered. To implement the analysis of the Ramadan effect, researchers rely on Sonjaya and Wahyudi's (2016) methodology and dummy variables. The study divides Ramadan effect into seven models, including index return: without the Ramadan effect, seven days before Ramadan (V1), first 10 days of Ramadan (V2), second 10 days of Ramadan (V3), third 10 days of Ramadan (V4), seven working days after Ramadan (V5), overall Ramadan effect model (V6). To simplify citing the models, each model is given a number from one to seven, as shown in Table 1. For each model, day, month and year besides Ramadan effect variables are used as independent variables, wherein the stock exchange index is used as the dependent variable. Each variable of the Ramadan effect is represented using a dummy variable of either zero or one. One would be assigned if the Ramadan effect existed based on the date, where zero was used for the rest of the sample.

After creating the dummy variables, a regression model is created for each country separately without merging the indices of various countries together. The aim of using linear regression is to understand the effect of the proposed Ramadan effect variables on stock exchange index estimation (movement).

3.2 Data collection

This study considers the exchange indices of eight Arab countries, which include Jordan; one of the strong emerged markets, Egypt with the highest population among all Arab countries; besides GCC (i.e. Saudi Arabia, Oman, Qatar, UAE, Bahrain, Kuwait) as they implement Shariah Law.

The data covered the period from 2008 to 2019. This period includes many market shocks, such as global crises and the Arab spring, which hit Islamic and non-Islamic countries. All stock indices through 12 years are considered without removing any odd values. To ensure the reliability in the collected data, multiple sources are used, namely, stock exchange websites in eight Arab countries and Investing.com, as shown by Assous *et al.* (2020) and Al-Najjar *et al.* (2021). All previous resources are used to ensure that the data sets are trusted to describe the performance of stock markets in the selected countries. The data have been adjusted to match the lunar calendar (Islamic Calendar) and holidays in each country. The lunar year has 12 lunar months and Ramadan is the ninth month of the lunar calendar. The lunar calendar shifts 11 days earlier from each successive solar year.

Ramadan dates are specified from 2008 to 2019. Then, Ramadan variables are created as will be discussed in the next section. The average stock exchange indices in each country are as follows: Bahrain, with an average of 1,295, Jordan with 2301, UAE with 3,861.3, Kuwait

Table 1. Ramadan models description

Model	Independent variables	Dependent variable
Model 1	Year. Month, Day	Stock market indices of Arab countries
Model 2	Year. Month, Day, V1	
Model 3	Year. Month, Day, V2	
Model 4	Year. Month, Day, V3	
Model 5	Year. Month, Day, V4	
Model 6	Year. Month, Day, V5	
Model 7	Year. Month, Day, V6	

with 6,341, Saudi with 7,426, Oman with 7,519, Egypt with 8,690 and the highest is the Qatar index with 9,441 points.

3.3 Multiple linear regression with the weight least square method

The generated models are compared together to extract the best model based on R^2, error function. To verify the effect of adding and removing one dummy variable at a model, an analysis of variance (ANOVA) test was used. The model with the highest R^2 and lowest error function is considered as the best model, and the variables of the best model are considered as the best variables. The dummy variables of each model are assigned as a weight least square of a multiple linear regression model and every time the model is evaluated to determine R^2, Error and F value. The weight least square method aims to adjust the linear regression model to improve the fitting model between the expected and predicted values. The weight least square method is adopted in this study because it exhibited high performance in the literature review. To find a regression equation, the following equation is adopted (Montgomery *et al.*, 2021):

$$Index = \beta_0 * 1 + \beta_1 * v_1 + \beta_2 * v_2 + \ldots\ldots\ldots + \beta_n * v_n + \varepsilon \tag{1}$$

$$Index = \beta * {v_i}^T + \varepsilon \tag{2}$$

where β, ν and ε are coefficients of the variable, the independent variable and epsilon, respectively. T is the transpose for the vector or the matrix, in which $\beta * {v_i}^T$ is the inner product between two vectors β and ν_i with i as a number of variables (Hartshorn, 2017):

$$Index = \beta * V + \varepsilon \tag{3}$$

$$\beta = (V^T V)^{-1} V^T r \tag{4}$$

For V

$$V = \begin{pmatrix} {V_1}^T \\ {V_2}^T \\ . \\ . \\ . \\ {V_n}^T \end{pmatrix} = \begin{pmatrix} 1 & v_{11} & v_{12} & v_{13} & \ldots\ldots & v_{1m} \\ 1 & v_{21} & v_{22} & v_{23} & \ldots.. & v_{2m} \\ 1 & \ldots. & \ldots. & \ldots. & \ldots\ldots & \ldots.. \\ 1 & \ldots. & . & . & \ldots. & . \\ . & \ldots. & \ldots\ldots & \ldots. & \ldots.. & \\ 1 & v_{n1} & . & .. & \ldots. & v_{nm} \end{pmatrix} \tag{5}$$

where n and m are the number of samples and the number of variables, respectively. The resulting models from stepwise methods of linear regression are evaluated using R^2 and error function, aside from ANOVA test, as follows (Al-Rousan *et al.*, 2021; Al-Rousan and Al-Najjar, 2021):

$$R^2 = 1 - \frac{\sum_{i=1}^{N}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{N}(y_i - \bar{y})^2} \tag{6}$$

$$Error = \frac{1}{N}\sum_{i=0}^{N}|y_i - \hat{y}_i| \tag{7}$$

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Therefore, (Miller, 2017):

$$p - value = 2xP(T > t)$$

Where y_1, $\hat{y}_i$, $\bar{y}$ and N are the target and the predicted value, the mean of the target data and the number of samples, respectively. Figure 1 explains the steps that will be used in this study.

4. Results, analysis and discussion

The analysis of Ramadan effect will be divided into five parts: seven days before Ramadan (Model 2), Ramadan ten-days effect (Models 3, 4 and 5), seven working days after Ramadan

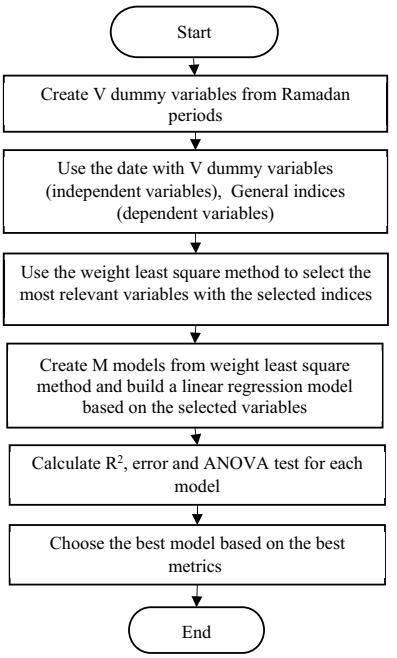

Figure 1.
Flowchart of the proposed methodology

(Model 6), overall Ramadan effect and without Ramadan effect (Models 7 and 1). Finally, the best model among all previous models (from Model 1 to Model 7) will be chosen and considered.

4.1 Jordan

After analyzing the data of the Amman Stock Exchange (ASE) and as shown in Table 2, all seven models have strong R^2 in a range of (0.942–0.973), and all are significant models with P-values less than 0.05, which show error values equal to 572, 545, 533, 420, 461, 407 and 503, respectively.

Studying the seven days before Ramadan shows a significant effect on the ASE index on a daily and monthly basis, while it is insignificant when it is year to year (as shown in Supplementary S.1). Results of the Ramadan ten-day effect was significant on daily basis in the last 10 days of Ramadan (Model 5), while significant on monthly basis in all ten-day models (3, 4 and 5). Year on year has an interesting result as the Ramadan affected the ASE index only in the first and second 10 days of (Model 3 and 4) with PV of each model equal to 0.096 and 0.037, respectively. Seven working days after Ramadan (Model 6) were significant only on a monthly basis. To study the overall effect of Ramadan on ASE, we compared the results with and without the Ramadan effect (Models 7 and 1), wherein results showed that the overall Ramadan effect is significant in all levels, Without the Ramadan effect, the model is insignificant on a daily basis.

According to all tested models, findings show that the Ramadan effect on the month variable is significant in all tested Models (2–7), whereas the day and year variables were significant in Models 2, 5 and 7, as well as models 1, 4 and 7, respectively. The best model with the least error and highest R^2 in all previous significant models is Model 6, which represents seven working days after Ramadan. In Model 6, the month variable is the significant variable with a positive coefficient and strongest effect, this result shows a positive significant Ramadan effect on ASE, for the working days after Ramadan and Eid Al-fittir holidays.

This result is consistent with Tan and Özlem (2018), who proved a positive and significant effect for the second and last 10 days of Ramadan on ASE. Al-Hajieh *et al.* (2011) and Tauraitis and Pukartas (2009) found that the Ramadan effect has a positive effect on the ASE. Many researchers found that the effect of working days after Ramadan and Eid Al-fittir is positive and significant on stock exchange indices. (Ali *et al.*, 2017; Tan, 2017; Hassan and Sarker, 2018).

4.2 Saudi Arabia

Tadawul is the Saudi Stock Exchange. As shown in Table 3, all tested models are strongly significant with *P*-value less than 0.05. R^2 for Models (1–7) are 0.968, 0.992, 0.964, 0.976,

Models	R^2	Error	DF1	DF2	F-value	*P*-value
Model 1	0.942	572	3	2949	15,954.00	0.000
Model 2	0.952	545	3	50.000	329.70	0.000
Model 3	0.953	533	3	81.000	541.67	0.000
Model 4	0.968	420	3	81	805.23	0.000
Model 5	0.964	461	3	70.000	632.86	0.000
Model 6	0.973	407	3	33.000	389.36	0.000
Model 7	0.955	503	3	327.000	2,332.27	0.000

Table 2.
Summary of seven models using weight least square linear regression to study the impact of Ramadan in Jordan

0.994, 0.976, and 0.972, respectively, while the error value for Models 1 to 7 are 1,344, 710, 1,583, 1,198, 584, 1,282 and 1,275, respectively (As shown in Supplementary S.2):

- In Model 2, the effect of the seven days before Ramadan was significant on the Tadawul index on a monthly and yearly basis.
- Testing Ramadan's ten-day effect shows a significant effect on a yearly basis for all models (3, 4 and 5) and on a monthly basis in the second and last 10 days of Ramadan in Models 4 and 5.
- Seven working days after Ramadan (Model 6) was significant only on a yearly basis.
- To study the overall effect of Ramadan on the Tadawul Index, we compared the results with and without the Ramadan effect (Models 7 and 1); findings show that the overall Ramadan model is significant in a monthly and yearly basis, while without Ramadan effect, the model is significant on a daily and yearly basis.
- In all tested models, Ramadan effect is significant on monthly basis in Models 2, 4, 5 and 7 with positive coefficients, while the year variable is significant in all tested models with negative coefficient.
- Model 5 has the highest R^2 and least errors, month variable has the most powerful significant effect with a higher coefficient. Accordingly, a negative Ramadan effect was observed on the Tadawul index in the last 10 days of Ramadan, which is consistent with Al-Hajieh *et al.* (2011), Sonjaya and Wahyudi (2016), and Gavriilidis *et al.* (2016), who proved that the trading volume of the Tadawul Index decreased during Ramadan, in which a negative Ramadan effect on the Tadawul Index was observed and it contradicts with Wasiuzzaman and Al-Musehel (2018). Moreover, investors usually prefer to give up their investment before Eid or festivals due to liquidity issues. This exit strategy may lead to market deterioration, especially when a large number of investors adopted this strategy.

4.3 Oman

The Muscat securities market is the Omani Stock Exchange. As shown in Table 4, all tested models are strongly significant with high R^2 and low error levels for Models 1–7. As shown in Supplementary S.3 model 2, the effect of seven days before Ramadan was significant on all levels, daily, monthly and yearly basis. Testing Ramadan's 10-day effect shows a significant effect on a yearly basis for all 10-day models (Models 3, 4 and 5). However, Models 4 and 5 showed a significant Ramadan effect on the Muscat securities market in the second and last 10 days, tested on a daily and monthly basis. Seven working days after Ramadan (Model 6) were significant only on yearly basis. To study the overall effect of

Table 3.
Summary of seven models using weight least square in Saudi Arabia

Models	R^2	Error	DF1	DF2	F-value	*P*-value
Model 1	0.968	1,344	3	2970	30,267	0.000
Model 2	0.992	710	3	13	559	0.000
Model 3	0.964	1,583	3	32	283	0.000
Model 4	0.976	1,198	3	28	387	0.000
Model 5	0.994	584	3	27	1,511	0.000
Model 6	0.976	1,282	3	22	295	0.000
Model 7	0.972	1,275	3	134	1,556	0.000

Ramadan on the Oman stock market, we compared the results with and without the Ramadan effect (Models 7 and 1), and the findings show that both models are significant on all levels. According to all tested models, the Ramadan effect on a daily basis is significant in Models 1, 2, 4, 5 and 7 with a positive coefficient, whereas the month variable is significant in Models 1, 2, 4, 5 and 7 with a negative coefficient.

Revising all models to choose the best model, we found that Model (4) is the best model according to the highest R^2 and lowest error level. Month variable in this model has the strongest significant negative effect on the Muscat securities market. This result is unlike Al-Hajieh *et al.* (2011), who found that the second 10 days have the most negative returns compared with the first ones in their sample study.

4.4 Qatar

The Qatar Stock Exchange (QSE) is the stock market of Qatar. As shown in Table 5, all tested models are strongly significant with high R^2 for Models (1–7), where the error values are 1,846, 1,325, 1,323, 1,488, 1,423, 1,257 and 1,405, respectively.

As shown in (Supplementary S.4) Model 2:

- The effect of seven days before Ramadan was significant on all levels, daily and yearly variable with positive coefficients, the negative coefficient on the monthly variable.
- Testing the Ramadan days-effect shows a significant effect on a monthly and yearly basis for all 10-day Models (3, 4, and 5), whereas Models 3 and 4 show a significant Ramadan effect on the QSE in the second and last 10 days tested on a daily basis.
- Seven working days after Ramadan (Model 6) were significant on a monthly and yearly basis. To study the overall effect of Ramadan on the QSE, we compared the results with and without the Ramadan effect (Models 7 and 1), wherein findings showed a model with the Ramadan effect (Model 7) is significant in all level,

Models	R^2	Error	DF1	DF2	F-value	*P*-value
Model 1	0.966	1,412	3	2967	28,120	0.000
Model 2	0.991	833	3	18	639	0.000
Model 3	0.968	1,464	3	32	324	0.000
Model 4	0.979	1,137	3	3	522	0.000
Model 5	0.994	595	3	34	1,934	0.000
Model 6	0.984	1,014	3	21	418	0.000
Model 7	0.978	1,139	3	150	2,247	0.000

Table 4. Summary of seven models using weight least square in Oman

Models	R^2	Error	DF1	DF2	F-value	*P*-value
Model 1	0.963	1,846	3	3001	26,207	0.000
Model 2	0.982	1,325	3	53	989	0.000
Model 3	0.982	1,323	3	82	1,473	0.000
Model 4	0.977	1,488	3	81	1,125	0.000
Model 5	0.979	1,423	3	74	1,138	0.000
Model 6	0.984	1,257	3	28	560	0.000
Model 7	0.979	1,405	3	330	5,054	0.000

Table 5. Summary of seven models using weight least square in Qatar

whereas without the Ramadan effect, Model 1 was only significant on a yearly basis.

- According to all tested models, the Ramadan effect on a daily and monthly basis is significant in Models 3, 4 and 7 with a negative coefficient, whereas the yearly variable is significant in all models with a positive coefficient. Revising all models, Model (6), which represents the seven working days after Ramadan and Eid Al-fittir holidays, is the best model that reflects a negative Ramadan effect on QSE. This result is partially consistent with Ali *et al.* (2017), Tan (2017) and Mustafa (2011), who concluded that the effect of working days after Eid Al-fittir is positive and significant on stock exchange indices. While our result contradicts with Tan and Özlem (2018) and Al-Hajieh *et al.* (2011), who found that the QSE recorded the highest ratio of returns during Ramadan days.

4.5 United Arab Emirates

The UAE has three main stock markets (i.e. the Dubai Financial Market, NASDAQ Dubai and Abu Dhabi Securities Exchange [ADSE]). In our study, we are using the ADSE as a proxy of UAE stock markets. ADSE is the Stock market of Abu Dhabi. All tested models, as shown in Table 6, are strongly significant with *P*-value less than 0.05. R^2 values are 0.938, 0.978, 0.975, 0.974, 0.977, 0.981 and 0.973, whereas error values are 991, 620, 652, 652, 628, 576 and 662, respectively.

As shown in (Supplementary S.5) Model 2:

- The effect of seven days before Ramadan was significant on the ADSE index on a monthly and yearly basis.
- Testing Ramadan's ten-day effect shows a significant effect on a month and year basis for all 10-day models (3, 4 and 5), whereas Models 3 and 4 show a significant Ramadan effect on (ADSE) in the first and second 10 days on a daily basis.
- Seven working days after Ramadan (Model 6) were significant only on a monthly and yearly basis.
- To study the overall effect of Ramadan on (ADSE), we compared the results with and without the Ramadan effect (Models 7 and 1), wherein findings show that the overall Ramadan model is significant in all levels, whereas without the Ramadan effect, the model is significant only on yearly basis.
- According to all tested models, the Ramadan effect is significant in all models except Model 1. Model 6; the highest R^2 and least error – represents the seven working days after Ramadan is the best model with a negative Ramadan effect on (ADSE) using a month-on-month variation. This result is consistent with Alatiyat (2014), who found a

Table 6.
Summary of seven models using weight least square in UAE

Models	R^2	Error	DF1	DF2	F-value	*P*-value
Model 1	0.938	991	3	2,984	15,128	0.000
Model 2	0.978	620	3	53	775	0.000
Model 3	0.975	652	3	82	1,047	0.000
Model 4	0.974	652	3	81	1,012	0.000
Model 5	0.977	628	3	65	911	0.000
Model 6	0.981	576	3	39	661	0.000
Model 7	0.973	662	3	332	3,982	0.000

negative Ramadan effect on a number of commercial banks listed in ADSE. However, both Al-Hajieh *et al.* (2011) and Tauraitis and Pukartas (2009) recorded a significant increase in UAE exchange index return during Ramadan.

4.6 Bahrain

Bahrain Bourse is the Bahraini Stock Exchange, in which all models' R^2 is higher than 0.99 and the error for all models is less than 124, as shown in Table 7. Moving to Supplementary S.6, it shows that all models were insignificant with *P*-value higher than 0.05 on a daily and monthly basis.

According to all tested models, the best model is Model 6, which represents the seven working days after Ramadan. Ramadan has an insignificant negative effect on predicting the stock market index in Bahrain Bourse, as the month variable (which has the largest coefficient) is insignificant. However, Al-Hajieh *et al.* (2011) and Tan and Özlem (2018) found a significant and negative Ramadan effect on Bahrain Bourse.

4.7 Kuwait

Boursa Kuwait is the Kuwaiti Stock Exchange. All tested models are strongly significant with high R^2, reasonable error term and *P*-value less than 0.05, as shown in Table 8.

As shown in Supplementary S.7 Model 2, we can see the following:

- The effect of the seven days before Ramadan was significant on the Boursa Kuwait index on a monthly and yearly basis with positive coefficients.
- Testing Ramadan's ten-day effect shows a significant effect on a month and year basis for all ten-day models (3, 4 and 5) with a positive coefficient.
- Seven working days after Ramadan (Model 6) were significant only on a yearly basis.

Models	R^2	Error	DF1	DF2	F-value	*P*-value
Model 1	0.990	131	3	2,366	77,581	0.000
Model 2	0.993	116	3	44	1,942	0.000
Model 3	0.992	116	3	67	2,883	0.000
Model 4	0.991	123	3	69	2,657	0.000
Model 5	0.992	118	3	58	2,484	0.000
Model 6	0.993	114	3	23	1,146	0.000
Model 7	0.992	118	3	273	11,180	0.000

Table 7. Summary of seven models using weight least square in Bahrain

Models	R^2	Error	DF1	DF2	F-value	*P*-value
Model 1	0.985	792	3	2320	49,689	0.000
Model 2	0.984	826	3	45	931	0.000
Model 3	0.985	799	3	67	1,442	0.000
Model 4	0.982	861	3	69	1,270	0.000
Model 5	0.982	861	3	56	1,034	0.000
Model 6	0.982	903	3	29	536	0.000
Model 7	0.983	838	3	278	5,268	0.000

Table 8. Summary of seven models using the weight least square in Kuwait

- The overall effect of the Ramadan on Boursa Kuwait is found by comparing the results with and without the Ramadan effect Models (7 and 1), in which findings revealed that the overall Ramadan Model (7) is significant on monthly and yearly levels, while without the Ramadan effect, Model 1 is significant only on a yearly basis.
- Comparing models between each other showed that Model 1 is the best model based on R^2 and errors. Monthly basis is the most effective coefficient, but with an insignificant model. As a result, there is an insignificant Ramadan effect on Boursa Kuwait, as Model 1 represents without the Ramadan effect model. Our results of the insignificant Ramadan effect on Boursa Kuwait contradict with both Al-Hajieh *et al.* (2011) and Sonjaya and Wahyudi (2016) significant results. As Al-Hajieh *et al.* (2011) and Sonjaya and Wahyudi (2016) findings revealed negative and positive significant Ramadan effects on Boursa Kuwait, respectively.

4.8 Egypt

The Egyptian Exchange is the Egyptian stock market, in which all tested models' *P*-value, R^2 values and error terms are shown in Table 8. As shown in Supplementary S.8 Model 2, the effect of the seven days before Ramadan had a significant effect on the Egyptian Exchange index on a monthly and yearly basis. Testing Ramadan's days effect shows a significant effect on a monthly and yearly basis for all 10 day-models (Models 3, 4 and 5), whereas Model 4 shows a significant and negative Ramadan effect on the Egyptian Exchange in the second 10 days on a daily basis.

Seven working days after Ramadan (Model 6) were significant only on a monthly and yearly basis. To study the overall effect of Ramadan on the Egyptian Exchange, we compared the results with and without the Ramadan effect (Models 7 and 1), in which findings show that the overall Ramadan model is significant in all levels, while without the Ramadan effect, Model 1 is significant on a monthly and yearly basis.

According to all tested models, the Ramadan effect on a monthly and yearly basis is significant in all models, while the daily variable is significant in Models 4 and 7 with a negative coefficient. Revising all models, Model (6) is the best model, which represents the seven working days after Ramadan and Eid Al-fitir. It reflects that there is a negative Ramadan effect on the Egyptian Exchange. This result is consistent with Al-Hajieh *et al.* (2011) and Gavriilidis *et al.* (2016), who found a significant negative Ramadan effect on the Egyptian exchange. Ali *et al.* (2017) found that the period after Ramadan and Eid Al-fitir is significant in stock markets. However, Tauraitis and Pukartas (2009) noticed that the Egyptian exchange index showed a significant increase during Ramadan. They stated that active trading strategies can theoretically be profitably exploited on a risk-adjusted basis in Egypt. Moreover, Tan and Özlem (2018) showed a significant and positive effect for the past 10 days of Ramadan (Table 9).

4.9 Comparison

Table 10 shows the effect of Ramadan in predicting stock exchange indices in Arab countries, which include Jordan, Saudi Arabia, Oman, Qatar, UAE, Bahrain, Kuwait and Egypt. Results show that the Amman, Qatar and ADSE offices, Bahrain bourse and Egyptian exchange achieved the highest prediction results when Model 6 is used. The Muscat securities exchange and Tadawul achieved the highest prediction results when Models 5 and 4 are used, respectively. However, Kuwait's exchange office showed the best

model using Model 1 (without the Ramadan effect), wherein no improvement was shown when the Ramadan effect variables were used.

Results revealed that the Ramadan effect has a role in predicting stock exchange indices of Arab countries except Kuwait. The best improvement is found after the second 10 days of Ramadan, as Al-Hajieh *et al.* (2011) have proven. Results found that the day of the month has no effect on the performance improvement of prediction models.

Finally, the results provided an indication that trading in Ramadan has a negative direction on stock exchange index movement in five out of eight Arab countries, which indicates that Ramadan decreases the trading processes in Arab countries (Akbalik and Tunay, 2016; Hassan and Kayser, 2019). The results can be interpreted by many facts concerning the holy month of Ramadan, in which the number of working hours is decreased, Muslims investors are more linked to worshipping (praying and reading the Holy *Quran*) because the worship is the main activity of this month. There are plenty of religious events within these holy days and no extra time to invest (Al-Khazali *et al.*, 2017). Moreover, Arab exchange markets may vary in many characteristics, one of which is the efficiency level, which differs from one exchange office to another (Shahid *et al.*, 2019). Moreover, the existence of economic crises from 2008 onward affects both Arab countries and the whole world (i.e. Arab spring, the subprime crisis). Finally, working days after Ramadan and Eid El-fitir has a positive effect on the stock index (Ali *et al.*, 2017; Tan, 2017; Hassan and Sarker, 2018).

This result contradicts other researchers who proved the positive Ramadan effect (Al-Ississ, 2015; Ali *et al.*, 2017; Wasiuzzaman and Al-Musehel, 2018). They justified this by the heterogeneity of worship intensity during Ramadan, as well as the happiness and optimism of investors achieving excess returns in trading activities.

Models	R^2	Error	DF1	DF2	F-value	*P*-value
Model 1	0.848	3,684	3	2899	5,390	0.000
Model 2	0.928	2,666	3	52	222	0.000
Model 3	0.925	2,630	3	83	340	0.000
Model 4	0.928	2,640	3	77	329	0.000
Model 5	0.922	2,647	3	69	271	0.000
Model 6	0.942	2,311	3	33	271	0.000
Model 7	0.920	2,689	3	326	1,245	0.000

Table 9. Summary of seven models using weight least square in Egypt

Country	Best model	R^2	Error	F-value	Significant variables
Jordan	6	0.973	407	389	Month
Saudi Arabia	5	0.993	584	1,511	Month, Year
Oman	4	0.994	595	1,934	Day, Month, Year,
Qatar	6	0.982	1,257	1,138	Month, Year
UAE	6	0.981	576	661	Month, Year
Bahrain	6	0.993	114	1,146	Year
Kuwait	1	0.985	792	49,688	Year
Egypt	6	0.942	2,311	177	Month, Year

Table 10. Comparison between the best results of the Ramadan effect on stock exchange prediction in various Arab countries

5. Research implications

In this section, the theoretical and practical implications of the research will be discussed and explained in detail.

5.1 Practical implications

This paper helped investors in all financial markets to benefit from the conclusion of this study depending on their country, in which they can predict the general index before, during and after Ramadan. Hence, it shapes a good opportunity for all existing and potential investors to predict the financial markets movement and gain excess returns over their investments. Moreover, regulatory bodies may take an advantage of predicting its financial market index before, during and after Ramadan as an early alert of any fluctuations in the market, which will facilitate the surveillance actions of these regulatory bodies on all firms listed at the financial markets. All findings are expected to enhance the soundness of the market and the stability of the economy.

5.2 Theoretical implications

This study presents extra evidence to the benefit of the AMH that the anomalies and abnormal returns exist in financial markets. This contradicts with the well-known EMH. This paper is an enhancement to the existing literature on behavioral finance that provides an explanation of these anomalies and abnormalities that investors can use to outperform the market. The results are consistent with many literature papers in the field that showed a significant effect of Ramadan on stock markets, as shown by Al-Hajieh *et al.* (2011), Akbalik and Tunay (2016), Gavriilidis *et al.* (2016), Sonjaya and Wahyudi (2016); Tan, 2017; Tan and Özlem (2018); Wasiuzzaman and Al-Musehel (2018), Hassan and Kayser (2019), Halari *et al.* (2019) and Andrikopoulos *et al.* (2020). The study showed that Ramadan has an effect on predicting stock market index in all countries under this study, except for Kuwait. We believe that our methodology offers a new way of analyzing the Ramadan effect with seven models for each country. This study is the first to divide the period of the study into days before, days during and days after Ramadan. This is the first time that the effect of Ramadan on the country's financial market base has been studied.

6. Conclusion

Based on various statistical tests and analysis, this study found that the effect of Ramadan is one of the anomalies that can have a strong effect in predicting stock markets in different Arab countries. This study considered eight Arab countries, which comprised Jordan, Saudi Arabia, Oman, Qatar, UAE, Bahrain, Kuwait and Egypt, to investigate the effect of Ramadan on stock market indices. To show the effect of Ramadan, seven models are adopted, including those without the Ramadan effect, seven days before Ramadan, first 10 days of Ramadan, second 10 days of Ramadan, third 10 days of Ramadan, seven working days after Ramadan and the overall Ramadan effect. A linear regression model was adopted as a regression model to investigate the effect of predicting the movement of a stock index. The results found that the month of Ramadan has an effect on predicting the stock market index in all countries surveyed with the exception of Kuwait. Hence, the R^2 and error terms are improved when Ramadan variables are taken under consideration. In addition, the effect of Ramadan is strongly shown after the second 10 days of Ramadan. This conclusion is consistent with many literature papers in the field that showed the significant effect of Ramadan on financial sectors.

Finally, researches have studied the effect of Ramadan for the whole month and after Ramadan on market return (Ali *et al.*, 2017; Tan, 2017). Results of the Ramadan effect on market return may vary between positive and negative effects. Researchers found justified

negative effect as decreasing working hours, hunger feeling and the requested worships through Ramadan, all these factors may lead to negative results (Akbalik and Tunay, 2016; Hassan and Kaiser, 2019). However, some researchers found a positive effect, as Ramadan is associated with many spiritual principles, including fasting and the Tarawih prayer, which makes the Muslims' investors more optimistic, happier and healthier during Ramadan.

7. Limitations and future research guidance

This study aims to show the effect of Ramadan on eight Arab countries by using linear regression models. Unfortunately, the limitations of this study can be summarized as follows:

- only Arab countries are included in the study and no Islamic countries are studied;
- only a linear regression model is used with the input factors; and
- the study uses only the Ramadan as an anomaly factor to study its effect on the stock market, without connecting it with other factors, such as Zukah and Umrah.

Therefore, future studies can be conducted in other Muslim-majority countries, such as Indonesia, Malaysia and Brunei, which definitely have significant influences on the global Muslim market, according to the Global Islamic Economy Report 2019/2020. Other non-linear models, such as the non-linear neural network model and support vector regression, can be used to improve the performance of the prediction model and study the effect of Ramadan and other anomalies on stock markets.

References

Abbas, A., Nisar, Q.A., Mahmood, M.A.H., Chenini, A. and Zubair, A. (2019), "The role of Islamic marketing ethics towards customer satisfaction", *Journal of Islamic Marketing*, Vol. 11 No. 4, pp. 1001-1018.

Abdullahi, S.I. (2019), "Zakah as tool for social cause marketing and corporate charity: a conceptual study", *Journal of Islamic Marketing*, Vol. 10 No. 1, pp. 191-207.

Ackert, F. (2014), "Traditional and behavioral finance", *Investor Behavior – The Psychology of Financial Planning and Investing*, Chapter 2: Traditional and Behavioral Finance, pp. 25-41, doi: 10.1002/9781118813454.ch2.

Ahmad, B.G.S. and Utami, W. (2019), "A study of ramadan effect on the Indonesia stock exchange", *Management and Entrepreneurship: Trends of Development*, Vol. 4 No. 10, pp. 67-78.

Akbalik, M. and Tunay, K.B. (2016), "An analysis of Ramadan effect by GJR-GARCH model: case of Borsa Istanbul", *Oeconomia Copernicana*, Vol. 7 No. 4, pp. 593-612.

Akhter, T. and Yong, O. (2019), "Adaptive market hypothesis and momentum effect: evidence from Dhaka stock exchange", *Cogent Economics and Finance*, Vol. 7 No. 1, pp. 1-20.

Alatiyat, M. (2014), "Ramadan Effect on UAE Stock Market-Banks Sector", *British University in Dubai*.

Al-Hajieh, H., Redhead, K. and 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*, Vol. 25 No. 3, pp. 345-356.

Alhor, M. (2012), "The impact of the Islamic month of Ramadan on Turkish financial markets", *Erasmus University Rotterdam*.

Ali, I., Akhter, W. and Ashraf, N. (2017), "Impact of Muslim holy days on Asian stock markets: an empirical evidence", *Cogent Economics and Finance*, Vol. 5 No. 1, pp. 1-10. 1311096.

Al-Ississ, M. (2015), "The holy day effect", *Journal of Behavioral and Experimental Finance*, Vol. 5, pp. 60-80.

Al-Khazali, O., Bouri, E., Roubaud, D. and Zoubi, T. (2017), "The impact of religious practice on stock returns and volatility", *International Review of Financial Analysis*, Vol. 52, pp. 172-189.

Al-Najaf, F.A.S.I., Salehi, M. and Al-Maliki, H.S.N. (2018), "The effect of Islamic sacred months on stock prices in Iran and Iraq stock exchanges", *ISRA International Journal of Islamic Finance*, Vol. 10 No. 1, pp. 111-119.

Al-Najjar, D. and Assous, H.F. (2021), "Key determinants of deposits volume using CAMEL rating system: the case of Saudi banks", *PLoS One*, Vol. 16 No. 12, p. e0261184, doi: /10.1371/journal. pone.0261184.

Al-Najjar, H., Al-Rousan, N., Al-Najjar, D., Assous, H.F. and Najjar, D. (2021), "Impact of COVID-19 pandemic virus on G8 countries' financial indices based on artificial neural network", *Journal of Chinese Economic and Foreign Trade Studies*, Vol. 14 No. 1, pp. 89-103.

Al-Rousan, N. and Al-Najjar, H. (2021), "Optimizing the performance of MLP and SVR predictors based on logical oring and experimental ranking equation", *Journal of the Chinese Institute of Engineers*, pp. 1-9.

Al-Rousan, N., Al-Najjar, H. and Alomari, O. (2021), "Assessment of predicting hourly global solar radiation in Jordan based on rules, trees, Meta, lazy and function prediction methods", *Sustainable Energy Technologies and Assessments*, Vol. 44, p. 100923.

Andrikopoulos, P., Cui, Y., Gad, S. and Kallinterakis, V. (2020), "Feedback trading and the Ramadan effect in frontier markets", *Research in International Business and Finance*, Vol. 51, p. 101085.

Assous, F.H. and Al-Najjar, D. (2021), "Consequences of COVID-19 on banking sector index: artificial neural network model", *International Journal of Financial Studies*, Vol. 9 No. 4, p. 67.

Assous, H., Al-Rousan, N., Al-Najjar, D. and Al-Najjar, H. (2020), "Can international market indices estimate TASI's movements? The ARIMA model", *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 6 No. 2, pp. 1-17.

Butt, M.M., de-Run, E.C., Ammen, U.D. and Mutum, D. (2018), "Religious symbolism in Islamic financial service advertisements", *Journal of Islamic Marketing*, Vol. 9 No. 2, pp. 384-401.

Chao, X., Tao, X. and Zeng, L. (2019), "Application of Markowitz's portfolio theory in obtaining the best portfolio in the stock market", *In The First International Symposium on Management and Social Sciences (ISMSS 2019)*, Atlantis Press.

Chhatwani, N. (2019), "Reflections on theories of market efficiency", *Journal of Public Affairs*, Vol. 19 No. 4, p. e1947.

Costa, D.F., Carvalho, M. and Moreira, M. (2019), "Behavioral economics and behavioral finance: a bibliometric analysis of the scientific fields", *Journal of Economic Surveys*, Vol. 33 No. 1, pp. 3-24.

Csikosová, A., Culková, K. and Janošková, M. (2016), "Evaluation of quantitative indicators of marketing activities in the banking sector", *Journal of Business Research*, Vol. 69 No. 11, pp. 5028-5033.

Dhankar, S. (2019), "Adaptive markets hypothesis", *In Risk-Return Relationship and Portfolio Management*, Springer, New Delhi, pp. 293-305.

Fang, E.S. (2016), "Three decades of "repackaging" Islamic finance in international markets", *Journal of Islamic Marketing*, Vol. 7 No. 1, pp. 37-58.

Fernando, H.A., Zibellini, J., Harris, R.A., Seimon, R.V. and Sainsbury, A. (2019), "Effect of Ramadan fasting on weight and body composition in healthy non-athlete adults: a systematic review and Meta-analysis", *Nutrients*, Vol. 11 No. 2, pp. 1-24, 478.

Floren, J., Rasul, T. and Gani, A. (2019), "Islamic marketing and consumer behaviour: a systematic literature review", *Journal of Islamic Marketing*, Vol. 11 No. 6, pp. 1557-1578.

Gabbouri, D. (2018), "The impact of Islamic events on herding behaviour in Saudi Arabia financial market", *European Financial Management Association, Annual Meeting*, Milan, 2018.

Gavriilidis, K., Kallinterakis, V. and Tsalavoutas, I. (2016), "Investor mood, herding and the Ramadan effect", *Journal of Economic Behavior and Organization*, Vol. Vol. 132, pp. 23-38.

Gill, R.K., Gill, R.B.R.K. and Bajwa, R. (2018), "Study on behavioral finance, behavioral biases, and investment decisions", *International Journal of Accounting and Financial Management Research*, Vol. 8 No. 3, pp. 1-14.

Halari, A., Helliar, C., Power, D.M. and Tantisantiwong, N. (2019), "Taking advantage of Ramadan and January in Muslim countries", *The Quarterly Review of Economics and Finance*, Vol. 74, pp. 85-96.

Hartshorn, S. (2017), *Linear Regression and Correlation: A Beginner's Guide*, Amazon digital services LLC.

Hasbullah, F. and Masih, M. (2016), "Fast profits in a fasting month? A Markov regime switching approach in search of Ramadan effect on stock markets", *MPRA Paper 72149*, University Library of Munich, Germany.

Hassan, M.H. and Kayser, M.S. (2019), "Ramadan effect on stock market return and trade volume: evidence from Dhaka stock exchange (DSE)", *Cogent Economics and Finance*, Vol. 7 No. 1, p. 1605105, doi: 10.1080/23322039.2019.1605105.

Hassan, H. and Sarker, A. (2018), "Holiday effect on stock market return: evidence from Dhaka stock exchange (DSE)",

Hoque, M.E., Hashim, N.M.H.N. and Azmi, M.H.B. (2018), "Moderating effects of marketing communication and financial consideration on customer attitude and intention to purchase Islamic banking products", *Journal of Islamic Marketing*, Vol. 9 No. 4, pp. 799-822.

Kadirov, D., Bahiss, I. and Bardakcı, A. (2020), "Causality in Islamic marketing research", *Journal of Islamic Marketing*, Vol. 12 No. 2, doi: 10.1108/JIMA-05-2019-0113.

Kotler, P., Burton, S., Deans, K., Brown, L. and Armstrong, G. (2015), "Marketing", *Pearson Higher Education AU*.

Krisjanous, J., Allayarova, N. and Kadirov, D. (2021), "Clothing of righteousness: exploring tensions of halal maternity wear on online apparel websites", *Journal of Islamic Marketing*, Vol. 13 No. 5, doi: 10.1108/JIMA-03-2020-0080.

Kurt, S.D. and Ozgen, O. (2013), "The meanings, rituals and consumption patterns of holy feast and new year in Turkey", *Journal of Islamic Marketing*, Vol. 4 No. 1, pp. 64-79.

Li, Z. (2019), "The theory and empirical research of risk measuring method statistics and portfolio model", *International Conference on Management, Finance and Social Sciences Research (MFSSR 2019)*, Francis Academic Press, UK, doi: 10.25236/mfssr.2019.082.

Li, Q., Tan, J., Wang, J. and Chen, H. (2020), "A multimodal event-driven LSTM model for stock prediction using online news", *IEEE Transactions on Knowledge and Data Engineering*, Vol. 33 No. 10, doi: 10.1109/TKDE.2020.2968894.

Lo, A.W. (2019), *Adaptive Markets: Financial Evolution at the Speed of Thought*, Princeton University Press.

Miller, S.J. (2017), *The Probability Lifesaver: All the Tools You Need to Understand Chance*, Princeton University Press.

Mnif, E., Jarboui, A., Hassan, M.K. and Mouakhar, K. (2020), "Big data tools for ISLAMIC financial analysis", *Intelligent Systems in Accounting, Finance and Management*, Vol. 27 No. 1, pp. 10-21.

Montgomery, D.C., Peck, E.A. and Vining, G.G. (2021), *Introduction to Linear Regression Analysis*, John Wiley and Sons.

Munusamy, D. (2019), "Does Ramadan influence the returns and volatility? Evidence from shariah index in India", *Journal of Islamic Accounting and Business Research*, Vol. 10 No. 4, pp. 565-579.

Mustafa, K. (2011), "The Islamic calendar effect on Karachi stock market", *Global Business Review*, Vol. 13 No. 3, pp. 562-574.

Obalade, A. and Muzindutsi, F. (2020), "Validating the adaptive market hypothesis in the Tunisian stock market", *International Journal of Trade and Global Markets*, Vol. 13 No. 1, pp. 42-51.

Odabasi, Y. and Argan, M. (2009), "Aspects of underlying Ramadan consumption patterns in Turkey", *Journal of International Consumer Marketing*, Vol. 21 No. 3, pp. 203-218.

Petersen, J.A., Kushwaha, T. and Kumar, V. (2015), "Marketing communication strategies and consumer financial decision making: the role of national culture", *Journal of Marketing*, Vol. 79 No. 1, pp. 44-63.

Sandikci, O. and Omeraki, S. (2007), "Islam in the marketplace: does Ramadan turn into Christmas?", *Advances in Consumer Research*, Vol. 34.

Sedlarski, T. and Georgieva, G. (2018), "Towards behavioral finance theory", *Yearbook of St Kliment Ohridski University of Sofia, Faculty of Economics and Business Administration*, Vol. 15 No. 1, pp. 207-241.

Shahid, M.N., Sattar, A., Aftab, F., Saeed, A. and Abbas, A. (2019), "Month of Ramadan effect swings and market becomes adaptive", *Journal of Islamic Marketing*, Vol. 11 No. 3, pp. 661-685.

Sonjaya, A.R. and Wahyudi, I. (2016), "The Ramadan effect: illusion or reality?", *Arab Economic and Business Journal*, Vol. 11 No. 1, pp. 55-71.

Tan, Ö.F. (2017), "Ramadan effect: evidence from borsa Istanbul", *M U Iktisadi ve Idari Bilimler Dergisi*, Vol. 39 No. 1, pp. 239-256.

Tan, Ö.F. and Özlem, Ş. (2018), "Ramadan effect on stock markets", *Journal of Research in Business*, Vol. 1 No. 3, pp. 77-98.

Tauraitis and Pukartas (2009), "Stock market efficiency and rationality of investors' behavior in Islamic countries: Ramadan effect", *Cogent Economics and Finance*, Vol. 7 No. 1, doi: 10.1080/23322039.2019.1605105.

Trung, P.T. and Quang, P. (2019), "Adaptive market hypothesis: evidence from the Vietnamese stock market", *Journal of Risk and Financial Management*, Vol. 12 No. 2, pp. 1-16.

Wasiuzzaman, S. and Al-Musehel, N.A. (2018), "Mood, religious experience and the Ramadan effect", *International Journal of Emerging Markets*, Vol. 13 No. 1, pp. 290-307.

Zhu, M., Zheng, X., Wang, Y., Li, Y. and Liang, Q. (2019), "Adaptive portfolio by solving multi-armed bandit via Thompson sampling", arXiv:1911.05309.

Further reading

Kok, S.K. (2020), "The branding of religious financial institutions in the UK: conversations with market actors within the Islamic financial sector", *Journal of Islamic Marketing*, Vol. 12 No. 4, doi: 10.1108/JIMA-01-2020-0016.

Mandacı, P.E., Taskın, F.D. and Ergun, Z.C. (2019), "Adaptive market hypothesis", *International Journal of Economics and Business Administration (IJEBA)*, Vol. 7 No. 4, pp. 84-101.

Öztürk, M.B., Uysal, M., Arslan, H. and Kayhan, T. (2018), "The impact of calendar anomalies on stock return and volatility: evidence from Turkish stock market", *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, Vol. 11 No. 1, pp. 221-238.

Shantha, K.V.A. (2019), "The evolution of herd behavior: will herding disappear over time?", *Studies in Economics and Finance*, Vol. 36 No. 4, pp. 637-661.

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