The Impact of COVID-19 on Stock Returns and Firm Characteristics in the Saudi Stock Market

Cogent Economics & Finance

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/oaef20

The Impact of COVID-19 on Stock Returns and Firm Characteristics in the Saudi Stock Market

Asim Alshaikhmubarek, Nada Kulendran & Lalith Seelanatha

To cite this article: Asim Alshaikhmubarek, Nada Kulendran & Lalith Seelanatha (2024) The Impact of COVID-19 on Stock Returns and Firm Characteristics in the Saudi Stock Market, Cogent Economics & Finance, 12:1, 2295754, DOI: 10.1080/23322039.2023.2295754

To link to this article: https://doi.org/10.1080/23322039.2023.2295754

Published online: 11 Jan 2024.

COGENT ECONOMICS & FINANCE
2024, VOL. 12, NO. 1, 2295754
https://doi.org/10.1080/23322039.2023.2295754

ECONOMETRICS | RESEARCH ARTICLE

OPEN ACCESS Check for updates

The Impact of COVID-19 on Stock Returns and Firm Characteristics in the Saudi Stock Market

Asim Alshaikhmubarek, Nada Kulendran and Lalith Seelanatha

Victoria University, Melbourne, Australia

ABSTRACT

This paper investigates the impact of the spread of COVID-19 on the Saudi stock market. More particularly, this study examines the implications of the recent coronavirus on the overall stock returns, sectoral stock returns, and the stock returns of specific firm characteristics: market capitalization, book-to-market ratio, profitability, investment growth, and Islamic compliance. The sample deployed in this study covers the weekly data from 3 March 2020 until 25 May 2021, with 62 observations for 183 stocks. For each firm characteristic, all the stocks in our sample were divided into three subsamples using the 35th and 65th quantiles as breakpoints, specifically to examine the implications of COVID-19 for different firm characteristics. Then, panel regression analysis and Wald tests were applied to test the devised hypotheses. A negative impact of COVID-19 was recorded for all market capitalization groups, and the impact was the same on small and large market capitalization stocks, whereas the worst was on medium stocks. The outcome also indicated that less profitable stocks were more vulnerable to COVID-19 than other profitability groups. Furthermore, the impact of COVID-19 on non-Islamic stocks was lower than that on Islamic stocks, which were affected the most by the contagion.

ARTICLE HISTORY
Received 7 February 2023
Revised 29 November 2023
Accepted 13 December 2023

KEYWORDS
COVID-19; stock returns; firm characteristics; panel regression; Saudi Arabia; Saudi stock market; coefficients equality

REVIEWING EDITOR
Xibin Zhang, Monash University, Australia

SUBJECTS
Statistics for Business, Finance & Economics; Finance; Public Finance

1. Introduction

The disease known as COVID-19, a virus from the Coronaviridae family caused by severe acute respiratory syndrome (Anand et al., 2021), was declared a pandemic in March 2020 by the World Health Organization (2020). In the wake of this announcement, the pandemic triggered an unprecedented global economic crisis and a virtual shutdown of all commercial activities. Ben Bernanke, the former chair of the US Federal Reserve, emphasized that COVID-19 initiated a situation similar to the Great Depression of the 1930s—causing an extreme tightening of the global economy and financial stress (Ryssdal & Wiles, 2020). Most studies investigating the impact of the pandemic on the stock markets have documented overall negative stock price reactions to the immediate shocks of COVID-19 (Al-Awadhi et al., 2020; Dörr et al., 2022; Li et al., 2022; Naidu & Ranjeeni, 2023; Setiawan et al., 2022; Xu, 2021). More particularly, researchers (Alqadhib et al., 2022; Alzyadat & Asfoura, 2021; Atassi & Yusuf, 2021; Sayed & Eledum, 2021) who examined the implications of COVID-19 for the Saudi stock market, which is the largest in the Middle East in terms of market capitalization, found a negative impact of COVID-19 on the main index of the market.

The Saudi government started introducing strict measures to protect citizens from the spreading disease soon after the pandemic declaration. In the early stages, the weekly number of active confirmed COVID-19 cases rapidly increased throughout the country (see Figure 1), and the Tadawul All Share Index (TASI) recorded a 25% loss. However, the sharp drop in market performance was short-lived, and the index started to show positive momentum earlier than other global markets (see Figure 2). Even though the market recovered from the losses within a few months, a more volatile market was evident

CONTACT Asim Alshaikhmubarek alshaikhmubarek@gmail.com Victoria University, 1906/163 City road, Southbank, VIC 3006, Australia

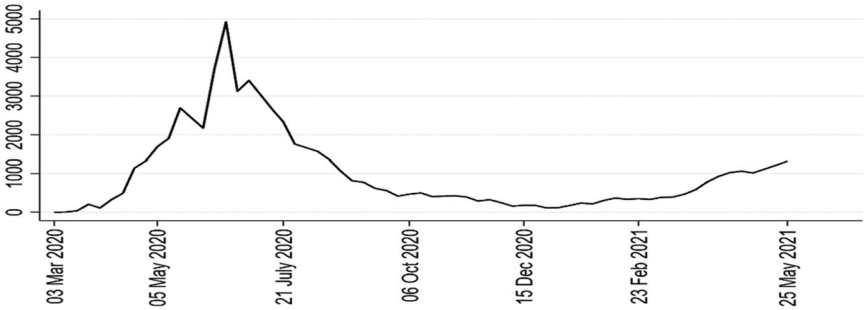

Figure 1. Weekly active confirmed COVID-19 cases (03 March 2020 to 25 May 2021).

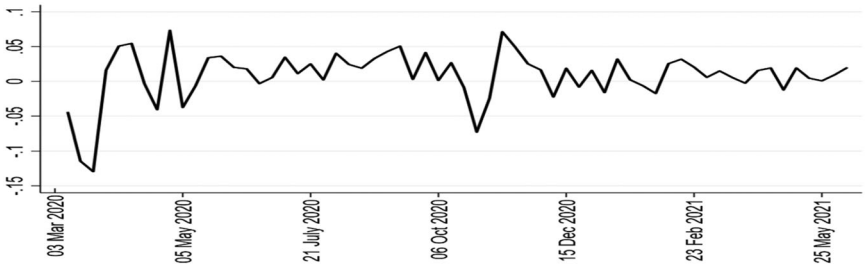

Figure 2. Weekly average return of all listed stocks (03 March 2020 to 25 May 20211).

during the rest of the period. Therefore, it is worthwhile to know why and how the Saudi stock market recovered more quickly than others and whether any specific factors brought this about.

COVID-19 caused a shock for most firms' revenues (Mazur et al., 2021), and some studies have found that the first year of the pandemic was financially worse than some of the previous global financial crises (Chen & Yeh, 2021; Li et al., 2022). This situation created challenges for some firms that were financially vulnerable. For instance, small capitalization firms usually suffer more during financial crises than large ones that have more cash, liquid assets, and access to external financial resources or assets (Knudsen, 2019). Similarly, value stocks with a high book-to-market ratio are usually financially distressed (Zhang, 2005), unlike growth stocks with a lower ratio. Furthermore, weak stocks with less profitability have poorer liquidity than robust stocks with higher profitability (Novy-Marx, 2013); therefore, they should be more sensitive to financial difficulties. In the same vein, stocks with high (aggressive) investment growth have less cash in hand than stocks with less (conservative) investment growth (Hou et al., 2014). For this reason, aggressive stocks should face more financial difficulties during a crisis. Finally, the literature has documented that Islamic equities have outperformed non-Islamic ones during financial crises (Ho et al., 2014; Jawadi et al., 2014). Thus, Islamic stocks should perform better than their non-Islamic counterparts in a crisis such as the COVID-19 situation.

Therefore, this study set out to investigate the impact of COVID-19 on the performance of all listed stocks in Saudi Arabia and analyze how this impact could vary among firms based on their characteristics, such as market capitalization, book-to-market ratio, profitability, growth of investment and compliance with Sharia law. The findings of this research offer valuable insights for both investors and policymakers. They will help investors comprehend the behavior of stocks across firms with different characteristics during a similar crisis and enable them to respond accordingly. For policymakers, the findings will enhance their awareness of the fluctuations and several implications on stocks with distinct characteristics in times of crisis, enabling them to implement and enforce regulations to maintain market stability and safeguard investors and vulnerable firms.

This study assumes that the growth of COVID-19 cases negatively affected the overall stock returns, and the impact varied among different industries and according to firms' characteristics. We first investigated the impact of COVID-19 on overall market returns and each market sector separately using the weekly returns for all listed stocks in the Saudi stock market. Unlike studies that examined the impact of COVID-19 using the main index in the Saudi market, this study employed the returns of all listed stocks to capture the cross-section and time-series implications of COVID-19. Then, the study examined the

effect of the growth of COVID-19 cases on the stock returns of different firm's characteristics. These widely used firm characteristics determine the expected returns (Fama & French, 2015; Ho et al., 2014).

The results of this research revealed no significant difference in the observed impact of COVID-19 on firms with small and large market capitalization, which contradicts what other scholars have recently concluded (Al-Awadhi et al., 2020; Dörr et al., 2022). However, the negative influence of COVID-19 on firms with low profitability was significantly higher than that on high and medium profitability firms. Likewise, the impact on the non-Islamic stocks in the Saudi stock market was lower than that on the Islamic stocks, and they did better throughout the COVID-19 years. This finding is not consistent with those of Ali et al. (2022), Salisu and Sikiru (2020), and Setiawan et al. (2022).

Finally, this study significantly contributes to the existing literature in two ways. First, we examine the resilience and immunity of firm characteristics against financial difficulties imposed by COVID-19. While previous researchers, such as Barth and Landsman (2010), Giroud and Mueller (2017), and Ramey (2019), have concentrated mainly on the causes and triggers of global financial crises, this study explicitly examines and provides evidence for the resistance of stocks with distinct firm characteristics during the recent crisis in the stock markets caused by COVID-19. Second, we provide new evidence about the performance of Islamic versus non-Islamic stocks, which has been increasingly debated in the literature. Some papers have claimed that Islamic equities are less risky and perform better during financial crises (Erragragui et al., 2018; Ho et al., 2014; Jawadi et al., 2014), whereas others have stated the opposite (Álvarez-Díaz et al., 2014; Ben Rejeb & Arfaoui, 2019; Erragragui & Revelli, 2016). Most studies have tested their hypotheses using Islamic indices; however, this study investigates the performance of all Islamic stocks in one of the world's most religious and conservative countries with a sentiment pattern of trading in Islamic stocks (Canepa & Ibnrubbian, 2014). This adds valuable insights to the literature on Islamic stocks and objective evidence about the performance of Islamic stocks during difficult times.

The rest of this paper is organized as follows. Section 2 reviews the relevant literature on stock market returns and the impact of COVID-19 on these returns. The third section explains the methodology. The following section presents the results and the empirical findings. The last section summarizes the implications and the conclusion of what has been discussed here.

2. Literature review

Most studies investigating the effect of the recent pandemic on the world's stock markets have recorded overall negative stock price reactions to the immediate shocks of COVID-19. In one of the earliest studies, Al-Awadhi et al. (2020) found that during the period 10 January to 16 March 2020, a significant negative effect of daily growth in COVID-19 cases on Chinese market stock returns occurred. Another early study by Ashraf (2020), which examined the stock returns of 64 countries from 22 January to 17 April 2020, reported a similar outcome. Some early studies also attempted to investigate how the increasing case numbers of COVID-19 shaped stock market volatility. For example, Cheng (2020) found that the immediate response of the market volatility, which was proxied by the volatility index (VIX) to the growth of COVID-19 cases, was not significant. However, later studies contended that the growth of COVID-19 cases significantly influenced the volatility of stocks (Baig et al., 2021; Engelhardt et al., 2021; Pyo, 2021; Yong et al., 2021).

In recent studies, Phiri et al. (2023) employed DCC-GARCH and Wavelet coherence analysis to examine the comovement between global COVID-19 indicators and G20 countries' stock returns. Their results show that the comovements have been shifting between negative and positive, and the negative comovements were around the initial pandemic announcement and the announcement of new COVID-19 virus strains. Furthermore, Liu et al. (2023) examined the implications of COVID-19 on 40 global tourism and hospitality stock market indices by performing the Granger-causality test. They found a significant spillover effect between COVID-19 and those indices. Additionally, Lee et al. (2023) used structural VAR to assess the dynamic relationship between the COVID-19 outbreak, macroeconomic fluctuations, and hospitality stock returns in China. They found the unexpected increase in COVID-19 decreased the stock market and hospitality industry returns. Lastly, the studies that examined the impact of COVID-19 used different assumptions, methodologies and approaches, which are summarized in Table 1. According to what is shown in Table 1, the vast majority of studies preferred to use event study analysis.

Table 1. List of key studies that examined the implications of COVID-19 on stock markets.

Studies	Methods
Ahmad et al. (2021), Al-Awadhi et al. (2020), Arendt and Mestas (2022), Bash (2020), Chen and Yeh (2021), Guo et al. (2023), Heyden and Heyden (2021), Ichev (2021), Kamal et al. (2022), Khanthavit (2020), Liu et al. (2020), Mazur et al. (2021), Phan and Narayan (2020), Poretti and Heo (2022), Rahman et al. (2021), Saleem et al. (2021), Sayed and Eledum (2021), Tao et al. (2022)	Event study analysis
Ashraf (2020), Atassi and Yusuf (2021), Beirne et al. (2021), Danisman et al. (2021), Demir and Danisman (2021), Dharani et al. (2023), Huynh et al. (2021), Jiang et al. (2022), Latif et al. (2021), Liu et al. (2023), Papadamou et al. (2020), Rabhi (2020), Ullah (2023)	Panel data analysis
Ali et al. (2022), Alzyadat and Asfoura (2021), Phiri et al. (2023), Saleem et al. (2021), Salisu and Shaik (2022), Xu (2021)	Time series analysis

Note. This table lists the key studies that investigated the growth of COVID-19 on the stock markets and their methodology.

The event study approach has been used widely to examine the implications of COVID-19 on the world's stock markets. Some researchers investigated whether there were any abnormal return behaviors due to the emergence of COVID-19 cases. For example, Bash (2020) explored the abnormal returns in stock market indices of 30 countries using the mean-adjusted returns and market model for multiple event windows. He found a diminishing market return as the number of COVID-19 cases rose. Khanthavit (2020) applied a similar methodology to the indices for nine countries (France, Germany, Italy, Spain, the United Kingdom, the United States, China, the Philippines, and Thailand) and found a marked negative reaction for all estimated returns. Later, Sayed and Eledum (2021) applied the same methodology to the TASI, which is the main index of the Saudi stock market, and found that the TASI had a significant negative reaction during the nine-day event window following the announcement of the first COVID-19 cases. Mazur et al. (2021) examined the implications of COVID-19 on the US stock markets via event analysis during March 2020. Their study noted that stock returns were negatively correlated with the growth of COVID-19, but the impact varied from firm to firm. Tao et al. (2022) also used the event study approach on the main index of Pakistan's stock market. They examined the impact of the announcements of the lockdowns on stock performance, using the daily data from 12 December 2019 to 7 June 2020. They found that abnormal returns were negatively affected before and after the window events, yet the stocks recovered fairly quickly. In their work, Liu et al. (2020) applied multiple approaches, an event study method and a panel data analysis, to measure the impact of the pandemic on the returns of 21 major market indices and reported a significant adverse effect.

In contrast, panel data analysis has been used in some studies and applied to many stock markets globally, as shown in Table 1. For instance, Beirne et al. (2021) used a panel approach and vector autoregression framework on 38 developed and emerging markets globally from 4 January 2020 to the end of August 2020. The study used daily data for the main indices of the markets examined and found that COVID-19 negatively impacted stock returns but was heavier in emerging economies. Ullah (2023) examined the effect of COVID-19 on the daily market returns of 30 developed and emerging markets using multiple panel data approaches from 1 January 2020 to 12 December 2020. The study concluded that the daily growth of COVID-19 had a negative impact on market returns globally. Yiu and Tsang (2023) examined the effects of COVID-19 on the stock returns of ASEAN5 markets by using panel regression and found the growth of COVID-19 cases had a significant negative impact on the stock returns of those countries. Atassi and Yusuf (2021) also applied a panel regression analysis specifically to the Saudi stock market using the main index of TASI. The study used the returns of TASI and found that they were adversely affected by the growth of COVID-19 cases.

It is important to note that COVID-19 is considered a financial crisis and had an unprecedented impact on the global economy and financial markets during the first year of the pandemic (Chen & Yeh, 2021; Li et al., 2022). The studies have implied that the impact of financial crises is multifaceted, but different firm characteristics react to crises differently. More specifically, research conducted in Islamic countries has found that Islamic equities were able to insulate themselves from the crisis and show positive momentum, mainly because of the unleveraged nature of Islamic stocks (Ho et al., 2014; Jawadi et al., 2014). Less leverage in Islamic stocks carries a lower level of fixed commitment, which can become a financial burden, especially during a downturn in the business cycle. Consequently, high leverage in non-Islamic equities is subject to poor earnings and higher fluctuations during financial crises. Moreover, variations in the impact of the financial crisis can be reflected in the expected risk premia in firms'

characteristics such as size, value, profitability, and investment growth. Furthermore, the risk premia in those firm characteristics are time-variant (Muir, 2017), countercyclical and higher during the financial crisis (Gourio, 2012), and varied across firms according to their different features (Smith & Timmermann, 2022).

A few studies have attempted to examine the implications of COVID-19 on some specific firm characteristics. Al-Awadhi et al. (2020) briefly investigated the disease's impact on firm characteristics. They found that the stock returns of firms with large market capitalization in China's stock market were more negatively affected than smaller ones. Because they used a dummy variable, this approach may not be useful in measuring the magnitude of COVID-19's impact on stock returns. Other studies investigated the impact of COVID-19 firm-specific characteristics using event study analysis (Naidu & Ranjeeni, 2023; Pandey & Kumar, 2022; Xiong et al., 2020) and found that some firm characteristics functioned better during the pandemic. However, the use of event study analysis might not be appropriate for measuring the fall-out of COVID-19. The spread of COVID-19 was a continuous and not a few days event, so an event study analysis may not be a suitable approach.

Other studies have set out to examine the implications of COVID-19 on Islamic stocks and investigate whether Islamic stocks performed better than non-Islamic stocks during the pandemic crisis. Ali et al. (2022) employed GARCH (1, 1) to measure changes in the volatility caused by COVID-19 on conventional (KSE) and Islamic (KMI) indices of Pakistan's stock market. The study found that the conventional index exhibited longer persistence shocks caused by COVID-19 than the Islamic index. Setiawan et al. (2022) employed a similar methodology by applying the GARCH family to analyze price movements for some Islamic indices in 7G stock markets. Their study found that the Islamic stock market had a different pattern of risk during the pandemic, so it was a great diversification opportunity. Salisu and Shaik (2022) used multiple regression analysis to examine the ability of Islamic stocks to serve as a good hedge during crises. The study applied the indices to more than 10 developed and emerging markets around the globe and concluded that non-Islamic stocks were more vulnerable during COVID-19. Salisu and Sikiru (2020) examined whether the Asia-Pacific Islamic stock market was a good hedge during COVID-19 and used multiple regression analysis. They discovered that Islamic stocks in those countries can be a good hedge during a pandemic such as COVID-19. Conversely, Saleem et al. (2021) used event study analysis and the GARCH model to analyze the implications of COVID-19 on nine Islamic stock indices in different regions. The study concluded that the implications of COVID-19 were severe around the globe and the performance of Islamic stocks during crises did not reveal any noticeable change.

The current study differs from prior studies that investigated COVID-19's impact on firms' performance according to their specific characteristics. First, this research used panel regression for weekly returns of all listed stocks in Saudi Arabia's stock market during the first year of the pandemic instead of using event study analysis, which is the method most similar studies implemented. Second, this study employed the returns of all listed stocks instead of the main index, whereas most studies that examined the implications of COVID-19 on Islamic stocks used market indices. Third, we allocated stocks into three sub-samples using two quantile breakpoints for each firm characteristic. Then, we regressed the weekly returns of stocks in each sub-sample against the growth in COVID-19 cases using panel regression. This made it possible to compare the magnitude of the estimated coefficients of the growth in COVID-19 for each sub-sample. To test the differences in estimated coefficients, we employed the Wald test to examine the hypothesis of the equal coefficients between those sub-samples. The following section explains our methodology and those differences.

3. Methodology

3.1. The sample

The study used weekly data for 183 companies listed on the Saudi stock exchange, covering the period from 3 March 2020 to 25 May 2021. This time frame spans more than 62 weeks, providing an extensive dataset to analyze the financial performance and market dynamics of the selected companies during the COVID-19 epidemic. The required data were extracted from Eikon's Datastream database and included stock price, number of outstanding shares, total book value, operating income, and total assets of each

listed firm. The data relating to the classification of stocks based on Islamic compliance were extracted from the Almaqased Economic Advisory website[1]. The numbers of daily active confirmed cases of COVID-19 were obtained from the King Abdullah Petroleum Studies and Research Center. This study also used all the listed stocks on the Saudi stock exchange, irrespective of whether they were active or not, to avoid survivorship bias. However, all new stocks listed during the analysis period were excluded from the study.

3.2. Study model

This study used the panel data regression approach as the best method to estimate Equation (1) for several reasons. The panel data approach is more appropriate for identifying unobserved time-series and cross-sectional effects (Himmelberg et al., 1999; López Iturriaga, 2005). The event study approach, used extensively in previous studies, is impractical since the COVID-19 pandemic lasted fairly long. The Event study analysis is more appropriate for determining an event's impact at a specific moment in time. However, the panel data approach can capture the impact of COVID-19 over time and across equities. It also accounted for both time-series and cross-sectional variation in the data. Moreover, panel data regression controls for individual heterogeneity, minimizes multi-collinearity bias in estimations, and captures the time-varying relationship between dependent and independent variables (Baltagi, 2021; Hsiao, 2014).

Further, this study applied multiple tests to identify the appropriate panel regression technique. We performed (a) Chow (1960) test to compare the pooled ordinary least squares (OLS) and fixed-effect models; (b) Breusch and Pagan (1980) Lagrange multiplier test to compare the pooled OLS and random-effect models; and finally, (c) Hausman (1978) test to compare fixed-effect and random-effect models. These tests constitute a common procedure to choose the best-fitting model (Baltagi, 2008a). The results confirmed that the pooled OLS regression is the desired approach to investigate the impact of COVID-19 on returns in the Saudi stock market.

Thus, Equation (1) below measures the impact of the growth in COVID-19 confirmed cases on (a) the overall returns of all listed stocks, (b) the sector returns, and (c) returns based on firms' specific characteristics. The Wald test compared the regression results, estimated for each subsample according to the firms' characteristics. In Equation (1), the weekly returns of all listed stocks serve as the dependent variable, while the weekly growth of COVID-19 confirmed cases is the primary testing variable. Since the oil price is a significant determinant of the Saudi economy, this study used the weekly growth of the Brent oil price as a control variable. Thus, this study estimated the following model (Cameron & Trivedi, 2010, p. 232):

$$R_{i,t} = \alpha + \beta_1 \ COVID19_t + \beta_2 \ Brent_t + \ u_{i,t}. \tag{1}$$

$$u_{i,t} = \mu_i \ + \ \nu_{i,t}. \tag{2}$$

where $R_{i,t}$ denotes the weekly return of stock i on week t; α is the intercept of all stocks; β_1 stands for the coefficient of the explanatory variable $COVID19_t$, which is the natural log for the growth in total confirmed cases of COVID19 in week t; β_2 represents the coefficient of the control variable $Brent_t$, which is the natural log of the Brent oil price in week t; and $u_{i,t}$ is the error term, which comprises μ_i and ν_{it}. In this case, μ_i is constant over time and accounts for individual-specific effects, which are not included in the regression, and ν_{it} is the usual disturbance that varies over time and across individual stocks (Baltagi, 2008b). The error term is uncorrelated with the regressors of the model (Croissant & Millo, 2008). The assumption here is that the error term is uncorrelated with the regressors in the model (Cameron & Trivedi, 2005, p. 699). The variables used as the main inputs in the pooled OLS model given in Equation (1) are calculated using the equations below:

a) Weekly stock return:

$$R_{i,t} = ln \ (P_{i,t}/P_{i,t-1}). \tag{3}$$

where $P_{i,t}$ denotes the adjusted closing price of stock i in week t, and $P_{i,t-1}$ denotes the adjusted closing price of stock i in week $t-1$.

Table 2. Subsamples based on firms' characteristics.

	Quantile breakpoints for the subsamples		
Firms' characteristics	Below 35th	Between 35th and 65th	Above 65th
Market capitalization	Small stocks	Medium stocks	Large stocks
Book-to-market ratio	Growth stocks	Medium stocks	Value stocks
Profitability	Low-profit stocks	Medium stocks	High-profit stocks
Investment growth	Conservative stocks	Medium stocks	Aggressive stocks

Note. All listed stocks are divided independently into three subsamples for each firm's characteristics.

b) Growth of COVID-19 cases:

$$COVID19_t = ln\ (C_t/C_{t-1}). \tag{4}$$

where $C_{i,t}$ denotes the number of cases in week t, and $C_{i,t-1}$ denotes the number of cases in week t_1.

c) Change in the global oil price:

$$Brent_t = ln\ (BP_t/BP_{t-1}). \tag{5}$$

where $BP_{i,t}$ denotes the closing price of Brent oil in week t, and $BP_{i,t}$ denotes the closing price of Brent oil in week $t-1$.

Using the model in Equation (1), we first estimated the overall returns of all listed stocks in a one-panel regression. Then, we estimated the returns of each sector standalone in a separate panel regression. Finally, we estimated the returns of each sub-sample of firm characteristics, which are explained in the subsection below.

3.3. Capturing the impact of COVID-19 on stock return based on firms' characteristics

In order to capture the effect of COVID-19 on firms based on their characteristics, the study sample was divided into three subsamples based on market capitalization, book-to-market ratio, profitability, investment growth, and Islamic compliance. In devising these subsamples, the study applied two quantile breakpoints: 35th and 65th (see Table 2 for the subsamples). For Islamic compliance, three subsamples were identified based on the classifications of the Almaqased Advisory Center and allocated to three groups: Islamic (I), mixed (M), and non-Islamic (N) stocks. The calculations of market capitalization, book-to-market ratio, profitability, and investment growth for each stock are represented in Appendix B.

These subsamples allowed us to examine whether the effect of the growth of COVID-19 cases in the returns varied among them within each specific firm characteristic. For this reason, we test whether the estimated coefficients for the $COVID19_t$ in Equation (1) across related subsamples from Table 2 were equal or not. Therefore, this study performs the Wald test of *H0:* $\hat{\beta}\ COVID19_{sub-sample1} - \hat{\beta}\ COVID19_{sub-sample2} = 0$ that rejects the null if the Z-score in Equation (6) is larger than the appropriate χ_1^2 threshold (Clogg et al., 1995; Weesie, 1999). The test is separately applied for each of the two subsamples in each firm characteristic, which means three tests are conducted for each characteristic.

$$z = \frac{\hat{\beta}\ (COVID19_{sub-sample1}) - \hat{\beta}\ (COVID19_{sub-sample2})}{\left[\hat{\sigma}^2{}_{\hat{\beta}\ (COVID19_{sub-sample1})} + \hat{\sigma}^2{}_{\hat{\beta}\ (COVID19_{sub-sample2})}\right]^{1/2}}. \tag{6}$$

where Z denotes the test statistics, $\hat{\beta}\ \mathrm{COVID19}_{\mathrm{sub-sample1}}$ and $\hat{\beta}\ COVID19_{sub-sample2}$ are the estimated coefficients for the two different groups employed for the comparison, $\hat{\beta}\ (COVID19_{sub-sample1})$ is the coefficient variance of the first group, and $\hat{\sigma}^2{}_{\hat{\beta}\ (COVID19_{sub-sample2})}$ is the coefficient variance of the second group.

This technique of examining the equality of the coefficients has been widely applied in studies (e.g. Paternoster et al., 1998; Sloat et al., 2020). More precisely, this comparison method between the slopes was employed recently to examine the impact of the growing COVID-19 cases on the mutual fund industry's performance in Saudi Arabia (Alqadhib et al., 2022).

4. Empirical analysis

4.1. Stock returns and COVID-19 cases

As mentioned earlier, governments worldwide began implementing protective measures to control the spread of COVID-19 in March 2020. The measures introduced in Saudi Arabia were able to control its spread within a very short time. Figure 1 shows that Saudi Arabia passed the pandemic peak in June 2020. The success of the early intervention was reflected in the performance of the Saudi stock market. Figure 2 shows a sudden drop in the weekly average return of all stocks when the COVID-19 pandemic was declared in March. This could be attributed to the panic and uncertainty associated with the beginning of the crisis (Salisu & Akanni, 2020). However, the downturn in returns was short-lived, and the market began to recover and uptrend within a few weeks. A few slight drops in returns are evident, but they were not as large as at the beginning of the pandemic. This suggests that the Saudi stock market responded positively to the measures introduced by the Saudi authorities to control the spread of COVID-19.

Moreover, the summary statistics of the data included in this study are shown in Table 3, and the correlation matrix between variables is documented in Table 4. The correlation matrix in Table 4 shows no significant relationships between variables. Table 3 shows that the observations of each variable are 11284, which means our panel data are strongly balanced.

The rest of this section presents the results of the regression analysis that examined how the growth in COVID-19 affected returns on the stock market. First, we show how COVID-19 affected the overall market performance. Second, we examine whether there was any variation in the impact of the coronavirus on different sectors. Third and finally, we examine the impact of COVID-19 on stock returns based on the identified firms' characteristics.

4.2. The impact of COVID-19 on the overall market performance

The regression results presented in Table 5 reveal how the overall market reacted to the change in COVID-19 cases. The model was first estimated using the weekly stock returns of all firms listed on the Saudi stock exchange as the dependent variable, and the growth in COVID-19 cases and the change in Brent oil price are the explanatory variables represented in Column 1. Then, the model estimated the same weekly returns using the interaction term between COVID-19 and the Brent oil price in Column 2. Because the model examined only the impact of COVID-19 and ignored the other factors that can explain the returns, both regression models show a low *R*-squared value. However, the high 'F' statistics for both estimations indicate the model is reasonably valid. As expected, COVID-19 recorded statistically significant negative coefficients in both regressions. Despite the current study using all listed stock returns, the findings are consistent with other research (Alzyadat and Asfoura, Atassi and Yusuf) that investigated the effect of COVID-19 on the Saudi stock market's main index, TASI.

Furthermore, the results show that the weekly change in the Brent oil price had a positive relationship with the returns, which was expected since the oil industry remains a major part of Saudi Arabia's

Table 3. Summary statistics (03 March 2020 to 25 May 2021).

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Returns	11284	0.008	0.059	−0.407	0.495	−0.163	0.183	0.374	9.918
COVID-19	11284	0.1	0.429	−0.623	2.028	−0.623	2.028	2.317	10.534
Brent	11284	0.002	0.129	−0.588	0.413	−0.588	0.413	−1.104	10.916

Note. Returns is the natural log for the weekly return of all listed stocks, COVID-19 is the natural log for the weekly growth of COVID-19 confirmed cases, and Brent is the natural log of weekly growth in Brent oil price.

Table 4. Correlation matrix (03 March 2020 to 25 May 2021).

Variables	Returns	COVID-19	Brent
Returns	1.0000		
COVID19	−0.1881	1.0000	
Brent	0.2707	−0.1183	1.0000

Note. Returns is the weekly return of all listed stocks, COVID19 is the natural log for weekly growth of COVID19 confirmed cases, and Brent is the natural log of weekly growth in Brent oil price.

economy. Column 2 in Table 5 shows the results of the interaction between COVID-19, and the Brent price in the returns and indicates a significant positive relationship and that the R squared is greater than that in the model in Column 1. The magnitude of the interaction coefficient is almost half of the impact of the Brent oil price in the model without the interaction term, which makes sense because the negative impact of COVID-19 wiped out part of the effect of the Brent oil price. This means that in circumstances similar to COVID-19, if the oil price continues to increase, the increase in coronavirus cases will not significantly affect the stock returns.

4.3. Impact of COVID-19 on firms' performance in different sectors

The extent and nature of market reactions to the COVID-19 pandemic were not uniform across all sectors. Various industries demonstrated their level of vulnerability in response to the pandemic-induced uncertainties. In order to examine how various industries operating in the Saudi stock market reacted to COVID-19, this study estimated Equation (1) separately for each sector in the Saudi stock market. In the sector analysis, because of the small number of firms in a given sector, four sectors were combined to create two industry clusters: (a) the communication services and information technology sectors and (b) the energy and utilities sectors. Accordingly, the estimated coefficients for the panel regression for seven sectors and two sector clusters are presented in Table 6. The estimated coefficients for the growth in

Table 5. Overall market reaction to COVID-19 (03 March 2020 to 25 May 2021).

	(1) Main model	(2) Interaction model
α	0.0102***	0.0102***
	(0.0004)	(0.0004)
COVID19	−0.0219***	−0.0167***
	(0.0015)	(0.0014)
Brent	0.1159***	0.0803***
	(0.0040)	(0.0048)
COVID19 and Brent		0.0679***
		(0.0077)
R-square	0.0980	0.1031
F-Statistic	509.18	343.96

Note. This table shows the coefficients of the panel regression results for the stock returns of all listed stocks in the Saudi market. The robust standard errors are in parentheses while the asterisks *,** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t,}$ the weekly return of stock i at day t. α is the intercept, COVID-19 is the natural log for weekly growth in total confirmed cases of COVID-19, and Brent is the natural log of weekly growth in Brent oil price. Meanwhile COVID-19 and Brent stands for the interaction effect between COVID-19 and Brent.

Table 6. Industry variation of COVID-19's impact.

Industry sector	α	COVID-19	Brent	Observations	R^2	F
Financials	0.009***	−0.016***	0.13***	2852	0.106	201.25
	(0.001)	(0.002)	(0.007)			
Materials	0.011***	−0.028***	0.132***	2604	0.146	239.52
	(0.001)	(0.003)	(0.008)			
Consumer discretionary	0.011***	−0.03***	0.11***	1550	0.099	83.64
	(0.001)	(0.005)	(0.009)			
Industrials	0.011***	−0.026***	0.127***	1240	0.113	73.71
	(0.001)	(0.005)	(0.011)			
Consumer staples	0.013***	−0.01**	0.083***	930	0.031	32.93
	(0.002)	(0.004)	(0.011)			
Real estate	0.006***	−.025***	0.091***	682	0.122	118.68
	(0.001)	(0.002)	(0.009)			
Healthcare	0.009***	−0.022**	0.099***	496	0.143	20.40
	(0.001)	(0.008)	(0.017)			
Communication services and IT	0.013***	−0.012	0.085***	496	0.036	9.13
	(0.003)	(0.01)	(0.02)			
Energy and utilities	0.008**	−0.013***	0.082	434	0.062	12.97
	(0.003)	(0.003)	(0.046)			
Main model (all listed stocks)	0.010***	−0.022***	0.116***	11284	0.098	509.18
	(0.0004)	(0.001)	(0.004)			

Note. This table shows the coefficients of the panel regression results for the main model of all listed stocks in the market and each sector independently. The group-robust standard errors are in parentheses, while the asterisks *,** and ***denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t,}$ the weekly return of stock i at day t.

COVID-19 cases showed significant negative coefficients for all sectors except communication services and information technology, thus confirming the expected relationship. However, the magnitude of the estimated coefficients varied from sector to sector. Among all sectors, the estimated coefficients signaled the consumer discretionary sector as the worst hit. This could result from restricted operations made possible by the lockdown measures to control the spread of COVID-19. It could also be the outcome of limiting consumer spending on non-essential goods and services for precautionary reasons. The results also indicate that consumer staples were the least-hit industry sector. It is obvious that because of the essential nature of goods and services provided by firms in the consumer staples sector, it may not have experienced the significant revenue decrease or cash flow crises that the other industries experienced.

4.4. The impact of COVID-19 on firms' performance based on their characteristics

As stated earlier, to capture COVID-19's impact on firms based on their characteristics, the sample was divided into a couple of subsamples based on market capitalization, book-to-market ratio, profitability, investment growth, and Islamic compliance. This section presents the results and discussion of the regression analysis based on each factor separately.

4.4.1. Market capitalization

The market capitalization of publicly listed companies, frequently used to proxy a firm's size, has been recognized as a key determinant influencing stock market returns (e.g. Fama & French, 2015). Following previous work, this study used market capitalization to measure firm size and divided the study sample into three subsamples, namely small, medium, and large firms. By applying regression analysis, the study aimed to uncover how the impact of COVID-19 varied across these different groups. The estimated coefficients for the equation for these subsamples and the results of the overall sample are presented in Table 7. These results indicate that irrespective of a firm's size, the performance of all firms was negatively affected by the changing number of COVID-19 cases. However, the subsample representing medium size firms recorded the highest negative coefficients among the three sub-samples.

For further investigation, we employed the Wald test to examine the coefficients equality hypothesis between the market capitalization groups; Table 8 summarizes these hypotheses. The table shows that

Table 7. The impact of COVID-19 and market capitalization (03 March 2020 to 25 May 2021).

	(1) All listed stocks	(2) Small stocks	(3) Medium stocks	(4) Large stocks
α	0.0102***	0.0143***	0.0107***	0.0055***
	(0.0004)	(0.0007)	(0.0006)	(0.0005)
COVID-19	−.0219***	−.0186***	−.0294***	−0.0176***
	(0.0015)	(0.0024)	(0.0025)	(0.0025)
Brent	0.1159***	0.1093***	0.1178***	0.1207***
	(0.0040)	(0.0059)	(0.0058)	(0.0087)
Observations	11284	3782	3782	3720
R-square	0.0980	0.0581	0.1317	0.1473
F statistics	509.18	155.61	256.38	130.19

Note. Column 1 represents the coefficients of the panel regression for all listed stocks together, whereas columns 2, 3, and 4 represent the groups of small, medium, and large market capitalization stocks, respectively. The robust standard errors are in parentheses while the asterisks *,** , and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t,}$ the weekly return of stock *i* at day *t*.

Table 8. Equality test of COVID-19 estimated coefficients for the subsamples—market capitalization.

Groups compared	Chi^2	*p* value	Decision
Small and medium	9.82***	.0017	Null rejected
Small and large	0.09	.7679	Null not rejected
Medium and large	11.40***	.0007	Null rejected

This table shows the equality test of the coefficients between all market capitalization groups (small, medium, and large). Chi-square, *p* value, and decisions are shown in the table. We can reject the null if the *p* value is lower than 5%. The asterisks *,** , and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Stata/IC 16.1 was used to conduct these tests using (suest) and (test) commands.

we can reject the equality test hypothesis between (small and medium) and (medium and large) because the *p* value is significant and lower than 5%. Still, we cannot reject the equality of the coefficients between small and large groups. According to the magnitude of the COVID-19 coefficient of the medium group in Column 3 of Table 7 and the equality test in Table 8, we can conclude that stock returns in the medium capitalization group were more severely affected by the growth of COVID-19 cases than the other two groups. This finding differs from that of Al-Awadhi et al. (2020), who found that the impact of COVID-19 on large market capitalization stock was greater than that on other groups of stocks. However, this could be due to investors' preference to take risks and buy small stocks or play safe and buy large stocks, resulting in the neglect of medium stocks in the Saudi market.

4.4.2. Book-to-market ratio

This ratio, which compares a company's book value to its market value, offers insights into the perceived value of a firm's tangible assets relative to its market valuation. As previously explained, this research divided the study sample into three sub-samples: value stocks, medium stocks, and growth stocks (see Table 9), to examine whether COVID-19's influence on stock returns differs based on the book-to-market ratio. In this context, it was predicted that firms with higher book-to-market (value stocks) ratios could experience a different impact on their returns' performance than those with lower ratios (growth stocks and medium stocks). Existing literature on stock returns has claimed that value stocks usually outperform growth stocks. It has also been claimed that value stocks yield higher returns and carry a higher risk because they are financially distressed (Asness et al., 2013; Fama & French, 1998). The regression results presented in Table 9 for all subsamples have recorded significant negative coefficients, indicating that irrespective of the book-to-market ratio of stocks, all were equally affected by COVID-19 (see Appendix A for the Wald equality test results).

4.4.3. Profitability

A firm's profitability is a fundamental aspect of how investors perceive and value a company's shares in the stock market. Profitability refers to a company's ability to generate earnings from its operations, which is a key indicator of its financial health and potential for growth (Fama & French, 2015; Novy-Marx, 2013). The impact of COVID-19 on stock returns appears to be intricately linked to the profitability of companies. Those with higher pre-pandemic profitability were expected to demonstrate greater resilience, potentially weathering the challenges more effectively than their less profitable rivals. In order to explore the responses of profitable firms to the changes induced by COVID-19, this research estimated Equation (1) for three sub-samples (low, medium, and high profitable stocks). These subsamples were chosen according to the profitability levels of individual firms. The results shown in Table 10 recorded statistically significant negative coefficients with the change in COVID-19 cases irrespective of their profitability; however, the magnitude of the COVID-19 coefficient for the low profitability group was stronger. Furthermore, the outcomes of the Wald test statistics (see Appendix A) suggest that the estimated coefficients for less profitable firms and their highly profitable counterparts were unequal. This finding agrees with the anticipated hypothesis that highly profitable firms exhibited greater resilience than less profitable ones in the face of COVID-19.

Table 9. Book-to-market ratio (value vs. growth stocks) and COVID-19 (03 March 2020 to 25 May 2021).

	(1) All listed stocks	(2) Growth	(3) Medium	(4) Value
α	0.0102***	0.0093***	0.0099***	0.0114***
	(0.0004)	(0.0009)	(0.0007)	(0.0007)
COVID-19	−0.0219***	−0.0234***	−0.0200***	−0.0223***
	(0.0015)	(0.003)	(0.0025)	(0.0021)
Brent	0.1159***	0.0976***	0.1203***	0.13***
	(0.0040)	(0.0059)	(0.0073)	(0.0068)
Observations	11284	3782	3782	3720
R-square	0.098	0.0801	0.0966	0.122
F statistics	509.18	140.37	185.99	234.29

Note. Column 1 represents the coefficients of the panel regression for all listed stocks, whereas columns 2, 3, and 4 represent the groups of growth, medium, and value stocks, respectively. The robust standard errors are in parentheses while the asterisks *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t,}$ the weekly return of stock *i* at day *t*.

4.4.4. Investment growth

Contemporary literature has identified investment growth or the expansion of total assets as a novel factor influencing stock returns (Fama & French, 2015; Foye, 2018; Hou et al., 2014). Empirical evidence from the literature has indicated that a firm's investment exhibits a risk pattern in which stocks associated with higher investment tend to carry lower expected returns because of reduced risk exposure and vice versa (e.g. Chen et al., 2011; Cooper et al., 2008; Hou et al., 2014; Titman et al., 2004). In contrast, firms with higher investment growth tend to experience elevated market valuation, reflecting investors' optimism about their potential for future profitability. However, a notable aspect of this paradigm is a company's cash position. The concept is intuitive—a decrease (increase) in investment often corresponds to an increase (decrease) in available cash. In this light, it is conceivable that firms characterized by higher investment growth could experience varying effects from external shocks such as the spread of COVID-19. Specifically, these companies might encounter heightened vulnerability to such adverse events because of their lower cash reserves during times of crisis.

However, the findings derived from the estimated regression results for Equation (1) (as displayed in Table 11) reveal no substantial distinctions in the estimated coefficients among the three sub-samples: conservative, medium, and aggressive. Additionally, the outcomes of the Wald test statistics (see Appendix A) suggest similar results. This observation implies that the detrimental impact of COVID-19 was not substantially influenced by the extent of investment activities undertaken by the firms. This phenomenon could stem from the homogeneity in risk exposure spanning investment growth categories or the dominant influence exerted by market sentiment and external macroeconomic factors, which might overshadow the effects of investment growth dynamics.

4.4.5. Islamic compliance (Islamic stocks)

The literature has presented conflicting outcomes regarding the performance of Islamic stocks during financial crises. Some studies have asserted that Islamic equities' performance during these periods does not significantly differ from that of their conventional counterparts (Ajmi et al., 2014; Álvarez-Díaz et al.,

Table 10. Firms' profitability and COVID-19.

	(1) All listed stocks	(2) Low	(3) Medium	(4) High
α	0.0102***	0.0135***	0.0093***	0.0078***
	(0.0004)	(0.0007)	(0.0006)	(0.0007)
COVID-19	−0.0219***	−0.0261***	−0.0207***	−0.0187***
	(0.0015)	(0.0023)	(0.0027)	(0.0026)
Brent	0.1159***	0.1171***	0.1237***	0.1067***
	(0.0040)	(0.0059)	(0.007)	(0.0077)
Observations	11284	3782	3782	3720
R-square	0.098	0.0883	0.113	0.0994
F statistics	509.18	208.25	227.90	107.86

Note. Column 1 represents the coefficients of the panel regression for all listed stocks, whereas columns 2, 3, and 4 represent the groups of low, medium, and high profitability stocks, respectively. The robust standard errors are in parentheses while the asterisks *,**, and ***denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t,}$ the weekly return of stock i at day t.

Table 11. Investment growth and COVID-19.

	(1) All listed stocks	(2) Conservative	(3) Medium	(4) Aggressive
α	0.0102***	0.0122***	0.0099***	0.0085***
	(0.0004)	(0.0008)	(0.0007)	(0.0007)
COVID-19	−0.0219***	−0.0226***	−0.0223***	−0.0207***
	(0.0015)	(0.0023)	(0.0029)	(0.0024)
Brent	0.1159***	0.1215***	0.1077***	0.1184***
	(0.0040)	(0.0072)	(0.0059)	(0.0075)
Observations	11284	3782	3782	3720
R-square	0.098	0.0975	0.0965	0.1007
F statistics	509.18	154.14	236.23	137.06

Note. Column 1 represents the coefficients of the panel regression for all listed stocks, whereas columns 2, 3, and 4 represent the groups of conservative, medium, and aggressive investment growth stocks, respectively. The robust standard errors are in parentheses while the asterisks *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t,}$ the weekly return of stock i at day t.

Table 12. Sharia law compliance and COVID-19.

	(1) All listed stocks	(2) Islamic	(3) Mixed	(4) Non-Islamic
α	0.0102***	0.0105***	0.0106***	0.0091***
	(0.0004)	(0.0006)	(0.0009)	(0.0008)
COVID-19	−0.0219***	−0.0248***	−0.0219***	−0.0156***
	(0.0015)	(0.0023)	(0.0027)	(0.0023)
Brent	0.1159***	0.1093***	0.1132***	0.1336***
	(0.0040)	(0.0047)	(0.0078)	(0.0098)
Observations	11284	5270	3534	2480
R-square	0.098	0.1006	0.0913	0.1069
F statistics	509.18	293.07	127.54	118.37

Note. Column 1 represents the coefficients of the panel regression for all listed stocks, whereas columns 2, 3, and 4 represent the groups of Islamic, mixed, and non-Islamic stocks, respectively. The stocks are allocated into these groups according to Almaqased Advisory classifications. The robust standard errors are in parentheses while the asterisks *,** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t,}$ the weekly return of stock *i* at day *t*.

2014; Erragragui & Revelli, 2016). Conversely, numerous investigations have posited that Islamic equity exhibits stronger resilience during crises (Al-Khazali et al., 2014; Ghazali et al., 2015; Ho et al., 2014; Jawadi et al., 2014). Recent studies have examined Islamic stocks' performance during the COVID-19 pandemic, highlighting their superior performance to that of non-Islamic stocks (Ali et al., 2022; Salisu & Sikiru, 2020; Setiawan et al., 2022). Consequently, Saudi market-based religious investors should comprehend the implications of COVID-19 for Islamic stocks.

For this purpose, Equation (1) was estimated separately for the three sub-samples: Islamic, mixed, and non-Islamic stocks. As shown in Table 12, estimated regression coefficients show that changes in COVID-19 case numbers negatively affected the stock market returns of all three groups; however, the magnitude of the COVID-19 coefficient for the Islamic stocks group was the strongest. Furthermore, the estimated Wald test statistics show evidence that the adverse impact of COVID-19 on the performance of Islamic stocks was more significant than on non-Islamic stocks (see Appendix A). This outcome is inconsistent with other studies that found that the former performed better during COVID-19. This could have resulted from industry composition, diversification and flexibility of investments, and the global economic exposure of non-Islamic stocks.

5. Conclusion

This study measured the impact of COVID-19 on overall market returns, sector returns, and firm characteristics in Saudi Arabia using panel regression analysis from 3 March 2020 to 25 May 2021. Wald tests were then used to examine whether the impact of COVID-19 on stock returns varied across different groups based on their specific firm characteristics: market capitalization, book-to-market ratio, profitability, investment growth, and compliance with Sharia law. The study found that stock returns were negatively affected by the growth of COVID-19 cases. Similar findings were recorded in the sectoral analysis, except in the communication services and IT sectors.

Further analysis based on firm characteristics recorded the following findings. The growing number of COVID-19 cases undermined every stock in the market. However, the impact was more significant on medium capitalization stocks than small and large ones. Similarly, the low-profitability stocks suffered more significantly from the growing COVID-19 cases than the high and medium profitability stocks. Finally, the non-Islamic stock returns were less affected than the Islamic and mixed stock returns, while the Islamic stocks were affected the most by the pandemic. This could be attributed to the greater risks that Islamic stocks faced, such as limited financial sources (Canepa & Ibnrubbian, 2014), especially during a drop in most firms' revenues caused by COVID-19.

The findings of this study suggest that investors motivated by religion to buy Islamic stocks need to be cautious in a situation similar to COVID-19, since Islamic stocks were more vulnerable to the pandemic. Also suggested here is that stocks with low profitability might not be a good investment choice in a situation similar to the COVID-19 pandemic. Finally, this study emphasizes the need for future research on how the impact of the rising number of COVID-19 cases dictated the stock market returns

in other Gulf Cooperation Council countries. This would constitute beneficial information for investors to manage their portfolios during crises like the COVID-19 pandemic.

Note

1. https://almaqased.net/.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Asim Alshaikhmubarek http://orcid.org/0000-0001-8891-3602
Nada Kulendran http://orcid.org/0000-0002-4673-8217
Lalith Seelanatha http://orcid.org/0000-0001-9620-9092

References

Ahmad, W., Kutan, A. M., & Gupta, S. (2021). Black swan events and COVID-19 outbreak: Sector level evidence from the US, UK, and European stock markets. *International Review of Economics & Finance*, *75*, 546–557. https://doi.org/10.1016/j.iref.2021.04.007

Ajmi, A. N., Hammoudeh, S., Nguyen, D. K., & Sarafrazi, S. (2014). How strong are the causal relationships between Islamic stock markets and conventional financial systems? Evidence from linear and nonlinear tests. *Journal of International Financial Markets, Institutions and Money*, *28*, 213–227. https://doi.org/10.1016/j.intfin.2013.11.004

Al-Awadhi, A. M., Alsaifi, K., Al-Awadhi, A., & Alhammadi, S. (2020). Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns. *Journal of Behavioral and Experimental Finance*, *27,* 1-5. https://doi.org/10.1016/j.jbef.2020.100326

Ali, K., Ashfaque, M., Saleem, A., Bárczi, J., & Sági, J. (2022). Did the Islamic stock index provide shelter for investors during the COVID-19 crisis? Evidence from an emerging stock market. *Risks*, *10*(6), 109. https://doi.org/10.3390/risks10060109

Al-Khazali, O., Lean, H. H., & Samet, A. (2014). Do Islamic stock indexes outperform conventional stock indexes? A stochastic dominance approach. *Pacific-Basin Finance Journal*, *28*, 29–46. https://doi.org/10.1016/j.pacfin.2013.09.003

Alqadhib, H., Kulendran, N., & Seelanatha, L. (2022). Impact of COVID-19 on mutual fund performance in Saudi Arabia. *Cogent Economics & Finance*, *10*(1), 2056361. https://doi.org/10.1080/23322039.2022.2056361

Álvarez-Díaz, M., Hammoudeh, S., & Gupta, R. (2014). Detecting predictable non-linear dynamics in Dow Jones Islamic market and Dow Jones industrial average indices using nonparametric regressions. *The North American Journal of Economics and Finance*, *29*, 22–35. https://doi.org/10.1016/j.najef.2014.05.001

Alzyadat, J. A., & Asfoura, E. (2021). The effect of COVID-19 pandemic on stock market: an empirical study in Saudi Arabia. *The Journal of Asian Finance, Economics and Business*, *8*(5), 913–921. https://doi.org/10.13106/JAFEB.2021.VOL8.NO5.0913

Anand, U., Cabreros, C., Mal, J., Ballesteros, F., Sillanpää, M., Tripathi, V., & Bontempi, E. (2021). Novel coronavirus disease 2019 (COVID-19) pandemic: From transmission to control with an interdisciplinary vision. *Environmental Research*, *197,* 1-15. https://doi.org/10.1016/j.envres.2021.111126

Arendt, F., & Mestas, M. (2022). Coronavirus disease (COVID-19) pandemic and stock price crashes: A cross-national correlational approach. *Health Communication*, *37*(6), 760–767. https://doi.org/10.1080/10410236.2020.1871168

Ashraf, B. (2020). Stock markets' reaction to COVID-19: Cases or fatalities? *Research in International Business and Finance*, *54,* 1-7. https://doi.org/10.1016/j.ribaf.2020.101249

Asness, C. S., Moskowitz, T. J., & Pedersen, L. H. (2013). Value and momentum everywhere. *The Journal of Finance*, *LXVIII*(3), 929–985. https://doi.org/10.1111/jofi.12021

Atassi, H., & Yusuf, N. (2021). The effect of COVID-19 on investment decisions in Saudi stock market. *The Journal of Asian Finance, Economics and Business*, *8*(6), 797–807. https://doi.org/10.13106/jafeb.2021.vol8.no6.0797

Baig, A. S., Butt, H. A., Haroon, O., & Rizvi, S. A. R. (2021). Deaths, panic, lockdowns and US equity markets: The case of COVID-19 pandemic. *Finance Research Letters*, *38*, 101701. https://doi.org/10.1016/j.frl.2020.101701

Baltagi, B. H. (2008a). *Econometric analysis of panel data* (Vol. 4). Springer. https://link.springer.com/content/pdf/10.1007/978-3-030-53953-5.pdf

Baltagi, B. H. (2008b). Forecasting with panel data. *Journal of forecasting*, *27*(2), 153–173. https://doi.org/10.1002/for.1047

Baltagi, B. H. (2021). *Econometric analysis of panel data*. Chichester, England: Springer Nature.

Barth, M. E., & Landsman, W. R. (2010). How did financial reporting contribute to the financial crisis? *European Accounting Review*, *19*(3), 399–423. https://doi.org/10.1080/09638180.2010.498619
Bash, A. (2020). International evidence of COVID-19 and stock market returns: An event study analysis. *International Journal of Economics and Financial Issues*, *10*(4), 34–38. https://doi.org/10.32479/ijefi.9941
Beirne, J., Renzhi, N., Sugandi, E., & Volz, U. (2021). COVID-19, asset markets and capital flows. *Pacific Economic Review*, *26*(4), 498–538. https://doi.org/10.1111/1468-0106.12368
Ben Rejeb, A., & Arfaoui, M. (2019). Do Islamic stock indexes outperform conventional stock indexes? A state space modeling approach. *European Journal of Management and Business Economics*, *28*(3), 301–322. https://doi.org/10.1108/EJMBE-08-2018-0088
Breusch, T. S., & Pagan, A. R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The review of economic studies*, *47*(1), 239–253. https://doi.org/10.2307/2297111
Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics: Methods and applications*. Cambridge: Cambridge University Press.
Cameron, A. C., & Trivedi, P. K. (2010). *Microeconometrics using stata* (Vol. 2). College Station, TX: Stata Press.
Canepa, A., & Ibnrubbian, A. (2014). Does faith move stock markets? Evidence from Saudi Arabia. *The Quarterly Review of Economics and Finance*, *54*(4), 538–550. https://doi.org/10.1016/j.qref.2014.04.002
Chen, H.-C., & Yeh, C.-W. (2021). Global financial crisis and COVID-19: Industrial reactions. *Finance Research Letters*, *42*, 101940. https://doi.org/10.1016/j.frl.2021.101940
Chen, L., Novy-Marx, R., & Zhang, L. (2011). An alternative three-factor model. *SSRN 1418117*, 1-32. https://doi.org/10.2139/ssrn.1418117
Cheng, I.-H. (2020). Volatility markets underreacted to the early stages of the COVID-19 pandemic. *The Review of Asset Pricing Studies*, *10*(4), 635–668. https://doi.org/10.1093/rapstu/raaa010
Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. *Econometrica*, *28*, 591–605. https://doi.org/10.2307/1910133
Clogg, C. C., Petkova, E., & Haritou, A. (1995). Statistical methods for comparing regression coefficients between models. *American Journal of Sociology*, *100*(5), 1261–1293. http://www.jstor.org/stable/2782277 https://doi.org/10.1086/230638
Cooper, M. J., Gulen, H., & Schill, M. J. (2008). Asset growth and the cross-section of stock returns. *The Journal of Finance*, *63*(4), 1609–1651. https://doi.org/10.1111/j.1540-6261.2008.01370.x
Croissant, Y., & Millo, G. (2008). Panel data econometrics in R: The plm package. *Journal of statistical software*, *27*(2), 1–43. https://doi.org/10.18637/jss.v027.i02
Danisman, G. O., Demir, E., & Zaremba, A. (2021). Financial resilience to the COVID-19 pandemic: The role of banking market structure. *Applied Economics*, *53*(39), 4481–4504. https://doi.org/10.1080/00036846.2021.1904118
Demir, E., & Danisman, G. O. (2021). Banking sector reactions to COVID-19: The role of bank-specific factors and government policy responses. *Research in International Business and Finance*, *58*, 101508. https://doi.org/10.1016/j.ribaf.2021.101508
Dharani, M., Hassan, M. K., Huda, M., & Abedin, M. Z. (2023). Covid-19 pandemic and stock returns in India. *Journal of Economics and Finance*, *47*(1), 251–266. https://doi.org/10.1007/s12197-022-09586-8
Dörr, J. O., Licht, G., & Murmann, S. (2022). Small firms and the COVID-19 insolvency gap. *Small Business Economics*, *58*(2), 887–917. https://doi.org/10.1007/s11187-021-00514-4
Engelhardt, N., Krause, M., Neukirchen, D., & Posch, P. N. (2021). Trust and stock market volatility during the COVID-19 crisis. *Finance Research Letters*, *38*, 101873. https://doi.org/10.1016/j.frl.2020.101873
Erragragui, E., & Revelli, C. (2016). Is it costly to be both Shariah compliant and socially responsible? *Review of financial economics*, *31*, 64–74. https://doi.org/10.1016/j.rfe.2016.08.003
Erragragui, E., Hassan, M. K., Peillex, J., & Khan, A. N. F. (2018). Does ethics improve stock market resilience in times of instability? *Economic Systems*, *42*(3), 450–469. https://doi.org/10.1016/j.ecosys.2017.09.003
Fama, E. F., & French, K. R. (1998). Value versus growth: The international evidence. *The Journal of Finance*, *53*(6), 1975–1999. https://doi.org/10.1111/0022-1082.00080
Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, *116*(1), 1–22. https://doi.org/10.1016/j.jfineco.2014.10.010
Foye, J. (2018). A comprehensive test of the Fama-French five-factor model in emerging markets. *Emerging Markets Review*, *37*, 199–222. https://doi.org/10.1016/j.ememar.2018.09.002
Ghazali, M. F., Lean, H. H., & Bahari, Z. (2015). Sharia compliant gold investment in Malaysia: Hedge or safe haven? *Pacific-Basin Finance Journal*, *34*, 192–204. https://doi.org/10.1016/j.pacfin.2014.12.005
Giroud, X., & Mueller, H. M. (2017). Firm leverage, consumer demand, and employment losses during the great recession. *The Quarterly Journal of Economics*, *132*(1), 271–316. https://doi.org/10.1093/qje/qjw035
Gourio, F. (2012). Disaster risk and business cycles. *American Economic Review*, *102*(6), 2734–2766. https://doi.org/10.1257/aer.102.6.2734
Guo, Q., Qiu, Y., & Zhao, Y. (2023). An empirical analysis of the impact of the COVID-19 on China's tertiary industry stock price yield—Evidence from event study.
Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal of the Econometric Society*, *46*(6), 1251–1271. https://doi.org/10.2307/1913827

Heyden, K. J., & Heyden, T. (2021). Market reactions to the arrival and containment of COVID-19: An event study. *Finance Research Letters*, *38*, 101745. https://doi.org/10.1016/j.frl.2020.101745

Himmelberg, C. P., Hubbard, R. G., & Palia, D. (1999). Understanding the determinants of managerial ownership and the link between ownership and performance. *Journal of Financial Economics*, *53*(3), 353–384. https://doi.org/10.1016/S0304-405X(99)00025-2

Ho, C. S. F., Abd Rahman, N. A., Yusuf, N. H. M., & Zamzamin, Z. (2014). Performance of global Islamic versus conventional share indices: International evidence. *Pacific-Basin Finance Journal*, *28*, 110–121. https://doi.org/10.1016/j.pacfin.2013.09.002

Hou, K., Xue, C., & Zhang, L. (2014). Digesting anomalies: An investment approach. *The Review of Financial Studies*, *28*(3), 650–705. https://doi.org/10.1093/rfs/hhu068

Hsiao, C. (2014). *Analysis of panel data*. Cambridge: Cambridge University Press.

Huynh, N., Dao, A., & Nguyen, D. (2021). Openness, economic uncertainty, government responses, and international financial market performance during the coronavirus pandemic. *Journal of Behavioral and Experimental Finance*, *31*, 100536. https://doi.org/10.1016/j.jbef.2021.100536

Ichev, R. (2021). Stock price reaction to appointment of a chief health officer during COVID-19. *Journal of Behavioral and Experimental Finance*, *31*, 100541. https://doi.org/10.1016/j.jbef.2021.100541

Jawadi, F., Jawadi, N., & Louhichi, W. (2014). Conventional and Islamic stock price performance: An empirical investigation. *International Economics*, *137*, 73–87. https://doi.org/10.1016/j.inteco.2013.11.002

Jiang, B., Gu, D., Sadiq, R., Mohsan Khan, T., & Chang, H.-L. (2022). Does the stringency of government interventions for COVID19 reduce the negative impact on market growth? Evidence from Pacific and South Asia. *Economic Research-Ekonomska Istraživanja*, *35*(1), 2093–2111. https://doi.org/10.1080/1331677X.2021.1934058

Kamal, M. R., Chowdhury, M. A. F., & Hosain, M. M. (2022). Stock market reactions of maritime shipping industry in the time of COVID-19 pandemic crisis: an empirical investigation. *Maritime Policy & Management*, *49*(8), 1184–1199. https://doi.org/10.1080/03088839.2021.1954255

Khanthavit, A. (2020). World and national stock market reactions to COVID-19. *ABAC Journal*, *40*(2), 1–20.

Knudsen, E. S. (2019). Bad weather ahead: Pre-recession characteristics and the severity of recession impact. *Journal of Business Research*, *104*, 118–130. https://doi.org/10.1016/j.jbusres.2019.05.031

Latif, Y., Shunqi, G., Bashir, S., Iqbal, W., Ali, S., & Ramzan, M. (2021). COVID-19 and stock exchange return variation: Empirical evidences from econometric estimation. *Environmental Science and Pollution Research*, *28*(42), 60019–60031. https://doi.org/10.1007/s11356-021-14792-8

Lee, C. C., Lee, C. C., & Wu, Y. (2023). The impact of COVID-19 pandemic on hospitality stock returns in China. *International Journal of Finance & Economics*, *28*(2), 1787–1800. https://doi.org/10.1002/ijfe.2508

Li, Z., Farmanesh, P., Kirikkaleli, D., & Itani, R. (2022). A comparative analysis of COVID-19 and global financial crises: Evidence from US economy. *Economic Research-Ekonomska Istraživanja*, *35*(1), 2427–2441. https://doi.org/10.1080/1331677X.2021.1952640

Liu, H., Manzoor, A., Wang, C., Zhang, L., & Manzoor, Z. (2020). The COVID-19 outbreak and affected countries stock markets response. *International Journal of Environmental Research and Public Health*, *17*(8), 1-19. https://doi.org/10.3390/ijerph17082800

Liu, Y., Cheng, X., Liao, S. S., & Yang, F. (2023). The impact of COVID-19 on the tourism and hospitality Industry: Evidence from international stock markets. *The North American Journal of Economics and Finance*, *64*, 101875. https://doi.org/10.1016/j.najef.2022.101875

López Iturriaga, F. J. (2005). Debt ownership structure and legal system: an international analysis. *Applied Economics*, *37*(3), 355–365. https://doi.org/10.1080/0003684042000295269

Mazur, M., Dang, M., & Vega, M. (2021). COVID-19 and the march 2020 stock market crash. Evidence from S&P1500. *Finance Research Letters*, *38*, 101690. https://doi.org/10.1016/j.frl.2020.101690

Muir, T. (2017). Financial crises and risk premia. *The Quarterly Journal of Economics*, *132*(2), 765–809. https://doi.org/10.1093/qje/qjw045

Naidu, D., & Ranjeeni, K. (2023). Did outside directors' firm-specific accumulated knowledge benefit the firm's stock performance during COVID-19? *Australian Journal of Management*, 03128962231166831, 1-31. https://doi.org/10.1177/03128962231166831

Novy-Marx, R. (2013). The other side of value: The gross profitability premium. *Journal of Financial Economics*, *108*(1), 1–28. https://doi.org/10.1016/j.jfineco.2013.01.003

Pandey, D. K., & Kumar, R. (2022). Lockdown, unlock, stock returns, and firm-specific characteristics: the Indian tourism sector during the Covid-19 outbreak. *Current Issues in Tourism*, *25*(7), 1026–1032. https://doi.org/10.1080/13683500.2021.2005549

Papadamou, S., Fassas, A., Kenourgios, D., & Dimitriou, D. (2020). Direct and indirect effects of COVID-19 pandemic on implied stock market volatility: Evidence from panel data analysis. https://ideas.repec.org/p/pra/mprapa/100020.html

Paternoster, R., Brame, R., Mazerolle, P., & Piquero, A. (1998). Using the correct statistical test for the equality of regression coefficients. *Criminology*, *36*(4), 859–866. https://doi.org/10.1111/j.1745-9125.1998.tb01268.x

Phan, D. H. B., & Narayan, P. K. (2020). Country responses and the reaction of the stock market to COVID-19—A preliminary exposition. *Emerging Markets Finance and Trade*, *56*(10), 2138–2150. https://doi.org/10.1080/1540496X.2020.1784719

Phiri, A., Anyikwa, I., & Moyo, C. (2023). Co-movement between Covid-19 and G20 stock market returns: A time and frequency analysis. *Heliyon*, *9*(3), 1-25. https://doi.org/10.1016/j.heliyon.2023.e14195

Poretti, C., & Heo, C. Y. (2022). Asset-light strategies and stock market reactions to COVID-19's pandemic announcement: The case of hospitality firms. *Tourism economics*, *28*(6), 1692–1701. https://doi.org/10.1177/13548166211005198

Pyo, D.-J. (2021). The COVID-19 and stock return volatility: Evidence from South Korea. *East Asian Economic Review*, *25*(2), 205–230. https://doi.org/10.11644/KIEP.EAER.2021.25.2.396

Rabhi, A. (2020). Stock market vulnerability to the COVID-19 pandemic: Evidence from emerging Asian stock market. *Journal of Advanced Studies in Finance (JASF)*, *11*(22), 126–131. https://mpra.ub.uni-muenchen.de/id/eprint/101774 https://doi.org/10.14505//jasf.v11.2(22).06

Rahman, M. L., Amin, A., & Al Mamun, M. A. (2021). The COVID-19 outbreak and stock market reactions: Evidence from Australia. *Finance Research Letters*, *38*, 101832. https://doi.org/10.1016/j.frl.2020.101832

Ramey, V. A. (2019). Ten years after the financial crisis: What have we learned from the renaissance in fiscal research? *Journal of economic perspectives*, *33*(2), 89–114. https://doi.org/10.1257/jep.33.2.89

Ryssdal, K., & Wiles, K. (2020). In Ben Bernanke on COVID-19 downturn: "With help from the Federal Reserve and from the Treasury, I'm not really expecting a major financial crisis." https://www.marketplace.org/2020/03/23/former-fed-chair-bernanke-covid19-downturn/

Saleem, A., Bárczi, J., & Sági, J. (2021). COVID-19 and Islamic stock index: Evidence of market behavior and volatility persistence. *Journal of Risk and Financial Management*, *14*(8), 389. https://doi.org/10.3390/jrfm14080389

Salisu, A. A., & Akanni, L. O. (2020). Constructing a global fear index for the COVID-19 pandemic. *Emerging Markets Finance and Trade*, *56*(10), 2310–2331. https://doi.org/10.1080/1540496X.2020.1785424

Salisu, A. A., & Shaik, M. (2022). Islamic Stock indices and COVID-19 pandemic. *International Review of Economics & Finance*, *80*, 282–293. https://doi.org/10.1016/j.iref.2022.02.073

Salisu, A. A., & Sikiru, A. A. (2020). Pandemics and the Asia-Pacific Islamic stocks. *Asian Economics Letters*, *1*(1), 1-5. https://doi.org/10.46557/001c.17413

Sayed, O. A., & Eledum, H. (2021). The short-run response of Saudi Arabia stock market to the outbreak of COVID-19 pandemic: An event-study methodology. *International Journal of Finance & Economics*. *28*(3), 2367-2381. https://doi.org/10.1002/ijfe.2539

Setiawan, B., Afin, R., Wikurendra, E. A., Nathan, R. J., & Fekete-Farkas, M. (2022). Covid-19 pandemic, asset prices, risks, and their convergence: A survey of Islamic and G7 stock market, and alternative assets. *Borsa Istanbul Review*, *22*(1), S47-S59. https://doi.org/10.1016/j.bir.2022.11.011

Sloat, L. L., Davis, S. J., Gerber, J. S., Moore, F. C., Ray, D. K., West, P. C., & Mueller, N. D. (2020). Climate adaptation by crop migration. *Nature Communications*, *11*(1), 1243. https://doi.org/10.1038/s41467-020-15076-4

Smith, S. C., & Timmermann, A. (2022). Have risk premia vanished? *Journal of Financial Economics*, *145*(2), 553–576. https://doi.org/10.1016/j.jfineco.2021.08.019

Tao, R., Su, C.-W., Yaqoob, T., & Hammal, M. (2022). Do financial and non-financial stocks hedge against lockdown in Covid-19? An event study analysis. *Economic Research-Ekonomska Istraživanja*, *35*(1), 2405–2426. https://doi.org/10.1080/1331677X.2021.1948881

Titman, S., Wei, K. J., & Xie, F. (2004). Capital investments and stock returns. *Journal of Financial and Quantitative Analysis*, *39*(4), 677–700. https://doi.org/10.1017/S0022109000003173

Ullah, S. (2023). Impact of COVID-19 pandemic on financial markets: A global perspective. *Journal of the Knowledge Economy*, *14*(2), 982–1003. https://doi.org/10.1007/s13132-022-00970-7

Weesie, J. (1999). Seemlingly unrelated estimation and the cluster-adjusted sandwich estimator. *Stata Technical Bulletin*, *9*(52), 34–47. https://www.stata.com/products/stb/journals/stb52.pdf

World Health Organization. (2020, 11 March 2020). WHO Director-General's opening remarks at the media briefing on COVID-19. https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19

Xiong, H., Wu, Z., Hou, F., & Zhang, J. (2020). Which firm-specific characteristics affect the market reaction of Chinese listed companies to the COVID-19 pandemic? *Emerging Markets Finance and Trade*, *56*(10), 2231–2242. https://doi.org/10.1080/1540496X.2020.1787151

Xu, L. (2021). Stock return and the COVID-19 pandemic: Evidence from Canada and the US. *Finance Research Letters*, *38,* 1-6. https://doi.org/10.1016/j.frl.2020.101872

Yiu, M. S., & Tsang, A. (2023). Impact of COVID-19 on ASEAN5 stock markets. *Journal of the Asia Pacific Economy*, *28*(4), 1392–1405. https://doi.org/10.1080/13547860.2021.1947550

Yong, J. N. C., Ziaei, S. M., & Szulczyk, K. R. (2021). The impact of covid-19 pandemic on stock market return volatility: Evidence from Malaysia and Singapore. *Asian Economic and Financial Review*, *11*(3), 191–204. https://doi.org/10.18488/journal.aefr.2021.113.191.204

Zhang, L. (2005). The value premium. *The Journal of Finance*, *60*(1), 67–103. https://doi.org/10.1111/j.1540-6261.2005.00725.x

Appendix A

COVID-19 implications for firm characteristics are as follows: Book-to-market ratio, profitability, investment growth, and Islamic compliance.

Table A1. Equality test of COVID-19 estimated coefficients between groups of firm characteristics.

Groups compared	Chi^2	*p* value	Decision
Panel A: Subsamples of book-to-market ratio (growth, medium, and value stocks)			
Growth and medium	0.78	0.3771	Null not rejected
Growth and value	0.09	0.7614	Null not rejected
Medium and value	0.50	0.4814	Null not rejected
Panel B: Subsamples of profitability (low, medium, and high stocks)			
Low and medium	2.44	0.1183	Null not rejected
Low and high	4.60	0.0319**	Null rejected
Medium and high	0.27	0.6036	Null not rejected
Panel C: Subsamples of investment growth (conservative, medium, and aggressive stocks)			
Conservative and medium	0.01	0.9410	Null not rejected
Conservative and aggressive	0.32	0.5734	Null not rejected
Medium and aggressive	0.18	0.6741	Null not rejected
Panel D: Subsamples of Islamic compliance (Islamic, mixed, and non-Islamic)			
Islamic and mixed	0.67	0.4140	Null not rejected
Islamic and non-Islamic	8.05	0.0046***	Null rejected
Mixed and non-Islamic	3.15	0.0757*	Null rejected

This table shows the equality test of the coefficients between all market capitalization groups (small, medium, and large). Chi-square, *p* value, and decisions are represented in the table. We can reject the null if the *p* value is lower than 5%. The asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Stata/IC 16.1 was used to conduct these tests using (suest) and (test) commands.

Appendix B

The computation of market capitalization, book-to-market ratio, profitability, and investment growth.

Table B1. Equations for calculating firm characteristics

Firm characteristics	Equation
Market capitalization	$=$ (Stock price $_i \times$ Common share outstanding $_{i,t}$)
Book-to-market ratio	$=$ (Total book value $_{i,t}$ / Market capitalization $_{i,t}$)
Profitability	$=$ (Operating profit $_{i,t}$ / Total book value $_{i,t}$)
Investment growth	$=$ (Total asset $_{i,t}$ − total asset $_{i,t-1}$) / total asset $_{i,t-1}$

This table presents the equations that compute the firm characteristics essential for categorizing stocks into three groups. The price of stock *i* is the closing price of stock *i* on the initial day of the study sample. Additionally, the remaining accounting data are derived from the annual report of stock *i* for the year *t*, which is 2019.