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# COVID-19 and operating performance: evidence from Shariah-compliant and non-compliant firms

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## Abstract

**Purpose** – This study aims to investigate the impact of the COVID-19 pandemic on the operating performance of Shariah-compliant (SC) and non-Shariah-compliant (NSC) firms in the USA, addressing a critical gap in the literature on firm-level operational resilience during unexpected economic shocks. Understanding the operational impact is crucial as the pandemic caused significant disruptions across all sectors, and these effects are reflected in firms' financial statements.

**Design/methodology/approach** – Using a unique data set from LSEG Workspace and S&P's Compustat North America, the authors analyze quarterly financial statement data for US firms from 2018 to 2022. The authors use rigorous matching techniques, various model specifications and control for the potentially endogenous nature of a firm's SC status to ensure robust comparisons between SC and NSC firms.

**Findings** – The authors show that while COVID-19 negatively impacted the profitability of all firms, the decline was significantly less severe for SC firms. This resilience can be attributed to the lower leverage and conservative financial practices inherent to Shariah compliance, which enhance firms' ability to withstand economic shocks. The results are robust across different measures of operating profitability and various robustness tests.

**Practical implications** – The findings highlight the importance of financial conservatism in SC firms as a buffer against economic shocks. This has significant implications for corporate risk management, investment strategies and policy formulation. Adopting similar financial disciplines can enhance operational resilience, making SC firms attractive to investors seeking stability during economic uncertainty. Policymakers can also promote these practices to strengthen economic stability in anticipation of future systemic shocks. Overall, this study underscores the critical role of financial structure in determining corporate resilience.

**Originality/value** – To the best of the authors' knowledge, this study provides the first large-scale empirical evidence on the differential impact of COVID-19 on the operating performance of SC versus NSC firms. By shifting the focus from stock price performance to operational performance and profitability, the authors offer a novel perspective on the benefits of Shariah compliance. The findings have important implications for investors, corporate managers and policymakers, highlighting the strategic value of conservative financial practices in enhancing firm resilience during economic downturns.

**Keywords** Operating profitability, Shariah compliance, Islamic, COVID-19, Pandemic

**Paper type** Research paper



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## 1. Introduction

The COVID-19 pandemic was an unprecedented shock to the global economy, forcing widespread shutdowns and causing significant disruptions across all sectors. The magnitude of the economic impact on the US economy was very large, as evidenced by the US$2.1tn emergency aid package for businesses and households passed by the US Senate on March 26, 2020 (WSJ, 2020). While substantial research has examined the pandemic's effects on stock markets, a critical gap remains in understanding its impact on firms' operating performance, particularly those adhering to Shariah compliance.

A considerable body of studies has primarily focused on understanding how the pandemic affected local and international stock markets (Bahrini and Filfilan, 2020; D'Orazio and Dirks, 2020; Ali *et al.*, 2020), market volatility (Kusumahadi and Permana, 2021; Baig *et al.*, 2021; Haroon and Rizvi, 2020) and bidirectional spill-over effects across economies (He *et al.*, 2020), as well as the pandemic's impact on firms' liquidity (Nerantzidis *et al.*, 2023; De Vito and Gomez, 2020). Another stream of literature has investigated the stock price reaction of Shariah-compliant (SC) firms in response to COVID-19 and global financial shocks at both the firm and country levels (Bhutto *et al.*, 2022; Shear and Ashraf, 2022; Raza *et al.*, 2022; Yarovaya *et al.*, 2021; Hassan *et al.*, 2022; Sukor and Abdul Halim, 2022; Chazi *et al.*, 2023; Al-Khazali *et al.*, 2014; Alnori and Alqahtani, 2019), as well as the risk, resilience and stability of SC firms in times of volatility relative to non-Shariah-compliant (NSC) firms (Shaikh *et al.*, 2019; Cheong, 2021; Khaw *et al.*, 2019; Hasan *et al.*, 2021). These studies have generally provided evidence that SC stocks, funds and indices outperformed their NSC counterparts during the pandemic and economic downturns.

COVID-19's impact is expected to be very significant on firm operations, yet large-scale and robust empirical evidence on the COVID-19's influence on firms' operating profitability is scarce [1]. This study fills this significant gap in the literature and provides, to our knowledge, the first large-scale and robust empirical evidence on the impact of COVID-19 on the operating performance of SC and NSC firms in the USA. Pandemics drive substantial economic downturns by disrupting labor supply, productivity and consumer demand (Eichenbaum *et al.*, 2021). These negative supply and demand shocks, while sometimes sector-specific, can also cascade throughout the economy, leading to significant drops in consumption and overall output (Guerrieri *et al.*, 2022). Output declines can also be persistent following financial distress (Romer and Romer, 2017). By using unique firm-level employment data from the USA, Census *et al.* (2017) show that large local consumer demand shocks, such as those during the Great Recession (i.e. global financial crisis of 2007–2009), cause firms with higher leverage to lose significantly more of their employees. Lower leverage reduces the financial risk and vulnerability of these firms during economic downturns, allowing them to better withstand adverse shocks (Touti and Taïb, 2024). SC firms provide us with a unique angle as they are characterized by lower leverage and lower risk (Khaw *et al.*, 2019; Cheong, 2021). These characteristics suggest that SC firms are likely to maintain operational stability and be more resilient to unexpected adverse shocks, such as the COVID-19 pandemic, and experience less severe impacts on their operating profitability compared to their NSC counterparts.

For our empirical analysis, we construct a unique data set by combining extensive quarterly financial statements data for US firms with SC firm indicator from LSEG Workspace, covering the period 2018–2022 [2]. We carefully construct a matching sample where SC and NSC firms are matched by the same industry and closest asset size to make sure firms are comparable. In our empirical tests, using various measures of operating profitability, we first show that SC firms are more profitable than NSC firms, consistent with Akguc and Al Rahahleh (2018, 2020), who provided the first evidence on the operational

(i.e. financial statement) impact of Shariah compliance on firm profitability. We then show that COVID-19 negatively impacted profitability for all firms, but the effect was much less for SC firms [3]. For example, in our full sample, ROA (measured as the net income divided by total assets) dropped by 1.89% for NSC firms, whereas it fell only by 1.28% for SC firms. Similarly, profit margin (measured as the net income divided by net sales revenue) fell by 39.4% for NSC firms, but the drop was only 23.3% for SC firms. These differences between SC and NSC firm profitability are statistically and economically significant and highlight the resilience of SC firms compared to NSC during the COVID-19 pandemic.

We perform several robustness tests to provide additional support for our main findings. First, we address concerns over endogeneity. The choice of SC can be endogenous such that characteristics that make a firm SC might also correlate with firm profitability, potentially leading to inconsistent coefficient estimates. Following Akguc and Al Rahahleh (2018 and 2020), we use the percentage of SC firms within the two-digit SIC industry as an instrument for the potentially endogenous SC dummy. Our two-stage least squares estimations show strong support for our key results. Second, we estimate our baseline model using median regression (i.e. least absolute deviation method), which is not affected by outliers, further confirming our baseline pooled OLS estimation results. Finally, we construct two alternative set of matching samples: industry-asset size nearest neighbor matching without replacement and propensity score matching to further alleviate sample selection concerns. Our baseline results remain robust.

The rest of the paper is structured as follows: in Section 2, we briefly review the literature on COVID-19, Shariah-compliance and their impact on firm profitability and develop our hypothesis; in Section 3, we describe our sample construction and provide summary statistics; we discuss the main empirical results in Section 4, as well as additional empirical tests in Section 5; we discuss implications of our findings in Section 6, and in Section 7, we conclude.

## 2. Literature review and hypothesis development

The COVID-19 pandemic has been widely studied due to its global impact on firms and consumers. A significant portion of this research has focused on the effect of the pandemic on regional and international stock markets, while relatively fewer studies have examined its impact on firms' operating performance and profitability. Understanding this distinction is critical, as stock market reactions are driven by a mix of fundamental and behavioral factors, whereas operational performance directly reflects a firm's financial health, resilience and business strategy during economic downturns.

Mazur *et al.* (2020) showed the differential effect of COVID-19 on US firms and industries. In addition, a number of recent studies analyzed the relative stock market reaction of Islamic and conventional stock indices as well SC and NSC firms. Mahendra (2023) highlighted a contrast in US stock market performance pre- and post-pandemic, noting that widespread lockdowns and economic disruptions during COVID-19 led to substantial losses in major indices like the DJIA, compounded by increased uncertainty and weakened investor sentiment. Similarly, Gupta *et al.* (2023) explored the pandemic's ramifications on the financial market, particularly the sharp decline in stock prices of big technology companies, underscoring the vulnerability of even high-performing sectors. Geng (2023) further emphasized the scale of the pandemic's impact on the US-listed companies, noting that the S&P 500 index lost 34% of its value by August 2020, with market recovery only beginning by December 2020. Baig *et al.* (2021) analyze confirmed cases and deaths in the USA and show a significant decrease in market liquidity and increase in volatility following this negative news. Haroon and Rizvi (2020) show heightened volatility in US equity markets in

response to negative news sentiment. These studies collectively illustrate the pandemic's transformative and dynamic impact on US stock markets, transitioning from severe initial losses to a gradual recovery and highlight the need for resilience-focused investment strategies in times of global crises.

Additional literature focuses on the cross-country comparative analysis of the impacts of COVID-19 on stock markets across major global markets. Liu (2023) examined the comparative impact on U.S. and Chinese stock markets, revealing that U.S. markets faced higher volatility and were more severely affected during the peak periods of the pandemic. Additionally, research on nonfinancial firms (Berger, Karakaplan, and Roman, 2024) found that these firms suffered significant economic damages, including large-scale business failures and sales declines during global business shutdowns. Ali *et al.* (2020) analyze various asset classes and show a significant decline across the world. These studies highlight the economic impact of COVID-19, affecting both financial and nonfinancial firms globally.

In addition, a number of recent studies analyzed the relative stock market reaction of Islamic and conventional stock indices as well SC and NSC firms. Hassan *et al.* (2022) use a 50-country sample of MSCI Islamic and conventional market indices from January to September 2020 to analyze the impact of COVID-19 and showed that pandemic led to large drawdown in all markets; however, Islamic indices fared better, which they interpret as Islamic markets to be more resilient. Similarly, Yarovaya *et al.* (2021) showed that the Islamic equity funds outperformed non-Islamic counterparts during the peak months of the COVID-19 pandemic.

Shaikh *et al.* (2019) used data from 2007 to 2016 to show that SC companies are less susceptible to volatility and recovered more efficiently after the crisis period relative to their NSC counterparts. The above supports the notion that the stability of SC firms reflects the conservative characteristics of the contemporary Shariah stock screening methodologies and Shariah itself. As volatility goes hand-in-hand with risk management and resilience, the study by Cheong (2021) found that SC firms experience lower firm risk when measured by total and idiosyncratic risk and exhibit stronger resilience with more minor deviations from maximum values in sales, cost of goods sold, operating expenses and share price. As the effect of Shariah compliance is more profound in the years following the US subprime crisis, this study supports our hypothesis that SC firms could outperform conventional firms during or after a financial crisis, due to greater resilience and stability. Within the same paradigm, Khaw *et al.* (2019) highlight the risk-reducing benefits that naturally arise from becoming SC as a firm. The authors demonstrate how Sharia compliance brings in the picture an innate guidance toward less risky and more sustainable investment and operational decisions through prohibiting various speculative and risk-averse investments. The Hasan *et al.* (2021) study finds somewhat contrary results to prior literature. They explored the impact of COVID-19 on global Islamic and conventional stock markets and its co-movement using the Dow Jones and FTSE Index and daily data from January 2020 to November 2020 show that both stock markets are strongly correlated, resulting in similar levels of volatility during the 2020 sample pandemic period. This result implies evidence in favor of no difference between the impact of COVID-19 on SC vs NSC firm resistance to volatility.

Shear and Ashraf (2022) used firm-level stock returns to find robust evidence that SC stocks outperform their conventional counterparts during the COVID-19 market collapse. They showed that although both kinds of stocks experienced lower negative returns in reaction to the increase in COVID-19 cases and governmental restrictions, conventional stocks were adversely impacted to a greater extent than SC stocks. A potential explanation would be the lower leverage and higher level of tangible assets holding, both factors being main principles of general Shariah

compliance, as also observed by Alnori and Alqahtani (2019). These findings reinforce our key claim that SC firms are expected to perform better during the pandemic.

Several empirical studies reinforce the argument that SC firms tend to show better stock price performance during financial crises. Chazi *et al.* (2023) study the performance of SC firms during crisis periods as well by analyzing monthly returns from January 2, 1996, to May 1, 2022, from firms in both developed and emerging markets. The authors focus on the global financial crisis in 2008–2009 and the COVID-19 pandemic to comparatively examine the correlation between these times of crisis and the SC status, specifically the volatility of SC firms relative to their NSC counterparts. Their findings show that the indices move in tandem during tranquil periods but diverge during the stated periods of crises, further deducing that Islamic indices perform better. The authors explain their results by arguing that Islamic indices serve "as a hedge and offer better diversification benefits during crises" (Chazi *et al.*, 2023). Empirical evidence on the superior performance of Islamic stock indexes during periods of crises is reinforced by Al-Khazali *et al.* (2014). The study leverages stochastic dominance (SD) analysis to conclude that Islamic stock indices stochastically dominate their conventional counterparts during the 2007–2012 period for the global, European and the US Islamic indices. Our unique contribution to the literature is focusing precisely on operational performance and profitability during economic downturns and hence complementing the literature on stock price performance.

Maintaining the theme of analysis during times of crisis, Sukor and Abdul Halim (2022) recommend that SC firms should be included in portfolios during times of crisis because they are less affected by market-wide volatility, provide stability and do not experience significant deteriorations in their performance during crises. Further effects of the SC status have been examined by Farooq and AbdelBari (2015), particularly investigating the earnings management behaviors. The study unveils a significantly lower rate of earnings management exhibited by SC firms, meaning a significantly reduced likelihood to engage in artificially manipulating their earnings to meet targets.

Economic downturns triggered by pandemics result in disruptions to labor supply, productivity losses and declines in consumer demand (Eichenbaum *et al.*, 2021; Guerrieri *et al.*, 2022) where negative effects of output declines can be persistent following financial distress (Romer and Romer (2017). This, in turn, is expected to impact firms' operations and operating profitability. However, the severity of these effects varies across firms, depending on their financial structure, risk exposure and operational resilience. A growing body of literature suggests that firms with lower financial risk are better positioned to withstand economic downturns. Giroud and Mueller (2016) use US census firm-level employment data to show that firms with higher leverage experience significantly greater employment losses during demand shocks, such as those observed during the Great Recession.

Building on this literature, our study shifts the focus from stock price performance to firm-level operational performance and profitability for a unique set of SC firms in the USA. Akguc and Al Rahahleh (2018) analyze firms in six Gulf Cooperation Countries (GCC) and find that SC firms are more profitable and operationally efficient than NSC firms. Using a set of companies listed on the FTSE All World Index, Tahir and Ibrahim (2020) show that SC firms outperform their NSC counterparts in terms of both accounting and market returns not only during the Great Recession (2007–2020) but also in post-recession periods (2011–2014), highlighting their sustained resilience.

COVID-19 was a significant pandemic that had a direct impact on firm operations. The findings discussed above underscore the role of financial structure in shaping firm resilience.

SC firms provide a unique setting to examine these dynamics, as they are characterized by lower leverage and more conservative financial policies (Khaw *et al.*, 2019; Cheong, 2021).

The discussion above leads us to our key hypothesis:

*H1*. While COVID-19 negatively affects firm profitability, the decline is less severe for Shariah-compliant (SC) firms compared to non-Shariah-compliant (NSC) firms.

## 3. Data and methodology

This section outlines the sample construction process and presents univariate results along with summary statistics.

### *3.1 Data and full sample construction*

The initial raw data set consisted of two separate subsets merged by ticker name, as it follows: the Compustat North America database to extract quarterly financial data of US public firms between 2018 and 2022 and the complete list of 878 SC US public firms collected from LSEG Workspace, which classifies a firm as SC if all of the following conditions are satisfied:

- Cash, cash equivalents, receivables to total assets ratio less than 50%.
- Cumulative revenue and non-operating interest income from non-compliant activities does not exceed 5% of their total income [4].
- Cash, cash equivalents, short-term investments to total assets ratio less than 33%.
- Interest-bearing debt to total assets ratio less than 33%.

If any of these conditions is violated, the firm is classified as NSC. An SC firm can be reclassified as NSC if it fails to meet any of the criteria in a given fiscal quarter. LSEG Workspace provides an SC flag for companies that satisfy these conditions. We carefully merged the LSEG Workspace data with quarterly financial statement data from Compustat. After applying the full data filtering process, our final data set consists of 15,735 observations from 871 distinct SC public firms and 44,039 observations from 3,375 distinct NSC public firms. During the data filtering process, we followed the standard approach in empirical corporate finance by excluding financial firms with SIC codes ranging from 6000 to 6999 and regulated utility firms with SIC codes ranging from 4900 to 4949. In addition, observations with missing industry SIC codes, inconsistent observations such as negative values for total assets, total current assets, cash and cash equivalents, total debt and liabilities, total current liabilities and revenue were dropped. Missing values for some of the key variables for our analysis such as total assets, EBIT and EBITDA were also removed from the raw sample. We then carefully constructed our key variable, the COVID dummy, wherein we attribute a value of zero for periods preceding the start of the COVID-19 pandemic, and a value of 1 to represent post-COVID-19 periods. Our data timeline ranges from 2018 to 2022, and we recognized March 2020 as the point of exponential growth of COVID-19 in the USA, when in the beginning of the month, it was declared a world pandemic by WHO, and all the social distancing measures got extended and more restrictive, including business shutdowns, shortages and switching to remote environments (CDC, 2023). Thus, the time period before March 2020 was labeled as pre-COVID, while the time period after March 2020 was labeled as post-COVID.

To ensure that the potential effects of price changes are accounted for, we adjusted our key variables with nominal values for inflation using quarterly data extracted from the

US Bureau of Labor Statistics (BLS) (FRED, 2023) so that they are stated in 2020 constant dollars. To mitigate the effects of outliers, we winsorized each variable at 2.5% (Al Rahahleh *et al.*, 2021) level separately for SC and NSC firms.

### *3.2 Industry-size matching*

To mitigate potential sample selection biases and enhance comparability between SC and NSC firms, we constructed a separate subset, including only firms that have been matched by industry and asset size. This creates a data set that uniquely pairs each distinct SC firm to an NSC firm, within the same two-digit SIC industry and closest asset size. Matching "*with replacement*" indicates that after a certain SC firm has been matched to an NSC firm to form a pair, those particular SC and NSC firms cannot be matched to another different SC or NSC firm in the industry anymore. Following Asker *et al.* (2014), we restrict ratio of assets between SC and NSC firms to be a maximum of two to ensure a close match. In the robustness section, we apply alternative matching techniques to further confirm our findings.

The final industry-size matched (with replacement) data set consists of 25,600 total observations from 1,604 distinct firms; including 14,445 observations of 802 distinct SC firms and 11,155 observations of 802 distinct NSC firms. The density graphs in Figure 1 demonstrate how the discrepancies between the observations of SC and NSC firms were standardized and removed through the construction of the industry-asset matched sample. Panels A and B in Figure 1 exhibit kernel density estimations for both the full and industry-size matched sample with replacement, based on industry and *ln(total assets)* in constant 2022 USD million. Presenting our results both in full and matched samples provides further support for the robustness our results.

### *3.3 Variables specification and descriptive statistics*

In Table 1, Panel B provides summary statistics comparing key firm characteristics of SC vs NSC firms from the industry-size matched (with replacement) data set. Generally, SC firms are smaller than NSC firms. At the mean (median) level, SC firms have a total asset size of US$2bn (US$1.38bn), compared to US$8.27bn (US$1.7bn) of NSC firms. On average, SC firms also exhibit lower sales growth than NSC firms (4.22% vs 6%), significantly lower long-term debt-to-asset ratios (19% vs 27%), as well as lower total liabilities-to-asset ratios than NSC firms at the mean and median levels (around 48% vs 59%). Moreover, NSC firms notably show better liquidity than SC firms. On average, NSC firms hold more cash than SC firms (US$656m vs US$467m), as well as more cash and short-term investments (US$839m vs US$598m).

Various performance indicators show that SC firms outperform NSC firms overall. In the summary statistics (Table 1: Panel B), return on assets (ROA) and profit margin (PM) are included in three different definitions; earnings before interest and taxes (EBIT); earnings before interest, taxes, depreciation, and amortization (EBITDA) and net income (NI), scaled by total assets to compute ROA or revenue, respectively, to compute PM. Using ROA to measure profitability, SC firms are more profitable than NSC firms in each definition. Specifically, when EBIT, EBITDA and NI are used to define ROA, the differences in the mean (median) values are higher by 1.2% to 1.4% (0.4% to 0.6%) between SC and NSC firms. When measuring profitability using PM, SC firms are again more profitable than NSC firms in each definition. Using EBIT, EBITDA and NI to define PM, the differences in mean (median) values are 23.6%, 25% and 27.3% (1.3%, 1.5% and 2.1%) between SC and NSC firms. All differences in means and medians for both ROA and PM are significant at the 1% level. These results are visualized in Figure 2, which presents quarterly time-series graphs of the mean and median differences in operating profitability (ROA) between SC and NSC

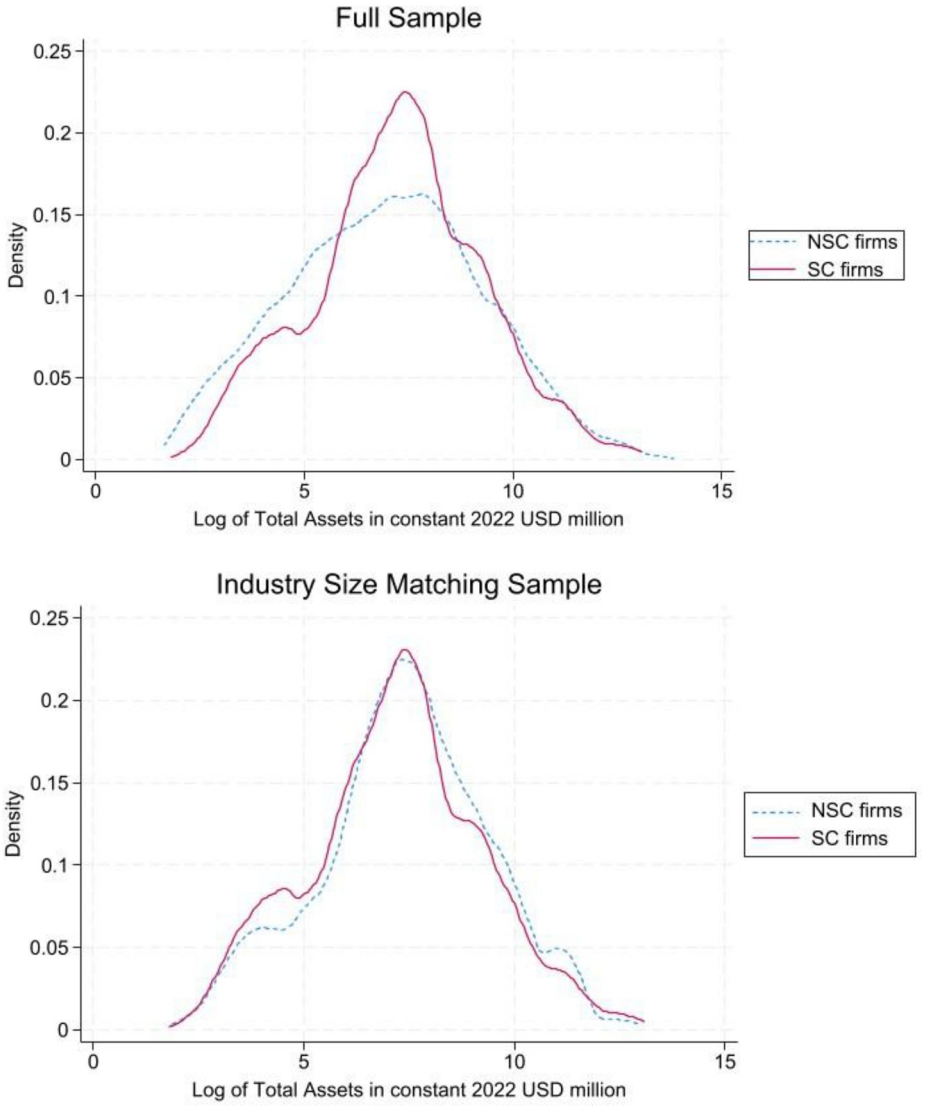


**Figure 1.** Matching quality: asset size distribution of SC firms vs NSC firms
**Source:** Authors' own work

firms over our research period (2018–2022). Clearly, the mean and median ROA differences, represented by positive values throughout the period, indicate that SC firms consistently outperform their NSC counterparts across all definitions of profitability measured by ROA (EBITDA, NI and EBIT) [5]. Notably, all three panels illustrate an increasing gap starting around the first quarter of 2020, as evidenced by the

**Table 1.** Summary statistics

| | Shariah-compliant (SC) | | | | | | Non-Shariah-compliant (NSC) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | *N* | Mean | SD | p25 | p50 | p75 | *N* | Mean | SD | p25 | p50 | p75 | Difference in means | Difference in medians |
| *Panel A: Full sample* | | | | | | | | | | | | | | |
| Assets (US$m) | 15,735 | 7,082.455 | 15,590.260 | 390.517 | 1,402.242 | 5,135.437 | 44,039 | 7,950.815 | 18,283.620 | 190.810 | 1,082.000 | 5,290.361 | −868.360*** | 320.242*** |
| Revenue (US$m) | 15,733 | 1,436.014 | 3,237.888 | 81.471 | 309.681 | 1,070.872 | 44,010 | 1,341.514 | 3,110.400 | 23.473 | 155.767 | 873.904 | 94.500*** | 153.914*** |
| Sales growth (%) | 15,689 | 4.344 | 18.802 | −4.915 | 2.560 | 10.896 | 42,856 | 6.684 | 29.441 | −5.953 | 2.842 | 13.437 | −2.340*** | −0.282** |
| Cash (US$m) | 15,734 | 462.349 | 992.124 | 17.680 | 85.645 | 345.351 | 44,022 | 591.500 | 1,352.588 | 20.467 | 102.361 | 401.306 | −129.152*** | −16.716*** |
| Cash and ST inv. (US$m) | 15,734 | 585.265 | 1,347.348 | 19.929 | 101.314 | 386.600 | 44,022 | 752.000 | 1,697.371 | 26.045 | 133.704 | 527.500 | −166.735*** | −32.391*** |
| Long-term debt-to-asset | 15,610 | 0.195 | 0.139 | 0.072 | 0.189 | 0.298 | 43,601 | 0.272 | 0.240 | 0.053 | 0.233 | 0.423 | −0.083*** | −0.066*** |
| Total liabilities-to-asset | 15,735 | 0.490 | 0.192 | 0.350 | 0.496 | 0.617 | 44,039 | 0.592 | 0.312 | 0.364 | 0.578 | 0.763 | −0.102*** | −0.082*** |
| ROA EBITDA | 15,735 | 0.012 | 0.038 | 0.000 | 0.016 | 0.031 | 44,039 | −0.010 | 0.066 | −0.027 | 0.009 | 0.025 | 0.022*** | 0.007*** |
| ROA EBIT | 15,735 | 0.001 | 0.040 | −0.012 | 0.006 | 0.022 | 44,039 | −0.021 | 0.067 | −0.038 | −0.003 | 0.016 | 0.022*** | 0.009*** |
| ROA net income | 15,735 | −0.005 | 0.038 | −0.015 | 0.001 | 0.015 | 44,039 | −0.029 | 0.068 | −0.043 | −0.009 | 0.008 | 0.024*** | 0.010*** |
| PM EBIT | 15,733 | 0.086 | 0.252 | 0.041 | 0.112 | 0.193 | 44,010 | −0.288 | 1.331 | −0.116 | 0.093 | 0.226 | 0.374*** | 0.018*** |
| PM EBITDA | 15,733 | 0.021 | 0.267 | −0.001 | 0.069 | 0.139 | 44,010 | −0.382 | 1.378 | −0.195 | 0.042 | 0.146 | 0.403*** | 0.027*** |
| PM net income | 15,733 | −0.006 | 0.264 | −0.014 | 0.046 | 0.102 | 44,010 | −0.444 | 1.417 | −0.238 | 0.014 | 0.094 | 0.438*** | 0.033*** |
| Total asset turnover | 15,733 | 0.251 | 0.144 | 0.139 | 0.224 | 0.333 | 44,010 | 0.204 | 0.162 | 0.092 | 0.160 | 0.264 | 0.047*** | 0.064*** |
| Fixed asset turnover | 15,707 | 2.059 | 2.647 | 0.618 | 1.244 | 2.258 | 43,745 | 2.821 | 5.051 | 0.429 | 1.106 | 2.542 | −0.762*** | 0.138*** |
| Avg. collection period | 14,647 | 55.633 | 66.497 | 34.805 | 51.298 | 66.322 | 39,671 | 62.488 | 125.217 | 29.454 | 51.358 | 72.860 | −6.855*** | −0.060 |
| Avg. credit period | 15,693 | 33.276 | 55.983 | 15.085 | 24.942 | 39.051 | 43,566 | 48.589 | 213.899 | 14.289 | 27.590 | 49.214 | −15.313*** | −3.098*** |
| *Panel B: Industry-size matched sample* | | | | | | | | | | | | | | |
| Assets (US$m) | 14,445 | 7,199.775 | 15,917.350 | 366.881 | 1,381.379 | 5,083.269 | 11,155 | 8,268.856 | 1,7731.41 | 486.913 | 1,703.593 | 6241.950 | −1,069.081*** | −322.214*** |
| Revenue (US$m) | 14,443 | 1,425.398 | 3,234.949 | 76.215 | 296.381 | 1,019.694 | 11,153 | 1,447.856 | 2,912.998 | 71.147 | 304.625 | 1267.442 | −22.458 | −8.244 |
| Sales growth (%) | 14,401 | 4.216 | 18.527 | −4.908 | 2.492 | 10.607 | 10,904 | 6.011 | 26.606 | −5.517 | 2.891 | 12.275 | −1.794*** | −0.399** |
| Cash (US$m) | 14,444 | 467.289 | 1,009.971 | 17.297 | 84.265 | 338.688 | 11,153 | 656.197 | 1,372.925 | 32.000 | 142.760 | 512.000 | −188.907*** | −58.496*** |
| Cash and ST inv. (US$m) | 14,444 | 597.629 | 1,382.192 | 19.546 | 98.304 | 379.627 | 11,153 | 838.676 | 1,761.320 | 39.390 | 183.489 | 649.518 | −241.048*** | −85.185*** |
| Long-term debt-to-asset | 14,333 | 0.191 | 0.138 | 0.067 | 0.184 | 0.294 | 11,036 | 0.273 | 0.223 | 0.070 | 0.250 | 0.420 | −0.077*** | −0.044*** |
| Total liabilities-to-asset | 14,445 | 0.484 | 0.190 | 0.344 | 0.491 | 0.610 | 11,155 | 0.590 | 0.283 | 0.391 | 0.585 | 0.752 | −0.106*** | −0.095*** |
| ROA EBITDA | 14,445 | 0.011 | 0.038 | −0.001 | 0.015 | 0.031 | 11,155 | −0.001 | 0.057 | −0.013 | 0.012 | 0.027 | 0.012*** | 0.004*** |
| ROA EBIT | 14,445 | 0.000 | 0.040 | −0.013 | 0.006 | 0.022 | 11,155 | −0.011 | 0.057 | −0.024 | 0.001 | 0.018 | 0.012*** | 0.005*** |

(*continued*)

**Table 1.** Continued

| | Shariah-compliant (SC) | | | | | | Non-Shariah-compliant (NSC) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | *N* | Mean | SD | p25 | p50 | p75 | *N* | Mean | SD | p25 | p50 | p75 | Difference in means | Difference in medians |
| ROA net income | 14,445 | −0.005 | 0.038 | −0.016 | 0.001 | 0.014 | 11,155 | −0.019 | 0.057 | −0.029 | −0.005 | 0.010 | 0.014*** | 0.006*** |
| PM EBIT | 14,443 | 0.084 | 0.258 | 0.040 | 0.112 | 0.196 | 11,153 | −0.152 | 1.077 | −0.017 | 0.100 | 0.202 | 0.236*** | 0.013*** |
| PM EBITDA | 14,443 | 0.018 | 0.274 | −0.004 | 0.068 | 0.140 | 11,153 | −0.232 | 1.117 | −0.084 | 0.053 | 0.139 | 0.250*** | 0.015*** |
| PM net income | 14,443 | −0.010 | 0.271 | −0.018 | 0.046 | 0.103 | 11,153 | −0.283 | 1.148 | −0.118 | 0.025 | 0.093 | 0.273*** | 0.021*** |
| Total asset turnover | 14,443 | 0.245 | 0.143 | 0.135 | 0.217 | 0.325 | 11,153 | 0.223 | 0.168 | 0.108 | 0.178 | 0.284 | 0.023*** | 0.039*** |
| Fixed asset turnover | 14,420 | 2.004 | 2.399 | 0.632 | 1.269 | 2.281 | 11,116 | 2.517 | 4.115 | 0.571 | 1.175 | 2.368 | −0.513*** | 0.094*** |
| Avg. collection period (days) | 13,688 | 57.032 | 68.199 | 36.056 | 52.262 | 67.192 | 10,346 | 62.327 | 74.815 | 34.252 | 54.082 | 73.325 | −5.295*** | −1.82*** |
| Avg. credit period (days) | 14,403 | 33.574 | 58.154 | 14.761 | 24.827 | 39.232 | 11,056 | 44.706 | 101.770 | 16.453 | 28.800 | 47.681 | −11.132*** | −3.973*** |

**Note(s):** Panel A presents descriptive statistics for the full sample data set of SC and NSC firms in the USA from 2018–2022. Panel B presents descriptive statistics for the industry-size-matched data set (with replacement) of SC and NSC firms in the USA from 2018–2022. Data for both panels are sourced from Compustat North America database and Refintiv. Monetary values are also expressed in 2022 constant price using CPI and in million USD, continuous variables are winsorized at 2.5% at each tail to reduce the impact of outliers, ***, ** and * represent statistical significance at 1, 5 and 10% respectively

**Source(s):** Authors' own work

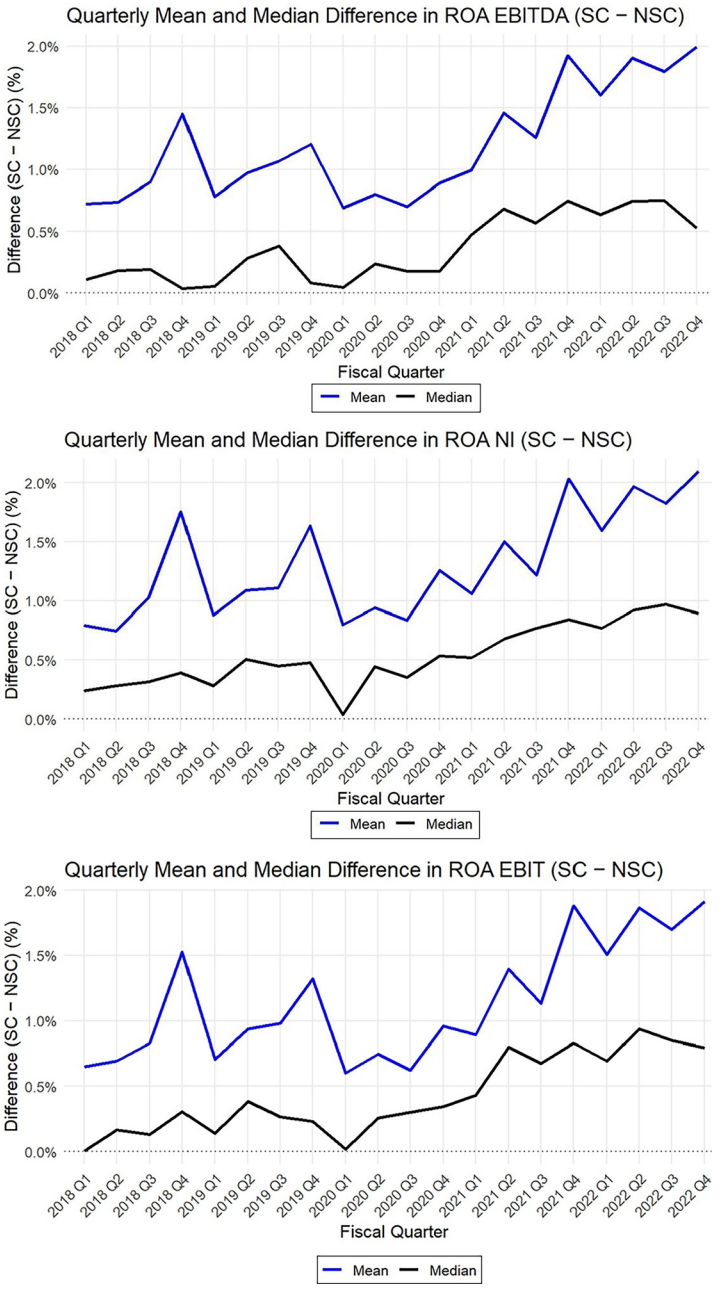


**Figure 2.** Operating performance by fiscal quarter
**Source:** Authors' own work

upward-sloping trend lines. This widening difference underscores that the operational performance advantage of SC firms not only persisted during the pandemic but strengthened over time as the economic effects of COVID-19 unfolded.

The consistent pattern of SC firms exhibiting a relatively higher ROA can be consolidated through observing the total asset turnover (ATO). We observe SC firms having a higher total asset turnover (ATO) than NSC firms, with mean (median) ATO of 24.5% (21.7%) vs 22.3% (17.8%), respectively. Furthermore, SC firms are also relatively more efficient in collecting their receivables (57 vs 62 days). Overall, in every definition of ROA and PM used, the average SC firm is more profitable than the average NSC firm. Our conclusions are consistent when using median differences instead, which are not affected by outliers. Therefore, these univariate results support our main hypothesis that SC firms are more profitable than NSC firms. We move to multivariate analysis to investigate the impact of COVID-19 on the operating performance of SC versus NSC firms.

### *3.4 Methodology*

The baseline multivariate regression model we estimate takes the following difference-in-difference form:

$$\begin{aligned} profitability_{it} = {} & \beta_0 + \beta_1 (COVID)_i + \beta_2 (SC)_i + \beta_3 (SC \times COVID)_i + \beta_4 ln(Total\ assets)_{it} \\ & + \beta_5 (Sales\ growth)_{it} + \beta_6 (Leverage)_{it} + \beta_7 (Fixed\ asset\ turnover)_{it} \\ & + Fiscal\ quarter\ dummies + \varepsilon_{it} \end{aligned}$$

where *profitability* is the dependent variable, measured by ROA or PM. In our analysis, we have included three different definitions for both ROA and PM in terms of EBIT, EBITDA and NI. The ratios are obtained through scaling by total assets to compute ROA, by revenue to compute PM, respectively. Our key independent variables are *COVID* dummy (1 if the financial quarter is post-COVID, and 0 if pre-COVID), *SC* dummy (1 for SC firm, 0 for conventional firm) and the interaction between these two variables (1 if SC and post-COVID, and 0 otherwise). In our data set, we classified the "COVID quarter" as the fiscal quarter that includes March 2020, as many firms do not have aligned calendar year-end structures and reporting schedules. Therefore, pre-COVID is classified as any quarters before the "COVID quarter," and post-COVID as any quarters after this quarter, respectively.

Our multivariate regression model also controls for firm-specific variables that have been shown to affect operating performance in previous studies (Akguc and Al Rahahleh, 2018; Akguc and Al Rahahleh, 2020). The additional firm-level controls are as follows:

- *ln(Total assets)* is the natural logarithm of total assets.
- *Sales growth* is the percent increase in revenue computed between the current and previous quarter's revenue.
- *Leverage* is total debt scaled by total assets.
- *Fixed-asset turnover* shows how efficient a firm is in generating sales from its fixed assets (revenue divided by net fixed assets).

The model also includes fiscal quarter dummies to control for potential time-specific variation between different quarters within a fiscal year (Flannery and Hankins, 2013).

## 4. Main empirical results

### *4.1 Multivariate regression analysis*

Panel B of Table 2 presents the regression results for the full sample as well as industry-size matched subset, estimating the difference in the impact COVID-19 had on SC vs NSC firms' operating performance, where robust standard errors are clustered at the firm level. As expected, an average firm experienced a significant decrease in its profitability during the pandemic, as indicated by the negative and statistically significant (at the 1% level) COVID dummy variable coefficients in all specifications. Interaction between COVID and SC is positive and statistically significant at 1% for all specifications, indicating that SC firms were not affected from the pandemic as much as NSC firms. For example, ROA EBITDA (Column 1) fell on average by 1.9% for NSC firms, whereas it fell only by 1.255% (–0.019 + 0.00645) in the full sample. These values are 1.89% and 1.484%, respectively, for the matched sample. Similarly, PM EBITDA (Column 4) fell on average by 32.4% for NSC firms, whereas it fell only by 17.5% (–0.324 + 0.149) for the matched sample, the drop is 24.5% and 13.3% for NSC and SC firm, respectively. Additionally, the SC dummy is positive and statistically significant for all specifications, indicating that SC firms perform better than NSC firms and the profitability difference increased even further as shown by the positive interaction between by COVID and SC dummies. In Columns 1–3, the average SC firm is 1.02% (ROA EBIT) to 1.07% (ROA EBITDA) more profitable than NSC firms, confirming our previous univariate analysis. When comparing the impact of COVID on SC vs NSC firms using the interaction dummy, SC firms are overall more profitable than their NSC counterparts post-pandemic. The average SC firm is 0.39% to 0.41% more profitable than NSC firms post-pandemic, statistically significant at the 1% level. Moreover, the estimation results also show that operational profitability is positively correlated to firm size (total assets), sales growth and fixed asset turnover and negatively correlated to leverage.

These multivariate estimation results confirm our main hypothesis that SC firms were not affected as much as NSC during the COVID-19 pandemic.

### *4.2 Endogeneity of firm's Shariah-compliant status*

A potential concern in our analysis is the endogeneity of the Shariah compliance (SC) dummy variable, as unobservable factors affecting a firm's SC status could also influence its operational performance, potentially causing inconsistent coefficient estimates. To address this, we use a two-stage instrumental variable (2SLS) approach, following Akguc and Al Rahahleh (2020), using the percentage of SC firms within each two-digit SIC industry as our instrument. This instrument leverages a "peer effect" logic: a firm's likelihood of Shariah compliance increases with the prevalence of SC firms in its industry. To further support the validity and exogeneity of our instrument, we conducted supplementary exploratory analyses. Specifically, we examined correlations between the percentage of SC firms in each industry and various profitability measures, finding them to be relatively weak (ranging from 9.1% to 11.8%). Moreover, detailed random comparisons across selected industries with varying percentages of SC firms revealed no systematic relationship between SC prevalence and profitability. For instance, industries with similarly low percentages of SC firms exhibited contrasting profitability levels, suggesting limited direct association between industry-level SC prevalence and firm profitability. Overall, these additional analyses help mitigate concerns regarding the exogeneity of our instrument, thereby supporting the validity of our methodological approach.

Table 3 presents the estimation results from our 2SLS regression. In the first stage, we estimated a probit model with SC as the dependent variable and the remaining control variables following the baseline model. The second stage uses the predicted probabilities

**Table 2.** Baseline operating profitability regressions

| Variable | ROA EBITDA (1) | ROA EBIT (2) | ROA net income (3) | PM EBITDA (4) | PM EBIT (5) | PM net income (6) |
|---|---|---|---|---|---|---|
| *Panel A: Full sample* | | | | | | |
| COVID | −0.0190*** (0.00239) | −0.0199*** (0.00243) | −0.0189*** (0.00228) | −0.324*** (0.0336) | −0.376*** (0.0360) | −0.394*** (0.0367) |
| Shariah-compliant | 0.0125*** (0.00130) | 0.0123*** (0.00134) | 0.0127*** (0.00129) | 0.257*** (0.0221) | 0.286*** (0.0228) | 0.308*** (0.0233) |
| COVID × shariah compliant | 0.00645*** (0.00109) | 0.00634*** (0.00112) | 0.00606*** (0.00109) | 0.149*** (0.0186) | 0.157*** (0.0194) | 0.161*** (0.0199) |
| Ln (total assets) | 0.0107*** (0.000340) | 0.0109*** (0.000345) | 0.0113*** (0.000355) | 0.130*** (0.00549) | 0.129*** (0.00567) | 0.133*** (0.00593) |
| Sales growth | 0.000159*** (1.19e-05) | 0.000156*** (1.19e-05) | 0.000130*** (1.17e-05) | 0.00227*** (0.000259) | 0.00246*** (0.000269) | 0.00241*** (0.000277) |
| Leverage | −0.0216*** (0.00282) | −0.0259*** (0.00285) | −0.0402*** (0.00295) | 0.163*** (0.0527) | 0.181*** (0.0543) | 0.0951* (0.0571) |
| Fixed asset turnover | 0.000796*** (0.000166) | 0.00114*** (0.000171) | 0.00106*** (0.000171) | 0.0253*** (0.00218) | 0.0304*** (0.00226) | 0.0328*** (0.00233) |
| Fiscal quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | −0.0621*** (0.00327) | −0.0718*** (0.00331) | −0.0740*** (0.00325) | −1.143*** (0.0625) | −1.227*** (0.0651) | −1.255*** (0.0666) |
| *N* | 58,292 | 58,292 | 58,292 | 58,292 | 58,292 | 58,292 |
| Adjusted R-squared | 0.1841 | 0.1855 | 0.2069 | 0.0947 | 0.0946 | 0.095 |
| *Panel B: Industry-size matched sample* | | | | | | |
| COVID | −0.0189*** (0.00288) | −0.0202*** (0.00294) | −0.0198*** (0.00281) | −0.245*** (0.0342) | −0.291*** (0.0362) | −0.303*** (0.0368) |
| Shariah-compliant (SC) | 0.0107*** (0.00192) | 0.0102*** (0.00197) | 0.0106*** (0.00193) | 0.189*** (0.0326) | 0.208*** (0.0340) | 0.225*** (0.0348) |
| COVID × shariah compliant | 0.00406** (0.00160) | 0.00388** (0.00163) | 0.00388** (0.00160) | 0.112*** (0.0266) | 0.113*** (0.0280) | 0.117*** (0.0289) |
| Ln (total assets) | 0.00909*** (0.000497) | 0.00956*** (0.000508) | 0.00956*** (0.000514) | 0.0915*** (0.00658) | 0.0923*** (0.00681) | 0.0925*** (0.00721) |
| Sales growth | 0.000190*** (1.87e-05) | 0.000184*** (1.87e-05) | 0.000153*** (1.78e-05) | 0.00158*** (0.000360) | 0.00167*** (0.000374) | 0.00157*** (0.000382) |
| Leverage | −0.0129*** (0.00427) | −0.0165*** (0.00435) | −0.0260*** (0.00435) | 0.0996 (0.0764) | 0.131* (0.0793) | 0.0893 (0.0840) |
| Fixed asset turnover | 0.00134*** (0.000236) | 0.00190*** (0.000241) | 0.00175*** (0.000236) | 0.0175*** (0.00312) | 0.0239*** (0.00326) | 0.0259*** (0.00339) |
| Fiscal quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | −0.0534*** (0.00490) | −0.0655*** (0.00495) | −0.0668*** (0.00487) | −0.775*** (0.0833) | −0.868*** (0.0866) | −0.893*** (0.0884) |
| *N* | 25,248 | 25,248 | 25,248 | 25,248 | 25,248 | 25,248 |
| Adjusted R-squared | 0.1701 | 0.1771 | 0.1856 | 0.0974 | 0.0984 | 0.097 |

**Note(s):** This table present OLS regressions results from the full sample data set in Panel A and the industry-size-matched data set (with replacement) in Panel B. The regression results show the impact of basic firm characteristics on operating profitability of SC vs NSC firms in the US from 2018–2022. COVID is a dummy variable that takes a value of one for the post-COVID period, and zero for the pre-COVID period. SC is a dummy variable that takes a value of one for SC firms, and zero for NSC firms. COVID × SC is a dummy that takes a value of 1 for SC firms post-COVID, and 0 otherwise. The data was sourced using Compustat North American database. All models are controlled for fiscal quarter fixed effects, and the *t*-statistics (reported in parenthesis) are computed using standard errors clustered at firm level. All monetary values are expressed in 2022 constant price using CPI, continuous variables are winsorized at 2.5% at each tail to reduce the impact of outliers, ***, ** and * represent statistical significance at 1, 5 and 10%, respectively

**Source(s):** Authors' own work

**Table 3.** Instrumental variable estimation

| | First stage | | Second stage | | |
|---|---|---|---|---|---|
| Variable | Shariah-compliant (SC) | Margins | ROA EBITDA | ROA EBIT | ROA net income |
| Shariah-compliant (predicted) | | | 0.0365*** (0.00364) | 0.0368*** (0.00377) | 0.0356*** (0.00367) |
| COVID | | | −0.0210*** (0.00267) | −0.0221*** (0.00274) | −0.0208*** (0.00261) |
| COVID × SC | | | 0.0138*** (0.00380) | 0.0146*** (0.00386) | 0.0130*** (0.00383) |
| % SC firms within each industry | 3.257*** (0.178) | 0.933*** (0.0445) | | | |
| Firm controls | Yes | Yes | Yes | Yes | Yes |
| Fiscal quarter FE | Yes | Yes | Yes | Yes | Yes |
| Constant | −1.142*** (0.106) | | −0.0711*** (0.00361) | −0.0811*** (0.00365) | −0.0826*** (0.00358) |
| Durbin–Wu–Hausman test *p*-value | 0.00 | | | | |
| *N* | 58,283 | 58,283 | 58,283 | 58,283 | 58,283 |
| Pseudo-*R*-squared | 0.1248 | | | | |
| R-squared | | | 0.181 | 0.184 | 0.204 |

**Note(s):** This table presents the two-stage least squares (2SLS) regression of basic firm characteristics that impacts the operating profitability of SC vs NSC firms from 2018–2022. COVID is a dummy variable that takes a value of one for the post-COVID period, and zero for the pre-COVID period. SC is a dummy variable that takes a value of one for SC firms, and zero for NSC firms. COVID × SC is a dummy that takes a value of 1 for SC firms post-COVID, and 0 otherwise. The first-stage regression is a probit model with SC dummy as the main independent variable. The instrument used for the potentially endogenous SC dummy is the percentage of SC firms within each industry. This is calculated by dividing the total number of SC firms by the total number of firms in each industry. The second column presents the marginal effects of all of the variables in the first-stage model at the mean level. The second stage are pooled OLS regression results, conducted on different definitions of ROA as the dependent variable. The null hypothesis for the endogeneity test is that the SC dummy is exogenous. All models controlled for ln(total assets), sales growth, leverage, fixed asset turnover, noted as "firm controls" and fiscal quarter fixed effects, and the *t*-statistics (reported in parenthesis) are computed using with robust for ln(total assets), sales growth, leverage, fixed asset turnover, noted as "firm controls" and fiscal quarter fixed effects and the *t*-statistics (reported in parenthesis) are computed with robust standard errors. All monetary values are expressed in 2022 constant price using CPI, continuous variables are winsorized at 2.5% at each tail to reduce the impact of outliers, ***, ** and * represent statistical significance at 1, 5 and 10%, respectively
**Source(s):** Authors' own work

obtained from the first stage as a proxy; the coefficient estimate for the instrument is positive and significant at the 1% level, thus supporting our assumption that, within a specific industry, the likelihood of firms desiring to adhere to Sharia compliance increases proportionally with the predominance of SC firms. In the second column of Table 3, we computed the marginal effects of all of the variables in the first stage model at the mean level. The instrument's coefficient shows that as the proportion of SC firms within a two-digit SIC industry increases by 1%, the probability that a firm will be SC increases by 0.93%. The *p*-value of 0.00 for the Durbin–Wu–Hausman test contributes to the argument refuting the exogenous nature of the SC dummy. As mentioned earlier, we used the predicted probabilities from the first stage as a proxy for the SC dummy in the second stage. In the second column, the coefficient for the SC dummy is positive and statistically significant at the 1% level in all specifications, with the average SC firm being around 3.56% to 3.68% more profitable than NSC firms. Without loss of generality, the trend maintains with the COV × SC interaction dummy, where the average SC firm is also 1.3 (ROA NI) to 1.46% (ROA EBIT) more profitable than the average NSC firm after the pandemic. Overall, this further supports our main finding that SC firms are more profitable than their NSC counterparts, even after the pandemic.

### *4.3 Median regression analysis*

To mitigate potential concerns regarding outliers, skewed distribution of values, we estimated the same baseline model using the quantile (median) regression method. As seen in Table 4, our results continue to hold strong. For both the full sample and industry-size matched samples in all specifications (Columns 1–6), COVID dummy is negative, the SC dummy is positive and the interaction between SC and COVID dummy is positive, and all are statistically significant, confirming our findings in the pooled OLS method in Table 2 while mitigating the concerns regarding outliers and skewed distributions given the nature of the quantile regression at the 50th percentile. The higher PM figures attest to the ability of SC firms to maintain a higher proportion of the revenue as profit through various executive decisions, thus proving financial health and efficiency, along with a better operational model and effective resource management, while significantly lower debt levels of SC firms lower the firm risk.

## 5. Additional robustness tests

### *5.1 Industry-size matched "without replacement" sample analysis*

Our main nearest-neighbor matching by industry and asset size is computed "with replacement," a standard method in finance literature – however, concerns may arise because, if an SC firm's closest NSC match is already matched to another SC firm in the data set, this NSC firm is no longer considered a matching option for the current SC firm. To alleviate this concern, we use an alternative matching technique where we match each SC firm to NSC firm in the same industry and with closest asset size without replacement. SC-NSC pairs were formed by selecting the firms that had the smallest difference between their respective recent asset size in the same industry. The final industry-size matched (without replacement) data set comprised of 24,022 observations from 1,474 distinct firms. These included 8,763 observations from 629 distinct NSC firms, and 15,259 observations from 845 SC firms as some NSC firms are matched to more than one SC firm. Table 5 presents the baseline regression results using this new matched sample. COVID dummy is negative, SC dummy is positive and interaction between COVID and SC is positive, all statistically significant, and hence confirming our key results from Table 2.

**Table 4.** Median operating profitability regressions

| Variable | ROA EBITDA (1) | ROA EBIT (2) | ROA net income (3) | PM EBITDA (4) | PM EBIT (5) | PM net income (6) |
|---|---|---|---|---|---|---|
| *Panel A: Full sample* | | | | | | |
| COVID | −0.0131*** (0.00183) | −0.0151*** (0.00176) | −0.0144*** (0.00161) | −0.0464*** (0.0110) | −0.0639*** (0.00851) | −0.0665*** (0.00805) |
| Shariah-compliant | 0.00575*** (0.000913) | 0.00615*** (0.000995) | 0.00640*** (0.000908) | −0.00577 (0.00512) | 0.0114*** (0.00432) | 0.0190*** (0.00388) |
| COVID × shariah compliant | 0.00510*** (0.000783) | 0.00623*** (0.000847) | 0.00574*** (0.000775) | 0.0287*** (0.00396) | 0.0278*** (0.00364) | 0.0268*** (0.00327) |
| Firm controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Fiscal quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | −0.0318*** (0.00254) | −0.0461*** (0.00275) | −0.0448*** (0.00263) | −0.110*** (0.0140) | −0.164*** (0.0141) | −0.149*** (0.0131) |
| *N* | 58,283 | 58,283 | 58,283 | 58,283 | 58,283 | 58,283 |
| *R*-squared | 0.178 | 0.179 | 0.199 | 0.057 | 0.065 | 0.063 |
| *Panel B: Industry-size matched sample* | | | | | | |
| COVID | −0.0138*** (0.00224) | −0.0146*** (0.00243) | −0.0146*** (0.00212) | −0.0371*** (0.0126) | −0.0572*** (0.00869) | −0.0586*** (0.00769) |
| Shariah-compliant (SC) | 0.00264** (0.00124) | 0.00345** (0.00135) | 0.00367*** (0.00122) | 0.000289 (0.00637) | 0.00709 (0.00550) | 0.0104** (0.00474) |
| COVID × shariah compliant | 0.00462*** (0.00107) | 0.00472*** (0.00118) | 0.00461*** (0.00105) | 0.0183*** (0.00497) | 0.0195*** (0.00475) | 0.0190*** (0.00391) |
| Firm controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Fiscal quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | −0.0238*** (0.00341) | −0.0405*** (0.00364) | −0.0387*** (0.00350) | −0.0747*** (0.0167) | −0.124*** (0.0166) | −0.107*** (0.0142) |
| *N* | 25,248 | 25,248 | 25,248 | 25,248 | 25,248 | 25,248 |
| *R*-squared | 0.160 | 0.169 | 0.176 | 0.051 | 0.059 | 0.056 |

**Note(s):** This table present median regressions results from the full sample data set in Panel A and the industry-size-matched data set (with replacement) in Panel B. Please refer to the description of Table 2 or Section 4a for more details about the controls and data descriptions. All monetary values are expressed in 2022 constant price using CPI, continuous variables are winsorized at 2.5% at each tail to reduce the impact of outliers, ***, ** and * represent statistical significance at 1, 5 and 10%, respectively
**Source(s):** Authors' own work

**Table 5.** Operating profitability regressions on "without replacement" data set

| Variable | ROA EBITDA (1) | ROA EBIT (2) | ROA NI (3) | PM EBITDA (4) | PM EBIT (5) | PM NI (6) |
|---|---|---|---|---|---|---|
| *Panel A: OLS regression* | | | | | | |
| COVID | −0.0188*** (0.00305) | −0.0200*** (0.00312) | −0.0195*** (0.00299) | −0.254*** (0.0365) | −0.300*** (0.0384) | −0.312*** (0.0391) |
| Shariah-compliant | 0.0107*** (0.00206) | 0.0103*** (0.00210) | 0.0108*** (0.00206) | 0.184*** (0.0362) | 0.203*** (0.0378) | 0.219*** (0.0387) |
| COVID × shariah compliant | 0.00321* (0.00175) | 0.00306* (0.00179) | 0.00309* (0.00176) | 0.107*** (0.0310) | 0.109*** (0.0326) | 0.113*** (0.0336) |
| Firm controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Fiscal quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | −0.0476*** (0.00484) | −0.0603*** (0.00490) | −0.0619*** (0.00477) | −0.680*** (0.0847) | −0.773*** (0.0883) | −0.794*** (0.0898) |
| *N* | 23,738 | 23,738 | 23,738 | 23,738 | 23,738 | 23,738 |
| *R*-squared | 0.1638 | 0.1723 | 0.1832 | 0.0912 | 0.0928 | 0.0923 |
| *Panel B: Median regression* | | | | | | |
| COVID | −0.0148*** (0.00230) | −0.0164*** (0.00270) | −0.0157*** (0.00206) | −0.0346*** (0.0127) | −0.0587*** (0.00984) | −0.0572*** (0.00844) |
| Shariah-compliant (SC) | 0.00227 (0.00141) | 0.00341** (0.00152) | 0.00362*** (0.00138) | −0.00106 (0.00684) | 0.00538 (0.00604) | 0.0101* (0.00556) |
| COVID × shariah compliant | 0.00475*** (0.00122) | 0.00463*** (0.00135) | 0.00440*** (0.00116) | 0.0147*** (0.00541) | 0.0188*** (0.00530) | 0.0177*** (0.00456) |
| Firm controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Fiscal quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | −0.0207*** (0.00351) | −0.0378*** (0.00374) | −0.0360*** (0.00355) | −0.0553*** (0.0158) | −0.105*** (0.0166) | −0.0937*** (0.0140) |
| *N* | 23,730 | 23,730 | 23,730 | 23,730 | 23,730 | 23,730 |
| *R*-squared | 0.154 | 0.164 | 0.173 | 0.045 | 0.053 | 0.052 |

**Note(s):** This table presents regression results from the industry-size-matched (without replacement) data set. Panel A presents the OLS regression results, Panel B presents the results from the median regression. Please refer to the description of Table 2 or Section 4 for more details about the controls and data description, and Section 5a for the matching process. All monetary values are expressed in 2022 constant price using CPI, continuous variables are winsorized at 2.5% at each tail to reduce the impact of outliers, ***, ** and * represent statistical significance at 1, 5 and 10% levels, respectively

**Source(s):** Authors' own work

*5.2 Propensity score matching*

We constructed a propensity score-matched sample to further address any concerns over the endogeneity of the SC variable with firms self-selecting as SC or NSC. We used a probit model to estimate propensity scores with the baseline model and estimating robust standard errors. Propensity scores derived from the estimated probit model were used to conduct

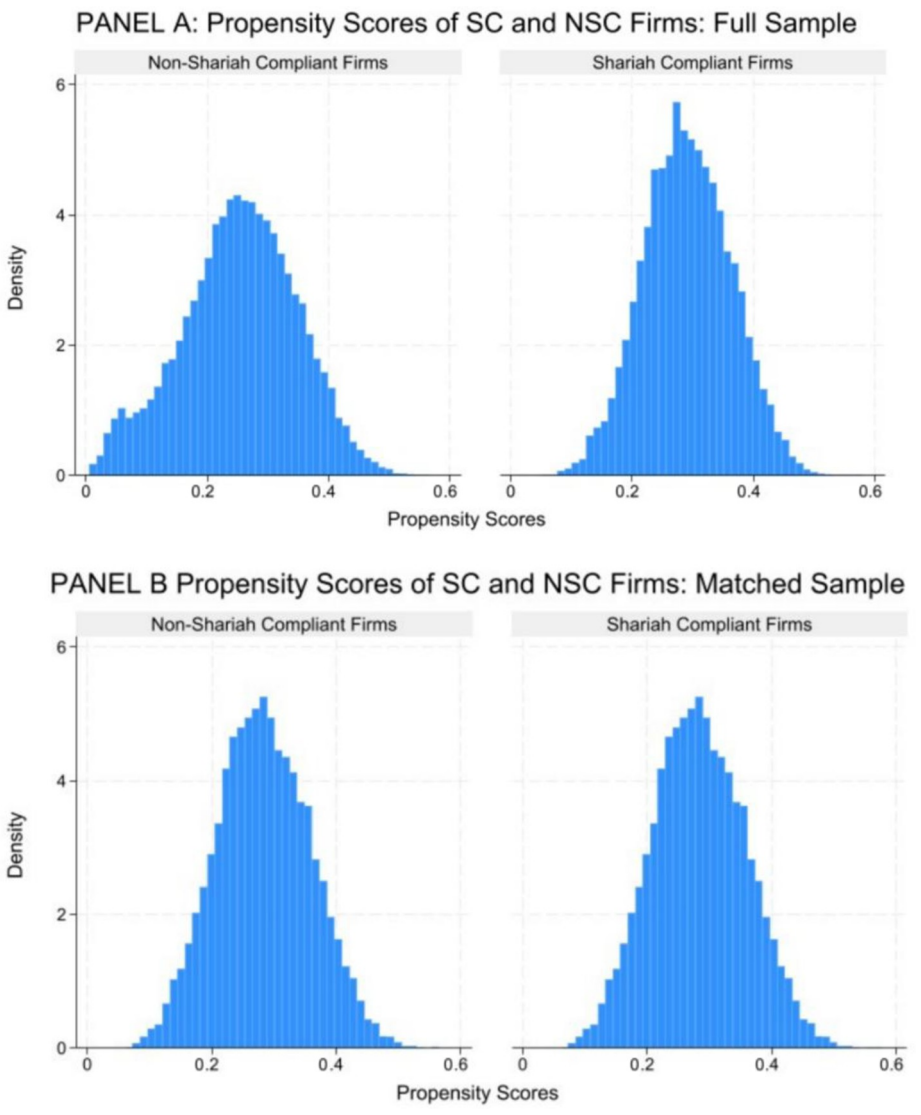


**Figure 3.** Propensity score distribution
**Source:** Authors' own work

**Table 6.** Operating profitability regressions on "without replacement" data set

| Variable | ROA EBITDA (1) | ROA EBIT (2) | ROA NI (3) | PM EBITDA (4) | PM EBIT (5) | PM NI (6) |
|---|---|---|---|---|---|---|
| Mean (SC- NSC) | 0.0051164*** | 0.0164052*** | 0.0168535*** | 0.365418*** | 0.3998104*** | 0.4268271*** |
| Median (SC-NSC) | 0.0060557*** | 0.0077079*** | 0.0085712*** | −0.0010863* | 0.0177592*** | 0.024224*** |

**Note(s):** This table shows the mean and median difference for measures of operational efficiency (different definitions of ROA and PM) for SC and SC firms in the USA for the period 2018–2022 using a propensity score-matched sample. Propensity scores come from a probit model, where the dependent variable is the SC dummy, that takes a value of one for SC firms, and zero for NSC firms. Control variables are ln(total assets), sales growth and leverage, which includes controlling for fiscal quarter fixed effects and clustering standard errors at firm level. Matching is done using propensity scores based on the nearest neighbor matching method using a caliper of 0.05. ***, ** and * represent significance at 1%, 5% and 10% levels, respectively. All variables are winsorized at 2.5% at each tail to reduce the potential impact of outliers
**Source(s):** Authors' own work

nearest neighbor matching of SC to NSC firms using a caliper of 0.05, where a particular SC firm could be matched with multiple NSC firms. Subsequently, the final propensity-score matched sample contained a total of 3,618 distinct firms, which included 8,943 observations from 869 SC firms and 8,943 observations from 2,749 NSC firms. Panels A and B (in Figure 3) display how the propensity score-matched sample is more comparable between SC and NSC firms instead of the full sample. As observed in Tables 6 and 7, the propensity score-matched sample yields qualitatively similar both univariate and multivariate results relative to the industry-size matched samples.

## 6. Further discussions

The empirical analysis and robustness checks we presented above provide strong evidence that SC firms exhibited greater resilience in operating profitability compared to NSC firms during the COVID-19 pandemic. While both groups experienced profitability declines, SC firms maintained stronger financial performance, as reflected in relatively smaller drops in various definitions of ROA and PMs. This resilience can be attributed to the specific quantitative and qualitative screening criteria that define Shariah compliance. SC firms must meet financial thresholds, such as maintaining relatively low leverage, limiting interest-based liabilities and ensuring that a majority of their revenue comes from permissible business activities. These constraints result in firms that, on average, have lower financial risk and a more conservative financial structure.

Consistent with this view, Frank and Goyal (2009) found that profitable firms tend to have lower leverage, as they generate sufficient internal financing, reducing their reliance on external debt. This lower leverage minimizes financial constraints, allowing firms to better withstand financial crises (Pedrosa, 2019). Similarly, SC firms maintain lower leverage due to restrictions on interest-bearing debt, making them structurally more resilient to financial shocks. Giroud and Mueller (2016) documented that highly levered firms experienced larger employment losses during the Great Recession due to their inability to raise additional debt in response to demand shocks. Facing financial constraints, such firms were forced to lay off employees and cut back on investments to meet debt obligations. By contrast, SC firms, with structurally lower leverage, are better positioned to retain their workforce and sustain investment levels during crises, which contributes to their superior financial performance.

**Table 7.** Baseline regression on propensity score-matched data set

| Variable | ROA EBITDA (1) | ROA EBIT (2) | ROA NI (3) | PM EBITDA (4) | PM EBIT (5) | PM NI (6) |
|---|---|---|---|---|---|---|
| COVID | −0.0136*** (0.00361) | −0.0129*** (0.00356) | −0.0132*** (0.00347) | −0.325*** (0.0522) | −0.276*** (0.0495) | −0.340*** (0.0519) |
| Shariah compliant (SC) | 0.0129*** (0.00157) | 0.0129*** (0.00152) | 0.0135*** (0.00152) | 0.281*** (0.0269) | 0.252*** (0.0260) | 0.304*** (0.0276) |
| COVID × SC | 0.00589*** (0.00156) | 0.00635*** (0.00152) | 0.00576*** (0.00152) | 0.194*** (0.0315) | 0.186*** (0.0304) | 0.199*** (0.0323) |
| Firm controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Fiscal quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | −0.0705*** (0.00375) | −0.0595*** (0.00372) | −0.0724*** (0.00364) | −1.189*** (0.0716) | −1.090*** (0.0689) | −1.222*** (0.0726) |
| *N* | 17,886 | 17,886 | 17,886 | 17,878 | 17,878 | 17,878 |
| R-squared | 0.175 | 0.175 | 0.178 | 0.110 | 0.106 | 0.109 |

**Note(s):** This table presents OLS regression results from the full sample data set in Panel A and the propensity-score-matched data set in Panel B. Please refer to the description of Table 2 or Section 4 for more details about the controls and data description, and Section 5c for the matching process. All monetary values are expressed in 2022 constant price using CPI, continuous variables are winsorized at 2.5% at each tail to reduce the impact of outliers, ***, ** and * represent statistical significance at 1, 5 and 10% levels, respectively

**Source(s):** Authors' own work

Our findings have important implications for corporate risk management, investment strategies and policy formulation. The financial conservatism of SC firms appears to serve as a buffer against economic shocks, highlighting the potential benefits of stringent financial constraints in enhancing firm resilience. While not all firms may qualify as SC, adopting similar financial discipline could serve as a strategic risk management approach that enhances operational resilience. Investors seeking stability during economic uncertainty might consider allocating capital to SC firms or firms that share similar financial structures. Additionally, policymakers could draw insights from the resilience of SC firms to promote financial practices that strengthen economic stability in anticipation of future systemic shocks. Overall, our study underscores the critical role of financial structure in determining corporate resilience, offering valuable lessons for firms, investors and regulators navigating crisis periods.

## 7. Conclusion

This paper examines the impact of the COVID-19 pandemic on the operating performance of SC versus NSC firms in the USA. Using a unique data set from LSEG Workspace and S&P's Compustat North America, we provide robust empirical evidence that SC firms exhibited greater resilience during the pandemic. Our findings indicate that while COVID-19 negatively affected the profitability of all firms, the decline was significantly less severe for SC firms. This resilience can be attributed to the lower leverage and conservative financial practices inherent to Shariah compliance, which enhance firms' ability to withstand economic shocks. Our study fills a critical gap in the literature by shifting the focus from stock price performance to operational performance and profitability, providing a novel perspective on the benefits of Shariah compliance. The results have important practical implications for investors, corporate managers and policymakers. Investors may consider incorporating SC firms into their portfolios to enhance stability during economic downturns. Corporate managers can adopt financial practices aligned with Shariah principles to improve resilience, while policymakers can promote such practices to strengthen economic stability.

A notable percentage of SC firms maintain very low leverage, despite being permitted to have interest-bearing debt up to 33% of total assets without violating Shariah compliance rules. During pandemics or economic crises, governments typically implement expansionary monetary policies to stimulate the economy, resulting in very low interest rates. This environment allows SC firms to borrow at favorable rates with minimal interest burden while maintaining their SC status. This ability to finance their operations under such conditions helps them navigate economic downturns more effectively.

Future research could also explore several avenues to build on our findings. Examining the long-term implications of Shariah compliance on firm performance across different industries and geographic regions would provide a deeper understanding of its strategic value in a rapidly changing global economy. Moreover, examining the long-term physical asset investment behavior of SC firms during economic downturns, such as the COVID-19 pandemic, will also provide valuable insights to this literature.

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## Notes

[1.] A small number of studies (Shen *et al.*, 2021; Fu and Shen, 2020; 2; Devi *et al.*, 2020; Alsamhi *et al.*, 2022) attempt to document the negative impact of COVID-19 on firm profitability (no separation of SC versus NSC firms), using Chinese-listed firms, Chinese energy companies, MENA firms, Indonesian-listed firms and Indian-listed firms, respectively. These works draw conclusions by using very limited data after the pandemic (just one quarter), except Almustafa *et al.*, 2023, which uses annual data for 2020, making it hard to isolate the effect of pandemic on firm profitability. Sufficient high frequency and balanced financial statements data, pre- and post-pandemic, covering the periods until pandemic restrictions eased in early 2023 (HHS, 2023) is necessary to provide robust evidence on the impact of pandemic on firm operating profitability.

[2.] For SC classification, we use the LSEG Workspace screening, and the details of qualitative and quantitative filters are provided in the Data section.

[3.] To isolate the true effect of COVID-19 on firm profitability, we carefully consider fiscal month end (not uncommon for US firms to be different from December 31) for all firms in our sample and exclude from our analysis any quarter that includes the month of March 2020. We use the timeline offered by the US Center for Disease Control to mark the end of the COVID-19 period and hence stop our COVID-19 period in the last quarter of 2022.

[4.] These categories comprise: adult entertainment, alcohol, cinema/broadcasting, insurance, tobacco, music, financial services, investment services, mortgage and lease, gambling, interest income, hotels, pork and defense.

[5.] In unreported results, we confirm that similar patterns emerge across all three definitions of PM.

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