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ORIGINAL RESEARCH

Bank stock performance during the COVID-19 crisis: does efficiency explain why Islamic banks fared relatively better?

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Abstract
This paper evaluates the stock performance of Islamic banks relative to their conventional counterparts during the initial phase of the COVID-19 crisis (from December 31, 2019, to March 31, 2020). Using 426 banks from 48 countries, we find that stock returns of Islamic banks were about 10–13% higher than those of conventional banks after controlling for a host of the bank- and country-level variables. This study explains the Islamic banks' superior crisis stock performance by exploring the potential role of pre-crisis bank efficiency. In a univariate analysis, we document higher non-parametric Data Envelopment Analysis (DEA) efficiency levels for Islamic banks than conventional banks in the year preceding the COVID-19 crisis. Our multivariate regressions show that the risk-adjusted DEA efficiency scores can explain crisis stock returns for Islamic banks but not conventional banks. The evidence is robust to alternative measures of stock returns, efficiency models, and other empirical strategies. Finally, we present insight on the importance of key bank characteristics in determining the stock returns of conventional banks during the crisis period.

Keywords COVID-19 · Bank performance · Islamic banks · Efficiency · Stock returns

JEL Classification G21 · C14 · D22 · P43

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1 Introduction

Islamic banks (IBs) are assumed to be more resilient during crisis times than their counterparts' conventional banks (CBs). Indeed, empirical studies that focus on the 2008 Global Financial Crisis (GFC) find that IBs withstood better the crisis (Beck et al., 2013; Farooq & Zaheer, 2015; Hassan & Dridi, 2010). In a separate line of research, efficiency levels are found to have positive effects on bank performance during both normal times (e.g., Berger & Mester, 1997; Fiordelisi et al., 2011; Hughes & Mester, 2015) and subsequent financial crises times (Assaf et al., 2019). Focusing on the COVID-19 crisis and building on the above two strands of literature, our paper attempts to address two important questions. Do IBs perform relatively better than CBs during the initial phase of the current health crisis? If so, does the level of efficiency in the pre-crisis period explain the comparatively stronger performance of IBs? We conduct our analysis by employing bank stock returns in March, 2020, as a proxy for bank performance during the COVID-19 pandemic, while systematically distinguishing IBs from their conventional counterparts.

We focus on bank stock performance for several reasons. First, the returns on bank stocks are associated with bank equity financing (Yang & Tsatsaronis, 2012). The new wave of micro- and macro-prudential regulations after the 2008 GFC have forced banks to raise their capital position. If stock prices are volatile, and returns are low, then banks would face difficult time improving their capital levels by, for example, issuing new shares. Second, we center our attention to a forward-looking indicator of bank performance, which is superior to backward-looking performance indicators such as return on assets. This is because the main goal of a bank is to maximize the value of its shareholders' wealth, which is materialized better in stock prices. Third, following recent studies by Demirgüç-Kunt et al. (2020), Gormsen and Koijen (2020) and Landier and Thesmar (2020), we use stock price returns as a performance of banks during the COVID-19 crisis, because empirically the stock data are currently available.

The COVID-19 crisis put the banking system under stress. Businesses experienced a lower stream of cash flows and were forced to draw more heavily on lines of credit. As the sources of cash started to deplete, borrowers faced dire situations with decreased ability to make loan repayments. Consequently, credit losses and the exposure to credit risk started to amplify. Significant increases in operating costs further exacerbate the crisis's adverse effects on the banks' balance sheets. Having to cope with the pandemic, banks were obliged to incur substantial operating expenses such as those associated with investing in digitization and arranging for ways to allow for remote work. Despite these stress factors, both types of banks, Islamic and conventional, were committed to playing their roles as system stabilizers throughout the crisis by providing essential financial services to their customers and their communities. Banks were engaged in identifying the most affected economic sectors and determining effective ways of providing their customers with relief measures, such as payment holidays. However, insights from prior empirical literature suggest that IBs have a higher ability to endure the COVID-19 crisis than CBs.

IBs have undergone phenomenal transformation from a little-known financial experiment to a considerable force in global finance. Much of this success is owed to their admirable performance during the 2008 GFC. The increased awareness of Islamic financial services and the consideration of IBs, at least by supporters, as safer alternatives to CBs, contributed to their significant and unabated growth (Aysan et al., 2018).[1] In a similar fashion to CBs, IBs play the role of intermediation. However, they have to adhere an additional layer of

[1] The size of the Islamic financial services industry, of which 72% is accounted for by Islamic banks, had reached $2.19 trillion in 2018 (Islamic Financial Services Board, 2019).

laws determined by Islamic principles, known as Shariah, that govern the different aspects of business transactions. We investigate whether IBs observed a superior stock performance than CBs during the COVID-19 crisis. We rely on previous studies that show that compliance with Shariah, which dictates equity and risk-sharing practices, advantages IBs over CBs during stressful times (e.g. Hassan & Dridi, 2010).

Using data for 426 banks from 48 countries, our empirical results support this conjecture. We find that the stock returns of IBs during the COVID-19 pandemic were about 10–13% higher than their conventional counterparts. This is after controlling for a rich-set of the pre-crisis bank-level and country-level variables, including the health conditions and risk-taking culture of the individual banks.

We next investigate the role of bank efficiency in the period that preceded the coronavirus crisis in determining the superior stock performance of IBs during the crisis. Previous studies have examined the relation between efficiency and stock returns, but mainly during the normal times. Beccalli et al. (2006) provide a strong evidence that the process of stock formation is determined by the changes in cost efficiency. All else equal, a cost-efficient bank is well positioned to raise capital at a lower cost, and therefore, to enhance profitability. The generated value to shareholders is then translated into higher stock returns. However, higher efficiency levels could have been achieved at the cost of higher risk levels, which expose banks to financial distress (Chen, 2012), and may eliminate any potential gains to shareholders. Empirically, we follow Safiullah and Shamsuddin (2019) and consider the dynamics between risk and cost efficiency, by creating efficiency measures that are robust to the level of risk.[2]

The novelty in the analysis used in this paper is that we compare the risk-adjusted efficiency scores, which were obtained using the non-parametric Data Envelopment Analysis (DEA), for Islamic and conventional banks in the year that preceded the COVID-19 crisis. We document that IBs dominated CBs in terms of higher efficiency levels before entering the crisis. We then formally test whether the pre-crisis efficiency can explain the relatively stronger stock performance of IBs during the initial phase of the COVID-19 period. In a multivariate regression model that controls for bank- and country-level factors that are known to influence bank stock returns, we find a strong association between performance during the crisis and pre-crisis levels of efficiency only for IBs, but not for CBs.

Our study is related to three different strands of literature. Firstly, it relates to studies that assert that the business orientations of IBs and CBs are significantly different. Importantly, when it comes to the performance of banks during a (financial) crisis, researchers report a relatively better performance of IBs (Beck et al., 2013; Farooq & Zaheer, 2015; Hassan & Dridi, 2010). We add to this literature by arguing that this phenomenon can be extended to the current health crisis.

Secondly, our paper is linked to the literature that predicts higher level of efficiency for IBs. Beck et al. (2013) discuss that the lower agency problems faced by IBs due to the risk-sharing elements in bank intermediation, results in lower monitoring and screening costs. Johnes et al. (2014) use a sophisticated meta-frontier analysis that allows for estimation of common efficiency frontier for both IBs and CBs. They find that IBs are more efficient, although depending on frontier specifications. Bitar et al. (2017) also create efficiency factors that are shown to be higher for IBs. Safiullah and Shamsuddin (2019) find that on risk adjusted basis, Islamic banks are characterized by higher cost efficiency scores. See also Alqahtani

[2] Alzahrani (2019) provides a recent overview on the relation between governance and cost of capital that are specific to Islamic banking.

et al. (2017) and Bitar et al. (2019).[3] The current paper contributes to this literature by finding a high level of efficiency for IBs in the year preceding the COVID-19 pandemic.

Third and finally, our paper is related to emerging body of empirical studies on the association between efficiency and bank stock performance. An early study by Chu and Lim (1998) find a positive and statistically significant relation between share prices and (profit) efficiency. Eisenbeis et al. (1999) report a positive relationship between (cost) efficiency and stock returns. See also Erdem and Erdem (2008), Kirkwood & Nahm, 2006), Sufian and Majid (2006), Beccalli et al. (2006), Liadaki and Gaganis (2010) and Fu et al., (2014).[4] Our paper adds to this by documenting a positive association between efficiency and stock performance in IBs.

The remainder of the paper is structured as follows. Section 2 develops our hypotheses. The methodology and model followed by a description of the data are presented in Sect. 3. Section 4 includes the results and related discussion. Finally, Sect. 5 concludes.

2 Hypothesis development

It is argued that the unique business orientation of IBs provides favorable characteristic to withstand crisis times. Previous scholars who support this view show that the profit and loss sharing (PLS) mechanisms have added to the stability of IBs and prevented any deterioration of their balance sheets during times of economic distress (Čihák & Hesse, 2010; Farooq & Zaheer, 2015).[5]

To fulfil their intermediary role, CBs usually face risk of maturity mismatch between the source and the uses of funds. Funds are raised through selling demand deposits that are easily accessible, but can be quickly withdrawn by depositors. However, these funds are used as loans of longer maturities with contracts that may have complicated terms against liquidation. This risk faced by CBs is exacerbated in an economic downturn when withdrawals may become more frequent, and loan repayments less stable. In contrast, IBs are expected to clearly separate the profit-sharing investment account (PSIA) from the demand deposits, which they post a 100% reserve against. The funds generated through PSIA can be used in either form of profit-loss sharing partnership (Musharakah or Mudharabah). Losses made in these types of PLS loans can then be absorbed by PSIAs which, as discussed above, allow losses to be exclusively suffered by the PSIA holder. Due to the PLS agreements in IBs, a decrease in the value of assets is matched by another decrease in liabilities.[6] In addition, the other major type of investment accounts, Murabahah, requires a transaction of an underlying real asset. As a direct consequence, derivatives are not permissible to be traded by IBs. This

[3] On the other hand, other researchers document lower efficiency for IBs (e.g., Johnes et al., 2009; Beck et al., 2013; and Wanke et al., 2016).

[4] On a related issue, the literature identifies many elements that are related to bank efficiency, or the production of outputs, using a specific set of inputs (e.g. Berger and Humphrey,1991; Maudos et al., 2002; Camanho and Dyson, 1999; Altunbas et al., 2001; Berger et al., 2009; Boubaker et al., 2020; Galariotis et al., 2020; Fries and Taci, 2005 and Chen et al., 2005). See also Ftiti and Hadhri (2019) for the factors determine stock returns of IBs, and Neukirchen et al. (2021) for the impact of firm efficiency on stock performance during the COVID-19 pandemic.

[5] See also Ftiti et al. (2013) and Belanès et al. (2015) for the impact of the subprime crisis on efficiency of IBs. Ariss (2010) studies the competitive conditions of IBs and Kaffash et al. (2020) focus on the impact of oil prices on bank efficiency.

[6] Bitar and Tarazi (2019) show that under the PLS principle, where depositors share profits and losses with the bank, the role of creditor protection may become irrelevant.

ensures that financing activities do not drift away from the real economy, and that IBs do not engage in trading of risky financial instruments.

Collectively, compliance with Shariah that prohibits the use of interest, discourages risk takings, and requires material finality, makes IBs more resilient to adverse financial and economic shocks than CBs (Abedifar et al., 2013; Hassan & Dridi, 2010). Beck et al. (2013) report that IBs are better capitalized, have higher asset quality, and are less likely to disintermediate during crises. Importantly, the authors assess the relative stock performance of these two types of banks. They find higher stock returns for IBs during the 2008 GFC.

Thus, we expect stock market participants have differential equity valuation of banks with different business models during the current COVID-19 crisis. Given the distinctive banking activities of IBs and a better record of withstanding adverse economic conditions than its conventional counterparts, we expect investors to attach a higher value to owning shares of IBs than CBs. We state our first hypothesis as follows:

Hypothesis 1: IBs experience relatively higher stock returns than CBs during the COVID-19 crisis.

We next develop a hypothesis that suggests that the better performance of IBs during the crisis can be explained by their pre-crisis levels of efficiency.

Prior literature documents evidence that changes in efficiency are part of the stock prices formation process (Beccalli et al., 2006). The underlying logic is that lower costs, which generate investor expectations of stronger financial performance in the future, should lead to consequent increases in stock prices. Managers of cost-efficient banks have the managerial skills to optimally utilize the available set of inputs to produce a given level of output with a minimum level of resources. Efficient banks thus have the ability to raise cheap capital, improve profitability, and therefore, create value for bank shareholders in the form of higher stock prices. Yet, there are two opposing arguments.

On the one hand, a negative effect of higher levels of pre-crisis cost efficiency on the stock returns during a crisis can be predicted through the "cost-skimping" view. Under this view, a bank appears to achieve cost efficiency, because it devotes fewer resources to conducting essential tasks such as screening and monitoring of loans (Berger & DeYoung, 1997). A bank may opt to cut on costs associated with solving day-to-day operational problems, and pursue strategies that improve cost efficiency in the short run. Such cost savings would lead to deterioration in performance in the medium and longer terms, as the problem loans mount and risk levels increase. This is exacerbated in situations when the price of taking such actions is assumed to be solely borne by shareholders (Gorton & Rosen, 1995).

On the other hand, a positive effect can be predicted through the efficient management channel. Assaf et al. (2019) show that cost efficiency during normal times reduces the probabilities of bank failures, decreases risk, and improves profitability during subsequent crisis times through the efficient management channel. A high efficiency score is interpreted as a sign of superior managerial practices, which extend beyond daily operations to cover decisions affecting risk levels and bank profitability. Good managers not only control the expenses, but also exercise diligence, while making decisions such as extending loans to creditworthy borrowers. The fruition of having capable managers during normal times is likely to be in the form of lower risk and greater profitability during crisis times.

We expect the association between efficiency and bank performance during the current COVID-19 outbreak to be observed only for IBs. The risk-sharing features on both sides of the balance sheet reduce the standard agency problems faced by IBs. Talented managers understand and react positively to the equity-like position of PSIAs holders who are left with high incentives to monitor. True to their partnership agreements, capable managers at the

Islamic bank follow risk management techniques, such a customizing a product while still in compliance with Shariah, which is mutually beneficial to the bank as well as the customer. The empirical literature suggests that managers in IBs enjoy superior capabilities than those in CBs. Johnes et al. (2014) report that while the modus operandi appears less efficient in IBs than CBs, the lag is compensated for by the superior abilities of managers in IBs. With regard to CBs, we believe that other key bank characteristics, such as pre-crisis liquidity position, can explain their performance during the crisis better than efficiency.[7]

Overall, we expect that information about the pre-crisis level of efficiency, which is a result of good managers, help the bank to monitor its costs and protect its profitability during crisis times, but this to be significant only for IBs. Thus, we state our second hypothesis as follows:

Hypothesis 2: Pre-crisis levels of efficiency can explain the better stock performance of IBs during the COVID-19 crisis.

3 Methodology and data

3.1 Empirical strategy

We assess whether IBs had a stronger stock performance than CBs during the COVID-19 outbreak, by estimating the following model:

$$\Delta P_{ij,Covid} = \vartheta_0 + \vartheta_1 . IB_{ij} + \varphi . X_{ij,2019} + \varepsilon_{ij,Covid} \tag{1}$$

where i and j denote bank i and country j. $\Delta P_{ij,Covid}$ is the change in log stock prices from December 31, 2019 to March 31, 2020.[8] Our choice of the months March, 2020 reflects a time period when stock markets were suffering during the most acute phase of the COVID-19 crisis, and ensures that the dependent variable $\Delta P_{ij,Covid}$ captures the adverse effect of the crisis. The relative performance of IBs during the selected time period is tested by using an indicator variable. Specifically, IB_{ij} is a dummy variable that takes value 1 if bank i domiciled in country j is Islamic, and zero otherwise. According to this model specification, conventional banks are treated as the base, while the coefficient on Islamic bank indicator (IB) can be viewed as the difference in the intercepts between IBs and CBs (Yip & Tsang, 2007). Guided by previous literature, we define $X_{ij,2019}$ as a vector of pre-crisis (end of 2019) bank-specific (or country-specific) variables that are shown to explain the performance of banks. It is important to note that while the dependent variable is measured during the crisis period, all the control variables are measured in the year leading up to the crisis. The estimated coefficient on IB variable captures the relative performance of IBs. A positive and statistically significant coefficient suggests that IBs fared relatively better during the COVID-19 crisis (consistent with Hypothesis 1).

Next, we check if the levels of pre-crisis efficiency mitigate the adverse impact of the crisis on IBs' stock returns. We compare the effect of efficiency on the change in bank stock prices between IBs and CBs by extending Eq. (1) as follows:

[7] We return to this point and elaborate it further in Sect. 4.4.

[8] As an alternative measure, we use the change in log of average stock prices of November 30, 2019 and December 31, 2019 and average stock prices of February 28, 2020 and March 31, 2020. All empirical results are robust to this alternative proxy.

$$\Delta P_{ij,Covid} = \vartheta_0 + \vartheta_1.IB_{ij} + \vartheta_2.E_{ij,2019} \times IB_{ij} + \vartheta_3.E_{ij,2019} \times CB_{ij} + \varphi.X_{ij,2019} + \varepsilon_{ij,Covid} \quad (2)$$

where Eq. (1) is analogous to Eq. (2), except that the latter model is augmented with the interaction terms. $E_{ij,2019}$ represents the estimated value of the efficiency score for bank i in country j in 2019. CB_{ij} is an indicator variable that takes value 1 if bank i domiciled in country j is a conventional bank, and zero otherwise. It should be noted that $IB_{ij}+CB_{ij} = 1$. In this regard, bank efficiency is portioned into efficiency of Islamic banks ($E \times IB$) and efficiency of conventional banks ($E \times CB$). This constructive partitioning of the effect of efficiency on the bank returns for the two categorical banks allows us to investigate whether the relatively better performance of IBs during the COVID-19 outbreak can be attributed to their pre-crisis levels of efficiency.

By comparing the t-statistics of ϑ_2 and ϑ_3, the coefficients of the multiplication terms, we can check whether the effect of efficiency on stock returns for Islamic or conventional is significant. ϑ_2 shows the effect of the bank efficiency on the stock returns for IBs, while ϑ_3 shows the effect on the stock returns for CBs.[9] As predicted by Hypothesis 2, we expect that ϑ_2 to be positive and significant, and ϑ_3 to be insignificant. Note that we are not interested to test the main effect (which is the weighted average effect for both types) of bank efficiency on bank stock performance. Yet, in the results section, we estimate a version of Eq. (2) where we do not partition bank efficiency, in order to estimate its average effect (see Sect. 4).

As dictated by the asset pricing models (Fama & French, 1992), we add four basic control variables ($X_{ij,2019}$) into both Eqs. (1) and (2) as follows. First, bank size ($Size$) measured by the natural log of total assets. The existing literature highlights the important role of size in determining bank stock returns (Aebi et al., 2012; Gandhi & Lustig, 2015). Second, beta ($Beta$) measured by the correlation between the bank and market stock returns over the past year. Since the overall market experienced a significant loss during the current crisis, an increase in $Beta$ would be linked to a decline in stock prices (Pelster et al., 2018). Third, a measure of the momentum factor (*Momentum*), defined as the stock returns for the bank from December 31, 2018 to December 31, 2019. By including this variable, we examine whether banks with high stock returns in normal times performed better during the subsequent crisis (Tong & Wei, 2011). Fourth, a proxy for firm value (bank Tobin's Q), measured as market value of common equity divided by book value of assets. Previous studies show a positive association between Tobin's Q ratio and bank stock returns (e.g., Tong & Wei, 2011 and Fahlenbrach et al., 2012).

We are careful in our specification of the models as described in Eqs. (1) and (2), to reduce concerns that relate to reverse causality. Specifically, we use the pre-crisis levels of bank and country level variables, for instance bank efficiency, to rationalize the relatively better performance of IBs during the crisis. However, one issue that remains with the empirical estimation is that the relation between the Islamic bank dummy and bank stock returns could be biased due to omitted variables. Accordingly, we go beyond the standard asset pricing, by introducing a vector of additional bank-specific and country-specific factors that may affect bank stock returns during the crisis. This alleviates concerns relating to the omitted variables and improves the accuracy of isolating the effects of IB on bank performance during the COVID-19 pandemic.

Regarding the bank-specific factors, we include five measures (namely $C1$). We rely on the CAMEL components to account for the health of a bank. Boubakri et al., (2017) report that

[9] While it is not our main focus, ϑ_2-ϑ_3 represents the differential impact of bank efficiency performed by IBs over CBs.

healthier banks perform better during crises times. Healthy banks are shown to record higher stock returns, as investors in the equity markets consider them to have higher ability to absorb external shocks than their fragile counterparts (Demirgüç-Kunt et al., 2013). The selected variables are as follows. (i) The ratio of equity to total assets (EQ_TA), as well-capitalized banks face lower risk of bankruptcy, and have greater capacity to withstand financial shocks. Earlier studies find that banks with better capital positions fared better during the 2008 GFC in terms of stock returns (Beltratti & Stulz, 2012; Demirgüç-Kunt et al., 2013 and Kapan & Minoiu, 2018). (ii) Loan loss provisions to total loan ratio (LLP_TL), an expense that is set aside to account for the allowance of bad loans as a share of total loans. Since a lower ratio indicates higher quality of the assets, it is expected that banks with higher ratios to be more vulnerable to external shocks. (iii) Bank fee income to total income ratio (FEE_INC), a proxy for management quality that captures the effect of bank income diversification (e.g., Baele et al., 2007). (iv) Bank return on assets (ROA), a measure of bank profitability. Banks that enter a crisis with high profitability tend to experience low losses during the crisis. Profitability has been shown to have a significant effect on stock returns at the firm level (Balvers et al., 2017). Finally (v), bank liquid assets to total assets ratio (LA_TA), as banks with a better liquidity position in the pre-crisis may enjoy a superior performance during the ongoing global crisis. A rise in the share of liquid assets lowers the volume of risky assets, and strengthens bank resilience to external shocks (Demirgüç-Kunt et al., 2013; Igan & Mirzaei, 2020).

In addition to the CAMEL variables, we employ the Z-score (ZSCORE), which is a proxy for the risk culture of individual banks (e.g., Boubakri et al., 2017). We expect the bank risk-taking culture to affect bank stock performance during crises. In our empirical estimation, we compute ZSCORE as the summation of return on assets (ROA) and equity-to-asset ratio divided by the volatility of ROA over a five-year window. The Z-score is a measure of bank default risk, because it estimates the number of standard deviations of profits that must fall below the mean before a bank becomes bankrupt.

Additionally, we include seven country-specific variables (namely $C2$). First, we include a proxy for institutional quality of a country. We use the KKZ institution index, computed using information on six factors of voice accountability, political stability, a government's effectiveness, regulatory quality, rule of law, and control of corruption. A higher score on KKZ indicates better quality of institutions, and is shown to be related to improved bank performance (Lensink & Meesters, 2014). Second, countries that experienced severe crises in the past may have engaged in the necessary reforms that would enable them to better withstand future stressful times. We quantify the experience of an economy with past financial crises using data on output loss reported by Laeven and Valencia (2012). We create a dummy variable ($LOSS$) that takes the value of one if the loss (output loss as % of GDP) of a country is greater than the cross-country median, and zero otherwise.[10] Third, we include two proxies to account for the pre-crisis activation of macroprudential measures in a country, as the third and fourth variable. Macroprudential policies are utilized by countries in order to enhance the stability of their banking system. Mirzaei and Moore (2020) find that credit-related tools are positively associated with the performance of banks during the COVID-19 crisis. Accordingly, we introduce two dummy variables: (MP_CG) and (MP_FC) that take the value of 1 if a country imposes limits on domestic and foreign currency loans, respectively. If no such limits are observed in a country, then the dummy variables are assigned a value of zero. Fifth, we include the sum of imports and exports as a share of GDP ($Trade$), as the

[10] Countries that did not report output loss are assumed to have experienced less severe crisis. Hence, the associated dummy variable takes value zero.

level of international trade is a channel through which a crisis can be spread across countries (Milesi-Ferretti & Lane, 2011).

Finally, we account for the varying levels in macroeconomic stability amongst the countries that are included in our sample, by considering two country-level variables that are constructed to measure the pre-crisis macroeconomic conditions. We include the growth in a country's GDP ($GDPG$) and change in the level of prices (INF), as our sixth and seventh variables. Overall, the inclusion of these country-level variables controls for the possibility that the relative performance of IBs could be explained by stronger pre-crisis conditions of countries hosting IBs, which may have provided more insulation against exogenous negative shocks hitting their capital markets.

3.2 Data

We obtain data for all bank-level variables by utilizing the OSIRIS database by Bureau Van Dijk, which provides financial data for listed and major unlisted companies across the globe. The database reports a wide range of financial information including stock data for publicly listed banks that are at the focus of our empirical research. As one of the most comprehensive databases of listed firms, OSIRIS has been increasingly used in academic research (Lo & Fu, 2016; Shao et al., 2010). We obtain stock data[11] of individual banks from December 31, 2019 to March 31, 2020,[12] which we use to estimate bank stock returns during the COVID-19 pandemic.

We select all banks, which are labelled "commercial" and "Islamic", and report stock data on March 31, 2020. Banks with missing data on our variable of interest (stock price) or on the other bank level variables (C1) are removed. As a result, 426 banks from 48 countries survive this filtering criteria. Our sample is diverse in terms of income groups and geographical areas. The number of banks in our dataset varies by country. On average, each country has about 9 banks with available data. There are 12 countries that host IBs, with more than 3 banks per country, on average. Out of 426 banks, 38 banks are labelled Islamic, while the remaining 388 banks are conventional.[13]

Data on the two macroprudential variables are obtained from a comprehensive IMF survey carried out by the IMF's Monetary and Capital Department during 2013–2014. This data is organized and documented in a cross-country databasee by Cerutti et al. (2017). The database covers the time period from 2000 to 2013, and was recently updated up to 2017. We use the 2017 data. Finally, data on the remaining variables come from standard databases such as the World Bank, World Development Indicators. Table 1 details the definition of all variables used in this study.

3.3 Descriptive evidence on stock performance

We pursue the empirical investigation of whether IBs performed relatively better during the COVID-19 crisis. We start by providing some descriptive evidence on how the crisis affected stock returns of IBs and CBs differently.

[11] Note that we select closing prices.

[12] Note that the most adverse impact of the COVID-19 crisis on bank stock returns occurred during March 2020.

[13] Following literature on IBs, we include only fully fledged IBs, neglecting CBs with an Islamic window.

Table 1 Variables definition and sources

Variable	Definition	Source
Dependent var.		
Stock performance (ΔP)	The change in log stock prices from December 31, 2019, to March 31, 2020	Bureau van Dijk, OSIRIS, and own calculation
Dummies		
IB	A dummy variable that takes value 1 if the bank is an Islamic bank, and 0 otherwise	Own calculation
CB (= 1-IB)	A dummy variable that takes value 1 if the bank is a conventional bank, and 0 otherwise	
Controls $_{Pre}$		
Size	Natural logarithm of a bank total assets in year 2019	Bureau van Dijk, OSIRIS
Beta	Beta is a measure of market risk, which compares the volatility of a stock against the volatility of the market, which is typically measured by a reference market index. It is computed as the weekly covariance between the bank's stock return and the country stock market return over the past year, from January 2019 to December 2019	Bureau van Dijk, OSIRIS
Momentum	The stock return for each bank from December 31, 2018, to December 31th, 2019	Bureau van Dijk, OSIRIS, and own calculation
Tobin Q	Total market value of common equity (market cap) divided by total book value of assets in year 2019. Tobin Q ratio is a measure of a company's assets in relation to its market value	Bureau van Dijk, OSIRIS
(C1) Other bank controls		
C: EQ_TA	The ratio of equity to total assets of a bank in year 2019	Bureau van Dijk, OSIRIS
A:LLP_TL	Loan loss provisions to total loan ratio in year 2019. A loan loss provision is an expense set aside as an allowance for bad loans	Bureau van Dijk, OSIRIS
M: FEE_INC	Bank net fees and commissions to total operating income ratio in year 2019	Bureau van Dijk, OSIRIS
E: ROA	Return on assets, which is defined as profit before tax as a percentage of average assets of a bank, in year 2019	Bureau van Dijk, OSIRIS

Table 1 (continued)

Variable	Definition	Source
L: LA_TA	Bank liquid assets to total assets ratio in year 2019	Bureau van Dijk, OSIRIS
Stability: ZSCORE	Bank Z-score in year 2019, as a proxy for individual bank risk-taking culture. It is computed as sum of return on asset and capital to asset ratio divided by return volatility. Return volatility is measured based on a 5-year window basis of volatility of the return on assets of the bank	Bureau van Dijk, OSIRIS, and own calculation
(C2) Country controls		
KKZ	KKZ institution index is an aggregate indicator of the quality of institutional development in the country. The index is calculated using the average indicators of information on six issues: voice accountability, political stability, government's effectiveness, regulatory quality, rule of law, and control of corruption. Higher value indicates higher institutional quality	Worldwide Governance Indicator. Kaufmann et al. (2011)
LOSS	A dummy variable that indicates whether a country experienced a significant loss in terms of output per GDP from past financial crises. If the loss of a country is greater than the cross-country median then the variable takes value one and zero otherwise	Laeven and Valencia (2012)
MP_CG	A dummy variable takes value 1 if a country imposes limits on domestic currency loans in year 2017, which is to reduce vulnerability to domestic credit growth	Cerutti et al. (2017)—2018 updated dataset
MP_FC	A dummy variable takes value 1 if a country imposes limits on foreign currency loans in year 2017, which is to reduce vulnerability to foreign-currency risks	Cerutti et al. (2017)—2018 updated dataset
TRADE	Sum of total imports and total export as % of GDP in year 2019	World Bank—WDI
GDPG	The real annual growth of GDP in year 2019	World Bank—WDI
INF	Inflation measured by consumer price index (CPI) is defined as the yearly change in the prices of a basket of goods and services in year 2019	World Bank—WDI
Efficiency		
E:(Efficiency)	Bank efficiency score in year 2019, using DEA approach. See Sect. 4.4 for further detail	Own estimation

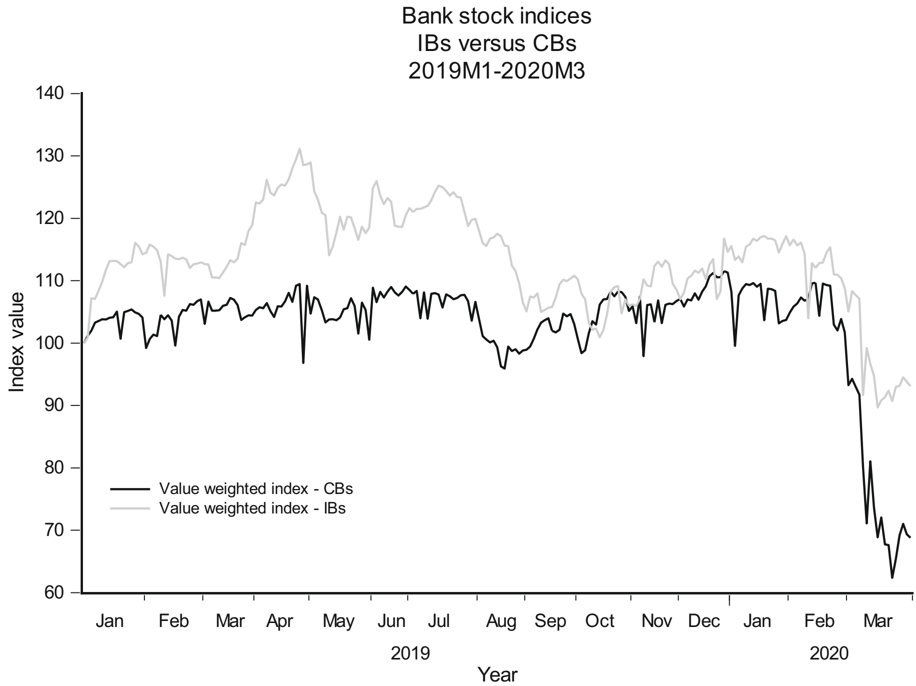

Fig. 1 Value-weighted indices of bank returns

Figure 1 plots the value weighted index for stock prices for our 426 sample banks over January 1, 2019 to March 31, 2020. Separate indices are created for IBs and CBs. We observe that IBs enjoy higher values of the price indices in the first three quarters of 2019, with the difference narrowing in last quarter of 2019. The decline in bank stock returns is noticed around mid-February 2020, and is more pronounced during March 2020. Importantly, we detect a superior stock performance of IBs than CBs, during mid-February, 2019 till end of March, 2020.

We then check the differences in the impact of the crisis on bank stock prices by country and by bank type. Changes in stock prices for IBs between the crisis period (March 31, 2020) and the pre-crisis period (December 31, 2019) are presented in Appendix, Table 7, Columns 1–3. Corresponding statistics for CBs are shown in Columns 4–6. We find that the stock returns significantly decreased in 26, out of 48, countries for CBs (Column 6) and only in 3, out of 12, countries for IBs (Column 3). This suggests that the deterioration of bank stock prices has been more wide spread amongst CBs than IBs, indicating comparably stable stock prices for IBs.

Table 2 presents the summary statistics for stock returns and bank-level control variables. After showing the means for each variable by bank type, statistical differences in the means are tested. We construct the $Stockperformance(\Delta P)$ as the change in log stock prices from December 31, 2019 to March 31, 2020. We report ΔP for all 38 IBs in Column 2. Similarly, we report ΔP for CBs in all countries (388 CBs in 48 countries) in Column 4, and then separately for CBs in the subsample of 12 countries that host IBs in Column 6 (117 CBs in 12 countries). Our results indicate a stronger stock performance for IBs when compared to

Table 2 Summary statistics of all bank-level variables

Variable	IBs		CBs				Diff	
			All countries (48)		Countries hosting IBs (12)			
	Obs [1]	Mean [2]	Obs [3]	Mean [4]	Obs [5]	Mean [6]	[7] = [2] − [4]	[8] = [2] − [6]
Stock performance (ΔP)	38	− 0.107	388	− 0.323	117	− 0.296	0.216***	0.189***
Controls								
Size	38	15.941	388	16.177	117	15.727	− 0.237	0.214
Beta	38	0.649	388	0.834	117	0.694	− 0.184*	− 0.045
Momentum	38	0.084	388	0.087	117	0.195	− 0.004	− 0.112
Tobin Q	38	0.111	388	0.136	117	0.168	− 0.025	− 0.057
Other bank controls (C1)								
EQ_TA	38	− 2.364	388	− 2.280	117	− 2.168	− 0.084	− 0.196**
LLP_TL	38	0.013	388	0.005	117	0.011	0.008	0.002
FEE_INC	38	0.085	388	0.151	117	0.085	− 0.067**	0.000
ROA	38	0.850	388	1.047	117	1.119	− 0.197	− 0.269
LA_TA	38	− 1.607	388	− 1.954	117	− 2.065	0.346***	0.458***
ZSCORE	38	4.578	388	6.241	117	5.443	− 1.664	− 0.865

This table presents a comparison of mean values between IBs and CBs for all bank-level variables used in our analysis. $Stockperformance(\Delta P)$ is the change in log of stock prices from Dec. 31, 2019 to Mar. 31, 2020.. See Table 1 for detailed definition of variables

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Our sample includes 426 (out of which 38 are IBs) in 48 countries

CBs. Specifically, we find $P1$ at -10.7% for IBs versus -32.3% for CBs in all countries, and -29.6% for CBs in the 12 countries that host IBs.

Overall, our detailed descriptive statistics show significant differences in bank stock returns across the two bank types during the COVID-19 crisis. The univariate tests of differences in means clearly show a dominant stock performance for IBs over their conventional counterparts. In Sect. 4, we examine whether this relationship is statistically significant and continues to hold in a more empirically rigorous regression analysis.

3.4 Efficiency estimation

For estimation of efficiency, we use Data Envelopment Analysis (DEA), which was first proposed by Charnes et al. (1978). DEA is a non-parametric method of efficiency analysis that is used for benchmarking decision making units (DMUs) relative to their best peers (efficient frontier). Since the original DEA study by Charnes et al. (1978), there has been a continuous growth in the field. As a result, a considerable amount of published research and applications have appeared in the DEA literature (Emrouznejad et al., 2018). The popularity of using DEA is due to the fact that it does not require any assumption on the shape of the frontier surface, and it makes no assumptions concerning the internal operations of a DMU. Accordingly, DEA has widely been used in assessing entities related to financial institutions including banks, bank branches and insurance companies (Kaffash & Marra, 2017; Kaffash et al., 2018). Mathematically, DEA is a linear programming-based methodology for benchmarking a set of DMUs with multi-inputs and multi-outputs. DEA estimates the production possibility frontier and evaluates the efficiency of each DMU against the frontier.

DEA can be either input- or output-orientated. Under constant returns to scale both input and output oriented DEA models produce the same efficiency scores, while under variable returns to scale the efficiency scores in two models may be different. This is because input-oriented DEA method defines the frontier by seeking the maximum possible proportional reduction in input usage, with output levels held constant, for each DMU. While, for the output-orientated case, the DEA method seeks the maximum proportional increase in output production, with input levels held fixed.

Two main types of DEA models are constant returns-to-scale (CRS) or CCR model (Charnes et al., 1978) and a variable returns-to-scale (VRS) or BCC model (Banker et al., 1984). The BCC model is one of the extensions of the CCR model where the efficient frontiers set is represented by a convex curve passing through all efficient DMUs. Consider a set of n banks ($j = 1, 2, ..., n$) with m input variables ($x_1, ..., x_m$), s output variables ($y_1, ..., y_s$), then an output-oriented DEA formulation is presented in Model 1 (for CCR model) and Model 2 (for BCC model). The only difference between these two models is the inclusion of the convexity constraints of $\sum_{j=1}^{n} \lambda_j = 1$ in the BCC model. Input oriented models can be defined in a similar way.

Model 1: DEA model – constant returns to scale

$$
\begin{aligned}
&\underset{\lambda, h, s_i^-, s_r^+}{\text{Max}} \quad h \\
&\text{s.t.} \\
&\sum_j \lambda_j x_{ij} + S_i^- = x_{ij_0} && \forall i \\
&\sum_j \lambda_j y_{rj} - S_r^+ = h y_{rj_0} && \forall r \\
&S_i^+ , \; S_r^- \geq 0 && \forall i, \forall r \\
&\lambda_j \geq 0 && \forall j.
\end{aligned}
$$

Model 2: DEA model – variable returns to scale

$$
\begin{aligned}
&\underset{\lambda, h, s_i^-, s_r^+}{\text{Max}} \quad h \\
&\text{s.t.} \\
&\sum_j \lambda_j x_{ij} + S_i^- = x_{ij_0} && \forall i \\
&\sum_j \lambda_j y_{rj} - S_r^+ = h y_{rj_0} && \forall r \\
&\sum_j \lambda_j = 1 \\
&S_i^+ , \; S_r^- \geq 0 && \forall i, \forall r \\
&\lambda_j \geq 0 && \forall j.
\end{aligned}
$$

In Model 1, S_i and S_r represent slack variables. If h^* is the optimum value of h, then bank j_0 is said to be Pareto efficient if $h^* = 1$ and the optimal values of S_i^{-*} & S_i^{+*} are zero for all i & r. This means that no other bank or combination of banks exist which can produce at least the same amount of output as bank j_0, with less for some resources and/or no more for any other resources. It should be noted that, a slack in an input i (i.e. $S_i^{-*} > 0$) represents an additional inefficient use of input i. A slack in an output r (i.e. $S_i^{+*} > 0$) represents an additional inefficiency in the production of output r.

Empirically, we follow the intermediation approach to select inputs and outputs (Chaffai & Hassan, 2019; Johnes et al., 2014; Srairi, 2010).[14] According to this approach, banks are viewed as financial intermediaries that borrow funds from surplus economic units and use labour and capital to transform such funds to earning assets (loans and other-earning assets) and non-interest income. Following Safiullah and Shamsuddin (2019), we use the following variables as inputs: (i) staff cost as a proxy for labour input[15]; (ii) fixed assets as a proxy for capital input; and (iii) total deposits as a proxy for financial input, and (iv) impaired loans to account for the credit risk.

Managing a high level of efficiency could be to the detriment of shareholder value, if it comes at the expense of excessive risk taking (Gorton & Rosen, 1995). Using Granger-causality methods, Berger and DeYoung (1997) show that changes in cost efficiency levels precede increases in problem loans. The finding that efficiency is a significant determinant of risk is confirmed by Kwan and Eisenbeis (1997). It is therefore important to consider the interplay between efficiency and risk levels while studying the impact of efficiency on stock returns of banks with different business models, as depicted by IBs versus CBs (Johnes et al., 2014; Safiullah & Shamsuddin, 2019). This is especially important at times of economic disorder, like that brought by the coronavirus outbreak, when bankers and investors face heightened uncertainty and increased levels of risk. As a result, we control for credit risk when comparing efficiency of IBs and CBs, by including impaired loans as an additional input, which represents the general attitudes toward (credit) risk.

Guided by Safiullah and Shamsuddin (2019), we consider three outputs: (i) total amount of customer loans; (ii) other earning assets, including investment securities, loans and advances to banks, and other investment[16]; (iii) non-interest income, including net fees and commissions, net gains/losses on trading and derivatives, and other operating income. Non-interest income can be viewed as a proxy for off-balance-sheet activities, which is an important component of banking business.

The empirical estimation of the DEA-efficiency measures is fraught with data challenges since the input and output variables are not entirely available for all banks. To handle this concern, for some banks we fill the missing values, using the averages of all banks in the country.[17]

Appendix, Table 8presents descriptive statistics of DEA input and output variables of each bank group. To have a better picture of comparisons across bank groups, we report all variables as percentage of total assets (but, of course, we employ the quantity of these variables to estimate efficiency). The summary statistics of input variables for our IBs sample show that, on average, IBs have 1% staff costs ratio, which is less than those reported for CBs

[14] We are aware of an alternative approach, production approach. See Berger and Humphrey, 1997 for a discussion on why intermediation approach is superior to production approach.

[15] A better proxy for labour would be number of employees. However, due to lack of information regarding number of staff, we follow the existing literature (e.g. Johnes et al., 2014) and use an alternative proxy, which is staff cost.

[16] Note that IBs do not offer loans in a conventional way as CBs, loans refer to Musharaka investment, Mudraba investment, Murabaha receivables, Ijara, etc. Also, other earning assets are Islamic bonds (Sukuk), equity investment, etc. For more detail see, for example, Zahar and Hassan (2001).

[17] In unreported results, we show that the impact of efficiency on IBs performance remains unaffected, if we remove banks with missing values for input/output variables and re-estimate efficiency values.

for all 48 countries (12 countries hosting IBs) at the 1.3% (1.3%). The differences in means are statistically significant when comparing with CBs of all 48 countries. This suggests that IBs are, to some extent, superior in managing overheads. On the other hand, IBs have a high ratio of fixed assets, compared to CBs, which is 2.1% versus 1.4% (2.0%). The mean differences are statistically highly significant when comparing with CBs of all 48 countries. This implies that CBs have a higher financial leverage than their IBs counterparts. Concerning the deposit ratio, it is lower in IBs, compared to their CBs counterparts. However, the differences are not statistically significant. And regarding, bank (credit) risk, we surprisingly find that IBs have a higher level of impaired loans to total asset ratio, and this is significant when comparing with CB of 12 countries hosting IBs. This indicates that a typical IB is riskier (at least in terms of loan portfolio quality) than that of a typical conventional bank.

With regard to output variables, we find the mean of loan ratio is slightly higher for IBs than those reported for CBs, but the differences are statistically insignificant. The ratio of other earning assets is rather lower in IBs, compared to those for CBs, and the difference is significant when comparing to CBs of 48 countries. This suggests that IBs are relatively less active in holding earning assets than loans. Finally, IBs earn comparatively less income from non-traditional bank activities. However, the differences are not statistically significant.

4 Results

4.1 Relative performance of Islamic banks

We estimate a cross-sectional regression with a model specification determined in Eq. 1 to test Hypothesis 1. In particular, we regress $Stockperformance$ of banks during the crisis on an Islamic bank indicator (IB), and a host of pre-crisis bank- and country-level control variables. Bank performance is computed as the change in log stock prices from December 31, 2019 to March 31, 2020.

The stock performance of IBs is tested relative to two groups of CBs. In Column 1 of Table 3, we report the results of estimating Eq. (1) using bank data derived from the full sample of countries. Accordingly, the IB variable in Column (1) is interpreted to measure the average difference in stock returns between IBs (38 in 12 countries) against all CBs (388 in 48 counties). Although we include variables that control for the different characteristics at the country level, a more direct comparison of performance of IBs would be against their peers that operate next to them in the same countries. Using the same model specification as in Column (1), we re-estimate the regression model while restricting the sample to only the 12 countries that host IBs, and then report the results in Column (2).

Supporting Hypothesis 1, the Islamic bank indicator IB loads a consistent positive and significant coefficient across both regression models. When compared against CBs during the first three month of the COVID-19 outbreak, IBs are found to enjoy higher stock returns between 10.57 and 13.41%.[18]

In contrast to previous researchers who mostly focused on CBs of countries hosting both types of banks, we compare the relative performance of IBs not only with CBs domiciled in the same countries, but also with CBs of all countries. As such, our findings constitute an important contribution to the existing literature. The reported results are also consistent with

[18] Our results broadly support previous findings that report higher returns for Islamic stocks than conventional stocks (e.g. Shamsuddin, 2014) and relate to a recent study by Alhomaidi et al., (2019) that attempts to explain such differences by religious preferences of Islamic investors.

Table 3 Relative performance of Islamic banks during COVID-19

	Panel A: All countries (48) [1]	Panel B: Countries hosting IBs (12) [2]
IB	0.1341***	0.1057**
	(2.87)	(2.43)
Size	− 0.0263***	0.0155
	(− 5.19)	(0.72)
Beta	− 0.1633***	− 0.2402***
	(− 7.30)	(− 5.30)
Momentum	− 0.0699***	− 0.0811***
	(− 4.47)	(− 4.29)
Tobin Q	− 0.0054	0.0646
	(− 0.04)	(0.44)
Other bank controls (C1)		
C: EQ_TA	− 0.0691	− 0.0312
	(− 1.56)	(− 0.44)
A:LLP_TL	0.0977**	− 1.0512
	(2.55)	(− 0.57)
M: FEE_INC	0.1174**	− 1.1154***
	(2.06)	(− 2.63)
E: ROA	0.0122	− 0.0162
	(1.13)	(− 0.86)
L: LA_TA	0.0483**	0.0215
	(2.15)	(0.88)
Stability: ZSCORE	0.0020	0.0057*
	(1.37)	(1.74)
Country controls (C2)		
Institutions: KKZ	− 0.0527***	0.0213
	(− 2.80)	(0.35)
Memory: LOSS	0.0030	0.0289
	(0.09)	(0.48)
Macroprudential: MP_CG	0.2154***	− 0.0526
	(6.63)	(− 0.52)
Macroprudential: MP_FC	− 0.0054	0.2315***
	(− 0.20)	(3.16)
Real linkage: TRADE	0.0005	0.0012

Table 3 (continued)

	Panel A: All countries (48) [1]	Panel B: Countries hosting IBs (12) [2]
	(1.64)	(1.35)
Economic growth: GDPG	− 0.0160*	0.0185
	(− 1.86)	(0.99)
Macroeconomic stability: INF	0.0052*	0.0017
	(1.78)	(0.47)
Constant	0.0840	− 0.5250
	(0.61)	(− 1.50)
N	426	155
Adj. R^2	0.384	0.374

This table reports the results estimating $\Delta P_{ij,Covid} = \vartheta_0 + \vartheta_1.IB_{ij} + \varphi.X_{ij,2019} + \varepsilon_{ij,Covid}$ where i and j denote bank i and country j. $\Delta P_{ij,Covid}$ is the change in log of stock prices in bank i in country j from December 31, 2019 to March 31, 2020. IB_{ij} is a dummy variable that takes value 1 if bank i domiciled in country j is an Islamic bank, and zero otherwise. $X_{ij,2019}$ is a vector of pre-crisis (end of 2019) bank-specific (or country-specific) variables that may explain the performance of banks during the crisis. See Table 1 for detail definition of variables. Regressions are estimated using OLS. The statistical inferences are based on robust standard errors (associated t-values reported in parentheses) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively

previous empirical studies that investigate the relative performance of IBs during the 2008 GFC. Beck et al. (2013) assess the relative stock performance of Islamic and conventional banks for a list of 207 banks. The reported results indicate that IBs yield higher stock returns during crisis times (Q4-2007–Q4-2008). The authors also document that the higher stock returns of IBs can be explained by better capitalization and lower loan loss provisions, relative to CBs. Hasan and Dridi (2010) attribute the different performance of IBs during the 2008 GFC to characteristics related to IBs business model, such as adherence to Shariah principals. Finally, Farooq and Zaheer (2015) find that during a financial panic, IBs sustain their lending relative to CBs.

Inspecting the sign and significance of the estimated coefficients on the control variables, we provide evidence on the determinants of bank stock returns during the current crisis. We start by focusing on the bank idiosyncratic variables that are conventionally known to explain stock returns. We find that bank size ($Size$) is inversely related to stock performance during the crisis in Column (1), i.e. only in regressions for the 426 banks drawn from all 48 countries. The negative and statistically significant coefficient on $Size$ is consistent with other studies that document comparatively better performance for small firms than large firms during periods of a financial crisis (e.g., Aebi et al., 2012). Similarly, bank risk ($Beta$) is negatively associated with the bank stock returns in both two models. This suggests that banks with higher market risk experienced lower stock returns during the crisis (Pelster et al., 2018). Furthermore, our results support the findings of Tong and Wei (2011) that banks with strong stock returns in the period leading up to the crisis, banks with a high $Momentum$, tend to fare worse during the crisis (Columns 1 and 2). Finally, no relation could be established between bank stock returns and Tobin's Q.

Turning to other bank-specific control variables ($C1$), we report a positive relation between fee to total income ratio (FEE_INC) and bank stock returns when considering banks from all 48 countries (Column 1). However, this is not the case for the smaller sample of 12 countries hosting IBs. Surprisingly, the coefficient on LLP to total loan ratio (LLP_TL) is found to be positive. The impact of other variables on stock returns is either insignificant or not robust. For instance, the coefficients on bank stability ($ZSORE$) and on bank liquidity ratio (LA_TA) are generally positive but largely insignificant. The effects of bank equity position (EQ_TA) and bank profitability (ROA) are mixed and statistically insignificant.

Regarding country-level variables ($C2$), we find that banks located in countries with better institutions (KKZ) suffered lower stock returns (Column 1). Additionally, there is limited evidence indicating that banks in countries that had experienced significant losses ($LOSS$) due to the previous financial crises ended up with higher stock returns during the current crisis. Importantly, we find strong evidence that banks in countries that had been active in curbing credit growth through activation of macroprudential measures in the pre-crisis period, recorded superior stock performance during the crisis. Specifically, we report positive association between bank stock returns and limits on domestic credit growth (MP_CG) when considering banks from all 48 countries (Column 1). This finding could be extended to the second macroprudential measure of limits on foreign currency lending only when using the sample of 12 developing countries where Islamic and conventional banks co-exist together (Column 2). These results are in line with the findings of the recent study by Mirzaei and Moore (2021) that macroprudential polices aimed at curbing credit growth contributed to bank resiliency during the current health crisis. Finally, we do not find any association between GDP growth and inflation and stock performance at the conventional level.

4.2 Efficiency and relative performance of Islamic banks

Having documented superior stock performance of IBs, in comparison to CBs (Sect. 4.1), we now test the ability of efficiency in the period that preceded the coronavirus crisis in explaining the relatively higher stock performance of IBs during the crisis. Efficiency is a determinant of the stock formation process because it allows banks to raise capital at a lower cost and to enhance profitability. Through the managerial competence channel, efficient managers during normal times are able to make sound managerial decisions, such as extending good loans to credit-worthy borrowers, while controlling costs. This will come most beneficial during crisis times, as it would save the bank on severe losses. The protection of profitability is expected to be valued by bank shareholders in the form of higher stock prices.

We test the Hypothesis 2 by estimating Eq. (2) with the aim to compare the effect of efficiency on bank stock prices during the COVID-19 outbreak. Following the research of Safiullah and Shamsuddin (2019), we adjust our efficiency measures for bank risk level to alleviate the concern that improved efficiency could lead to higher risk levels. We gauge the role of efficiency in measuring the differential impact in slope effects between the two bank types, Islamic and conventional banks, by using interaction terms. The two multiplication terms, $E \times IB$ and $E \times CB$, characterize efficiency into two segments: efficiency of IBs and efficiency of CBs, and allow us to separately test the impact on bank stock returns.[19]

[19] It may be interesting to assess the average impact of efficiency, rather than partitioning its impact by IBs and CBs. In Appendix, Table A3, we examine this model specification, and find that while the coefficients on

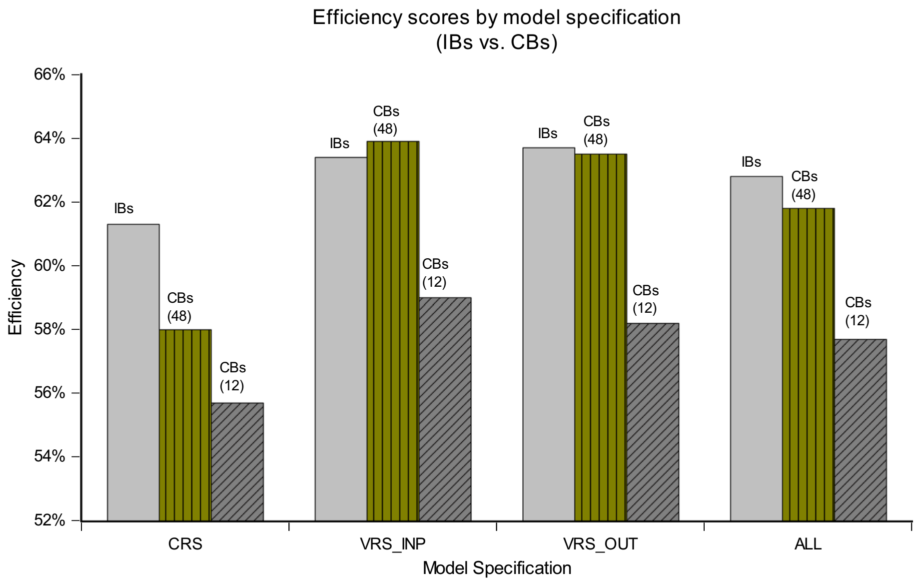

Fig. 2 Average efficiency scores of IBs versus those of CBs

Before examining the role of efficiency on the relative performance of IBs, we compare the risk-adjusted efficiency scores between IBs and CBs, which were obtained by employing different efficiency model specifications. Figure 2 displays the level of efficiency in IBs in comparison to CBs of all 48 countries and CBs in the subsample of 12 countries that host IBs. The inspection of the bar chart presentation by bank type reveals the dominance of IBs over CBs in terms of the higher levels of efficiency. We observe that the efficiency scores of IBs across all three different models (CRS, VRS-INP and VRS-OUT), as well as their average (ALL), are evidently higher. An exception is noticed when comparing the VRS-INP efficiency scores for IBs to those of CBs in all countries. Our findings clearly show differences in the pre-crisis level of risk-adjusted efficiency in favor of IBs are novel, and provide support to the early research that calls for considering the levels of risk while measuring efficiency scores (Safiullah & Shamsuddin, 2019).

After observing higher efficiency scores for IBs in the year approaching the COVID-19 crisis, we turn to formally examine whether the admirable stock performance of IBs is related to the pre-crisis levels of bank (risk-adjusted) efficiency, by reporting the estimation results in Table 4. The dependent variable is the change in log stock prices from December 31, 2019 to March 31, 2020. To ensure that our results are not sensitive the choice of efficiency model or the sample of banks, we present results using efficiency scores of three different efficiency estimation models (CRS, VRS-INP and VRS-OUT) for all 426 banks in 48 countries (Panel A), and for the set of 155 banks in the 12 countries with both types of banks (Panel B). We find that the estimated coefficients for the interaction terms between pre-crisis risk-adjusted efficiency scores and the Islamic bank dummy ($E \times IB$) to be consistently positive and statistically significant across all models and in both panels. These findings indicate

Footnote 19 continued
E are positive, they are statistically insignificant. This highlights the importance of splitting up the impact of efficiency by bank business model. Furthermore, we find that our initial finding regarding better performance of IBs, remain intact, after controlling for bank efficiency.

Table 4 Relative performance of Islamic banks during COVID-19: Does efficiency play a role?

Efficiency model	Panel A: All countries (48)			Panel B: Countries hosting IBs (12)		
	CRS	VRS-INP	VRS-OUT	CRS	VRS-INP	VRS-OUT
	[1]	[2]	[3]	[4]	[5]	[6]
IB	− 0.1891	− 0.1038	− 0.1466	− 0.1521	− 0.1123	− 0.1450
	(− 1.23)	(− 0.71)	(− 1.03)	(− 1.18)	(− 0.88)	(− 1.14)
E IB*	0.0050**	0.0044*	0.0047**	0.0045**	0.0041**	0.0043**
	(2.00)	(1.92)	(2.10)	(2.42)	(2.39)	(2.44)
E CB*	− 0.0004	0.0007	0.0003	0.0003	0.0008	0.0004
	(− 0.46)	(0.89)	(0.45)	(0.19)	(0.54)	(0.28)
Size	− 0.0255***	− 0.0284***	− 0.0280***	0.0114	0.0126	0.0109
	(− 4.36)	(− 4.81)	(− 4.45)	(0.53)	(0.58)	(0.51)
Beta	− 0.1652***	− 0.1651***	− 0.1654***	− 0.2353***	− 0.2397***	− 0.2385***
	(− 7.32)	(− 7.42)	(− 7.42)	(− 5.18)	(− 5.30)	(− 5.26)
Momentum	− 0.0710***	− 0.0745***	− 0.0734***	− 0.0842***	− 0.0858***	− 0.0854***
	(− 4.68)	(− 4.81)	(− 4.69)	(− 4.49)	(− 4.49)	(− 4.42)
Tobin Q	0.0077	− 0.0223	− 0.0134	0.0504	0.0418	0.0459
	(0.06)	(− 0.19)	(− 0.12)	(0.34)	(0.28)	(0.31)
(Controls: C1)						
EQ_TA	− 0.0678	− 0.0704*	− 0.0698*	− 0.0284	− 0.0335	− 0.0343
	(− 1.60)	(− 1.69)	(− 1.67)	(− 0.41)	(− 0.48)	(− 0.49)
LLP_TL	0.1045***	0.1027***	0.0999***	− 0.8686	− 0.8791	− 0.8179
	(2.74)	(2.73)	(2.68)	(− 0.46)	(− 0.46)	(− 0.43)
FEE_INC	0.1283**	0.1589**	0.1486**	− 0.8331*	− 0.8376*	− 0.8335*
	(1.97)	(2.31)	(2.16)	(− 1.76)	(− 1.80)	(− 1.78)
ROA	0.0100	0.0083	0.0085	− 0.0182	− 0.0184	− 0.0178
	(0.85)	(0.71)	(0.72)	(− 0.87)	(− 0.89)	(− 0.86)
LA_TA	0.0450**	0.0449**	0.0454**	0.0200	0.0192	0.0191
	(2.02)	(2.06)	(2.07)	(0.80)	(0.77)	(0.75)
ZSCORE	0.0019	0.0019	0.0019	0.0051	0.0049	0.0051
	(1.34)	(1.35)	(1.34)	(1.50)	(1.46)	(1.52)
(Controls: C2)						
KKZ	− 0.0527***	− 0.0618***	− 0.0588***	0.0071	0.0025	0.0062
	(− 2.61)	(− 2.93)	(− 2.81)	(0.11)	(0.04)	(0.10)
LOSS	0.0021	0.0112	0.0079	0.0443	0.0480	0.0460
	(0.06)	(0.34)	(0.24)	(0.73)	(0.80)	(0.77)
MP_CG	0.2206***	0.2020***	0.2089***	− 0.0850	− 0.0797	− 0.0819

Table 4 (continued)

Efficiency model	Panel A: All countries (48)			Panel B: Countries hosting IBs (12)		
	CRS	VRS-INP	VRS-OUT	CRS	VRS-INP	VRS-OUT
	[1]	[2]	[3]	[4]	[5]	[6]
	(6.34)	(5.57)	(5.85)	(– 0.85)	(– 0.80)	(– 0.82)
MP_FC	– 0.0025	– 0.0020	– 0.0031	0.2490***	0.2435***	0.2453***
	(– 0.10)	(– 0.07)	(– 0.11)	(3.47)	(3.36)	(3.40)
TRADE	0.0005*	0.0006*	0.0005*	0.0014	0.0015	0.0014
	(1.67)	(1.80)	(1.74)	(1.55)	(1.59)	(1.56)
GDPG	– 0.0160*	– 0.0132	– 0.0141	0.0285	0.0285	0.0277
	(– 1.83)	(– 1.50)	(– 1.62)	(1.46)	(1.47)	(1.43)
INF	0.0049*	0.0046	0.0047	0.0010	0.0010	0.0011
	(1.70)	(1.61)	(1.64)	(0.28)	(0.28)	(0.30)
Constant	0.0885	0.0520	0.0736	– 0.5689	– 0.6289*	– 0.5789
	(0.65)	(0.38)	(0.54)	(– 1.60)	(– 1.75)	(– 1.65)
N	426	426	426	155	155	155
Adj. R^2	0.395	0.393	0.394	0.395	0.393	0.394

This table reports the results estimating $\Delta P_{ij,Covid} = \vartheta_0 + \vartheta_1.IB_{ij} + \vartheta_2.E_{ij,2019} \times IB_{ij} + \vartheta_3.E_{ij,2019} \times CB_{ij} + \varphi.X_{ij,2019} + \varepsilon_{ij,Covid}$ where i and j denote bank i and country j. $\Delta P_{ij,Covid}$ is the change in log of stock prices in bank i in country j from December 31, 2019 to March 31, 2020. IB_{ij} is a dummy variable that takes value 1 if bank i domiciled in country j is an Islamic bank, and CB_{ij} is an indicator variable that takes value 1 if bank i domiciled in country j is a conventional bank. $E_{ij,2019}$ represents the value of 2019 efficiency score for bank i in country j. $X_{ij,2019}$ is a vector of pre-crisis (end of 2019) bank-specific (or country-specific) variables that may explain the performance of banks during the crisis. See Table 1 for detail definition of variables. Regressions are estimated using OLS. The statistical inferences are based on robust standard errors (associated t-values reported in parentheses)
***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively

that the strong stock return performance of IBs during the COVID-19 period appear to be linked to their pre-crisis levels of efficiency, even after controlling for a range of bank and country factors that may influence bank stock returns. Our results show that the persistent significance of coefficients on the interaction terms between the risk-adjusted efficiency and Islamic bank dummy ($E \times IB$) is contrasted with a complete absence of significance for conventional banks. Specifically, none of the coefficients on the interaction terms between efficiency and conventional bank dummy ($E \times CB$) is statistically significant. These results support Hypothesis 2 and suggest that the relatively better stock performance of IBs during the current health crisis can be attributed to their pre-crisis levels of efficiency. We are careful in the interpretation of our results not to conclude the irrelevance of efficiency to general performance of conventional banks, but rather to one measure of performance as determined by stock returns. We return to this point in Sect. 4.4. Additionally, we consider the roles of other factors, besides efficiency, such as bank revenue diversification and liquidity levels, in the determination of stocks returns of CBs during the crisis period.

The empirical results presented in Table 4 show that, in contrast to the case of CBs, improvements in pre-crisis efficiency of IBs are reflected in higher stock prices. This supports the conjecture that the business model of IBs pronounces the effect of efficiency on stock returns. Having partnership agreements on both sides of the balance sheet is valuable during a crisis, as it would provide efficient managers opportunities to fully take advantage of the benefits of pass-through mechanisms of the risk-sharing features. Managers of IBs face the supervision pressure from holders of the profit-sharing investment accounts who have an equity-like position, and are left with strong incentives to monitor the bank. Simultaneously, managers engage in creating partnership loans that often require the ability to customize products to meet the demands of the clients, while remaining in compliance of Islamic principles. Such arrangements, which are completely absent in CBs, are beneficial in crisis times, especially for an efficient bank with high manager capabilities. Aware of this potential, IBs spend significant amounts on trainings and professional development to promote managerial skill and knowledge levels. Empirically, Johnes et al. (2014) report that the high net efficiency in Islamic banks when measured relative to their own bank type frontier reflects the underlying superior managerial capabilities.

With respect to bank and country specific characteristics, we find that the coefficients on the control variables in Table 4 are nearly identical in terms of magnitude and significance level to those observed in Table 3. However, one distinctive feature is observed in the other bank-specific variables ($C1$), where we find an increasing effect of bank liquidity on bank stock returns, suggesting that banks that had entered into the COVID-19 pandemic with a high level of liquidity performed better during the crisis.

4.3 Sensitivity tests

In this section we conduct two sensitivity tests to check the robustness of our main conclusion that IBs performed relatively better than CBs during the early stage of COVID-19 pandemic, and that the documented superior performance can be explained by the pre-crisis levels of efficiency.

First, we assess whether the results are affected by the choice of the time period over which the efficiency scores are calculated. We re-estimate the efficiency models using information for the year 2018, and then construct a new efficiency proxy by taking averages in 2018 and 2019 scores. Computing an average level of efficiency over a two-year period reduces concerns of capturing features that are specific to a single year, and therefore, mitigates the impact of potential outliers. The estimation results, presented in Table 5, show that the coefficient on $E \times IB$ remains positive and statistically significant, with a magnitude comparable to those presented in Table 4. This finding supports our basic conclusion, and reinforces the role of efficiency in determining the better performance of IBs during the current Covis-19 crisis.

Second, rather than taking averages in each of the three efficiency measures (CRS, VRS-INP and VRS-OUT) over a two-year window (Table 5), we re-estimate Eq. (2) using a single efficiency measure that is calculated as an average across all three scores. The results that are reported in Table 6 indicate that the effect of efficiency on IBs remains robust, with a positive effect on the stock return during the COVID-19 pandemic. These findings strengthen the conclusion that efficiency indeed matters for the performance of IBs during the current health crisis.

4.4 Additional tests

Our empirical work is carried on with two additional tests. We start off by addressing the concern that the residuals from the OLS estimations of Eq. (2) may be correlated across banks. This may result in biased standard errors and would reduce the reliability of the reported

Table 5 Relative performance of Islamic banks during COVID-19: Does efficiency play a role? Robust to average 2018–19 values

Efficiency model	Panel A: All countries (48)			Panel B: Countries hosting IBs (12)		
	CRS	VRS-INP	VRS-OUT	CRS	VRS-INP	VRS-OUT
	[1]	[2]	[3]	[4]	[5]	[6]
IB	− 0.1804	− 0.1276	− 0.1594	− 0.1306	− 0.1246	− 0.1436
	(− 1.17)	(− 0.85)	(− 1.09)	(− 1.04)	(− 0.99)	(− 1.15)
*E (average 2018–19) * IB*	0.0052**	0.0049**	0.0052**	0.0048**	0.0045**	0.0047**
	(2.08)	(2.04)	(2.24)	(2.54)	(2.52)	(2.59)
E (average 2018–19) CB*	0.0000	0.0007	0.0006	0.0010	0.0009	0.0008
	(0.02)	(0.82)	(0.64)	(0.60)	(0.62)	(0.56)
Size	− 0.0268***	− 0.0287***	− 0.0290***	0.0094	0.0104	0.0082
	(− 4.54)	(− 4.69)	(− 4.42)	(0.44)	(0.48)	(0.38)
Beta	− 0.1642***	− 0.1654***	− 0.1654***	− 0.2348***	− 0.2397***	− 0.2382***
	(− 7.36)	(− 7.45)	(− 7.45)	(− 5.24)	(− 5.34)	(− 5.31)
Momentum	− 0.0722***	− 0.0743***	− 0.0736***	− 0.0845***	− 0.0866***	− 0.0862***
	(− 4.83)	(− 4.84)	(− 4.84)	(− 4.56)	(− 4.54)	(− 4.55)
Tobin Q	− 0.0027	− 0.0240	− 0.0206	0.0361	0.0352	0.0337
	(− 0.02)	(− 0.21)	(− 0.18)	(0.24)	(0.24)	(0.23)
(Controls: C1)	✓	✓	✓	✓	✓	✓
Constant	0.0921	0.0603	0.0774	− 0.5669	− 0.5890*	− 0.5509

Table 5 (continued)

Efficiency model	Panel A: All countries (48)			Panel B: Countries hosting IBs (12)		
	CRS	VRS-INP	VRS-OUT	CRS	VRS-INP	VRS-OUT
	[1]	[2]	[3]	[4]	[5]	[6]
N	426	426	426	155	155	155
Adj. R^2	0.396	0.395	0.397	0.398	0.397	0.399

This table reports the results estimating $\Delta P_{ij,Covid} = \vartheta_0 + \vartheta_1.IB_{ij} + \vartheta_2.E_{ij,2018-19} \times IB_{ij} + \vartheta_3.E_{ij,2018-19} \times CB_{ij} + \varphi.X_{ij,2019} + \varepsilon_{ij,Covid}$ where i and j denote bank i and country j. $\Delta P_{ij,Covid}$ is the change in log of stock prices in bank i in country j from December 31, 2019 to March 31, 2020. IB_{ij} is a dummy variable that takes value 1 if bank i domiciled in country j is an Islamic bank, and CB_{ij} is an indicator variable that takes value 1 if bank i domiciled in country j is a conventional bank. $E_{ij,2018-19}$ represents the average value of 2018 and 2019 efficiency scores for bank i in country j. $X_{ij,2019}$ is a vector of pre-crisis (end of 2019) bank-specific (or country-specific) variables that may explain the performance of banks during the crisis. See Table 1 for detail definition of variables. Regressions are estimated using OLS. The statistical inferences are based on robust standard errors (associated t-values reported in parentheses)

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively

Table 6 Relative performance of Islamic banks during COVID-19: Does efficiency play a role? Robust to average of different efficiency models

	Panel A: All countries (48) [1]	Panel B: Countries hosting IBs (12) [2]
IB	– 0.1465	– 0.1386
	(– 0.99)	(– 1.08)
*E (average CRS, VRS-INP, and VRS-OUT) * IB*	0.0048**	0.0044**
	(2.03)	(2.45)
*E (average CRS, VRS-INP, and VRS-OUT) * CB*	0.0003	0.0005
	(0.35)	(0.35)
Size	– 0.0276***	0.0114
	(– 4.50)	(0.53)
Beta	– 0.1648***	– 0.2377***
	(– 7.35)	(– 5.25)
Momentum	– 0.0729***	– 0.0852***
	(– 4.72)	(– 4.47)
Tobin Q	– 0.0120	0.0453
	(– 0.10)	(0.31)
(Controls: C1)	✓	✓
(Controls: C2)	✓	✓
Constant	0.0743	– 0.5928*
	(0.55)	(– 1.67)
N	426	155
Adj. R^2	0.394	0.395

This table reports the results estimating $\Delta P_{ij,Covid} = \vartheta_0 + \vartheta_1.IB_{ij} + \vartheta_2.E_{ij,2019} \times IB_{ij} + \vartheta_3.E_{ij,2019} \times CB_{ij} + \varphi.X_{ij,2019} + \varepsilon_{ij,Covid}$ where i and j denote bank i and country j. $\Delta P_{ij,Covid}$ is the change in log of stock prices in bank i in country j from December 31, 2019 to March 31, 2020. IB_{ij} is a dummy variable that takes value 1 if bank i domiciled in country j is an Islamic bank, and CB_{ij} is an indicator variable that takes value 1 if bank i domiciled in country j is a conventional bank. $E_{ij,2019}$ represents the value of 2019 efficiency score (obtained from average of CRS, VRS-INP and VRS-OUT) for bank i in country j. $X_{ij,2019}$ is a vector of pre-crisis (end of 2019) bank-specific (or country-specific) variables that may explain the performance of banks during the crisis. See Table 1 for detail definition of variables. Regressions are estimated using OLS. The statistical inferences are based on robust standard errors (associated t-values reported in parentheses) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively

results. Following Demirgüç-Kunt et al. (2013), we had thus far clustered standard errors at the bank-level. This empirical approach is methodologically equivalent to robust standard errors, because of cross-sectional nature of the dataset. Alternatively, clustering could be achieved at the country-level, which requires even cluster size (see, Nichols & Schaffer, 2007; Beck et al., 2013). However, our sample countries are characterized by uneven cluster size, with some countries having extremely high or low number of banks. Acknowledging this limitation, we proceed with conducting an additional test, and re-run our model while clustering at the country-level. The results, presented in Appendix, Table 10, confirm the findings from our baseline regressions, with magnitude of the coefficients comparable to those reported in Table 4.

Next, we supplement our analysis by providing insights on two important issues. The first relates to interpretation of our finding that shareholders of CBs do not value improvements in the pre-crisis levels of efficiency as would be depicted by higher stock prices. We caution against generalizing our results to imply that pre-crisis efficiency has no bearing on the performance of CBs during the current crisis. We note that this study focuses on one dimension of bank performance, which is stock returns, without investigating other performance dimensions, such as lending and profitability. Therefore, we argue that to draw a more general conclusion on the relation between efficiency and performance of CBs, a study must include a wider set of performance measures.

The second issue is, if pre-crisis efficiency does not determine crisis stock returns for CBs, then what are the other factors that could potentially do? This question is justified in light of the fact that commercial banks did not have uniform performance during the crisis. In fact, some CBs performed distinguishably well when compared to their peers. We attempt to provide explanations, while recognizing that a thorough investigation is out of the scope of the present paper. We follow a similar empirical methodology as in Eq. (2) and partition bank revenue diversification (FEE_INC) and bank liquidity (LA_TA) variables to IB portion and CB portion before re-estimating the model. Bank revenue diversification improves profitability, which consequently increases market value of the banks (Elsas et al., 2010). In this regard, Baele et al. (2007) find a positive association between bank revenue diversification and franchise value. Furthermore, improved bank liquidity position is thought to decrease the risk of bank asset portfolio. If this is valued by market participants, then one may expect the banks to be more resilient to an external shock (Igan & Mirzaei, 2020). Overall, we expect that CBs with higher liquidity levels and more diversified revenue stream in the pre-crisis period to perform relatively better than their counterparts during the crisis period. The results, which are reported in Appendix, Table 11, show that the pre-crisis levels of bank diversification and liquidity indeed explain better the performance of some CBs. Unlike efficiency, these two bank characteristics may be valued by shareholders of CBs during times of external shock.

4.5 Policy implication

From the application viewpoint, this paper provides important policy implications. *First*, if the finding that Islamic banks are more resilient than conventional banks during the GFC is repeated in the more recent COVID crisis, then the policy question becomes relevant. The conclusion that Islamic banks are capable of superior performance in various crises that differ fundamentally is remarkable and suggests that Islamic banks have fundamental advantages over conventional banks that are not unique to a period or specific economic condition. Accordingly, our findings support the conjecture that a greater inclusion, or wider adoption, of Islamic banking stabilizes economies and dampen the crisis's adverse effects, such as protecting shareholders' wealth in stock markets.

Second, the reported results suggest that efficiency is a good indicator of the quality of management in IBs. Interpreted as evidence that efficiency during normal times helps IBs withstand crisis periods, our results have direct implications for bank regulators. Banks with low-efficiency scores must be closely scrutinized as their performance is predicted to lag their conventional counterparts when hit by an unexpected exogenous macroeconomic shock in a crisis. This allows regulators to seize a window of opportunity to intervene with timely corrective measures to improve bank efficiency before a crisis occurs. Notably, bank regulators often enact policies focusing on standard measures such as bank capital and liquidities, but not necessarily efficiency measures. However, regulating two types of banks, Islamic and conventional, competing in the same economic sphere with one set of policies risks widening the efficiency gap of one bank type over another. Our papers call for the importance of considering the effect of regulation on bank-level efficiency.

Third, IBs should be encouraged to establish policies and procedures that enable quality managers to achieve higher efficiencies in bank operations while keeping the risk levels under control. This is in line with the view of previous researchers who highlight the paramount importance of efficiency in protecting bank performance and, as such, strengthening financial stability (e.g., Assaf et al., 2019).

5 Conclusion

The ongoing coronavirus crisis provides a natural experiment that allows for the study of stock price dynamics of public banks. In this paper, we take advantage of this opportunity and compare the stock returns during the first three months of the year 2020 for a sample of 426 banks from 48 countries. We do so while distinguishing a unique business model that is depicted by faith-based financial institutions, specifically Islamic banks. We highlight that IBs enjoy distinguishable ways of conducting the functions of bank intermediation. With a special role assigned to the feature of profit and loss sharing, IBs are shown to have resilience in withstanding the adverse consequences of economic crises. It is argued that compared to CBs, IBs are more capable of protecting their profitability during crisis periods, and therefore can generate shareholder value in the form of higher stock returns. In a regression analysis setting that controls for a range of bank- and country-level variables, we provide strong empirical evidence that IBs recorded 10% to 13% higher stock returns than that of CBs.

We document that the observed higher stock returns for IBs can be explained by their pre-crisis levels of efficiency. We utilize the two main types of DEA models (CRS and VRS) to estimate three variants of the efficiency scores that are adjusted for the level of bank risk (Safiullah & Shamsuddin, 2019). When inspected in the year 2019, it is revealed that IBs are evidently more efficient. The multivariate regression results indicate that the pre-crisis efficiency level of IBs is a significant determinant of stock returns for IBs but not CBs.

In summary, our results show that IBs fared significantly higher stock returns relative to CB during the coronavirus crisis, and this superior stock performance can be explained by their pre-crisis level of efficiency. These findings deepen the confidence in the resilience of IBs during economic fallouts, and highlight the importance of bank efficiency in holding out against potential adverse effects. We regard our findings as novel with significant contribution to an ongoing academic discussion about the impact of COVID-19 on bank performance.

Appendix

See Tables 7, 8, 9, 10 and 11.

Table 7 Change in bank stock prices during COVID-19

Country	Hosting IBs?	*N (IB/CB)*	Islamic banks (IBs)			Conventional banks (CBs)		
			Dec. 31th, 2019 (1)	Mar. 31th, 2020 (2)	diff. (3) = (2) − (1)	Dec. 31th, 2019 (4)	Mar. 31th, 2020 (5)	diff. (6) = (5) − (4)
Bahrain	Y	9 (4/5)	0.279	0.223	− 0.056**	1.348	1.182	− 0.166**
Bangladesh	Y	31 (7/24)	0.183	0.155	− 0.028***	0.252	0.206	− 0.046***
Egypt	Y	7 (3/4)	0.729	0.672	− 0.057	1.645	1.324	− 0.321
Indonesia	Y	32 (1/31)	0.024	0.014	− 0.010	0.212	0.148	− 0.064***
Iran	Y	6 (6/0)	0.052	0.090	0.038**			
Nigeria	Y	8 (1/7)	0.002	0.001	− 0.001	0.035	0.019	− 0.015*
Oman	Y	6 (1/5)	0.247	0.234	− 0.013	0.493	0.394	− 0.098**
Pakistan	Y	13 (2/11)	0.343	0.240	− 0.103	0.223	0.157	− 0.065
Qatar	Y	9 (4/5)	2.046	1.797	− 0.249	1.793	1.488	− 0.305
Saudi Arabia	Y	11 (4/7)	8.846	7.092	− 1.754***	8.523	5.587	− 2.936***
Turkey	Y	11 (1/10)	0.257	0.176	− 0.081	1.450	1.174	− 0.276***
UAE	Y	12 (4/8)	0.885	0.622	− 0.263	1.682	1.146	− 0.536*
Australia	N	6				19.899	13.364	− 6.535**
Austria	N	1				107.622	91.937	− 15.68
Brazil	N	14				5.854	3.239	− 2.614***
Chile	N	4				11.491	8.896	− 2.594
China	N	26				1.419	1.199	− 0.220***
Colombia	N	2				6.650	6.095	− 0.555
Croatia	N	1				9.323	7.143	− 2.180
Denmark	N	19				56.980	47.834	− 9.146*

Table 7 (continued)

Country	Hosting IBs?	*N (IB/CB)*	Islamic banks (IBs)			Conventional banks (CBs)		
			Dec. 31th, 2019 (1)	Mar. 31th, 2020 (2)	diff. (3) = (2) − (1)	Dec. 31th, 2019 (4)	Mar. 31th, 2020 (5)	diff. (6) = (5) − (4)
Finland	N	4				11.799	9.382	− 2.416**
France	N	3				32.879	16.839	− 16.04
Germany	N	1				7.777	6.419	− 1.358
Ghana	N	4				1.120	1.148	0.028
India	N	33				3.623	1.908	− 1.714***
Iraq	N	2				0.000	0.000	− 0.000
Israel	N	8				14.829	11.666	− 3.162***
Kenya	N	4				0.935	0.768	− 0.166**
Malaysia	N	1				0.464	0.342	− 0.122
Mexico	N	1				1.681	1.044	− 0.636
Morocco	N	5				46.773	37.802	- 8.970***
Nepal	N	24				2.257	2.496	0.239***
Norway	N	1				8.497	5.408	− 3.088
Peru	N	2				1.331	1.034	− 0.296
Philippines	N	12				1.225	0.817	− 0.407**
Poland	N	10				28.857	16.927	− 11.93**
Rep. Kore	N	1				3.502	2.020	− 1.482
Russia	N	10				26.131	28.826	2.694
Singapore	N	1				1.982	1.521	− 0.460

Table 7 (continued)

Country	Hosting IBs?	*N (IB/CB)*	Islamic banks (IBs)			Conventional banks (CBs)		
			Dec. 31th, 2019 (1)	Mar. 31th, 2020 (2)	diff. (3) = (2) − (1)	Dec. 31th, 2019 (4)	Mar. 31th, 2020 (5)	diff. (6) = (5) − (4)
Spain	N	6				3.929	2.143	− 1.786**
Sri Lanka	N	13				0.337	0.232	− 0.104***
Sweden	N	3				10.950	7.588	− 3.361*
Switzerland	N	1				6.600	5.717	− 0.882
Thailand	N	8				2.270	1.317	− 0.952**
Tunisia	N	9				9.478	8.396	− 1.081***
UK	N	1				2.706	1.165	− 1.540
USA	N	16				47.746	29.953	− 17.79***
Vietnam	N	14				0.974	0.728	− 0.246**
All countries (48)		426 (38/388)	1.401	1.144	− 0.256**	9.916	7.507	− 2.409***
Countries hosting IBs (12)		155 (38/117)	1.401	1.144	− 0.256**	1.091	0.786	− 0.305***

This table reports change in bank stock prices from December 31, 2019, to March 31, 2020 by country and by bank type
***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Our sample includes 426 banks in 48 countries

Table 8 Summary statistics for the DEA input and output variables

Variable	IBs		CBs				diff	
			All countries (48)		Countries hosting IBs (12)			
	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev	[7] = [1] − [3]	[8] = [1] − [5]
	[1]	[2]	[3]	[4]	[5]	[6]		
Inputs (% of total assets)								
Staff costs	0.010	0.006	0.013	0.009	0.013	0.008	− 0.002*	− 0.002
Fixed assets	0.021	0.021	0.014	0.013	0.020	0.017	0.007***	0.002
Deposits	0.726	0.127	0.868	1.369	0.868	1.278	− 0.142	− 0.142
Impaired loans	0.094	0.259	0.064	0.179	0.038	0.051	0.030	0.055**
Outputs (% of total assets)								
Laons	0.622	0.165	0.616	0.155	0.621	0.139	0.005	0.001
Other earning assets	0.224	0.146	0.273	0.159	0.255	0.156	− 0.049*	− 0.032
Non-interest income	0.046	0.020	0.047	0.027	0.047	0.024	− 0.002	− 0.002

This table presents a comparison of mean values between IBs and CBs for all input/output variables used for efficiency estimation. The variables are for year 2019 and scaled by bank total assets, and then mean values reported

Table 9 The average effect of efficiency on bank stock performance during the COVID-19 crisis

Efficiency model	Panel A: All countries (48)			Panel B: Countries hosting IBs (12)		
	CRS	VRS-INP	VRS-OUT	CRS	VRS-INP	VRS-OUT
	[1]	[2]	[3]	[4]	[5]	[6]
IB	0.1320***	0.1317***	0.1311***	0.0924**	0.0918**	0.0902**
	(2.88)	(2.90)	(2.88)	(2.05)	(2.04)	(1.98)
E	0.0005	0.0012	0.0009	0.0023	0.0023*	0.0022
	(0.56)	(1.46)	(1.15)	(1.58)	(1.77)	(1.65)
Size	− 0.0279***	− 0.0297***	− 0.0300***	0.0090	0.0115	0.0084
	(− 4.70)	(− 5.08)	(− 4.79)	(0.42)	(0.55)	(0.39)
Beta	− 0.1621***	− 0.1631***	− 0.1638***	− 0.2328***	− 0.2386***	− 0.2377***
	(− 7.24)	(− 7.44)	(− 7.43)	(− 5.32)	(− 5.46)	(− 5.39)
Momentum	− 0.0713***	− 0.0751***	− 0.0744***	− 0.0840***	− 0.0874***	− 0.0877***
	(− 4.55)	(− 4.74)	(− 4.65)	(− 4.47)	(− 4.52)	(− 4.52)
Tobin Q	− 0.0199	− 0.0371	− 0.0305	0.0204	0.0192	0.0216
	(− 0.16)	(− 0.32)	(− 0.26)	(0.14)	(0.13)	(0.15)
(Controls: C1)	✓	✓	✓	✓	✓	✓
(Controls: C2)	✓	✓	✓	✓	✓	✓
Constant	0.0804	0.0395	0.0658	− 0.6205*	− 0.6778*	− 0.6081*
	(0.58)	(0.28)	(0.47)	(− 1.67)	(− 1.82)	(− 1.67)
N	426	426	426	155	155	155
Adj. R^2	0.383	0.387	0.385	0.383	0.386	0.383

Table 10 Does efficiency explain why Islamic banks fared relatively better during COVID-19 outbreak?

Efficiency model	Panel A: All countries (48)			Panel B: Countries hosting IBs (12)		
	CRS	VRS-INP	VRS-OUT	CRS	VRS-INP	VRS-OUT
	[1]	[2]	[3]	[4]	[5]	[6]
IB	− 0.1891*	− 0.1038	− 0.1466*	− 0.1521	− 0.1123	− 0.1450
	(− 1.79)	(− 1.35)	(− 1.77)	(− 1.13)	(− 0.96)	(− 1.22)
*E * IB*	0.0050***	0.0044***	0.0047***	0.0045**	0.0041**	0.0043**
	(2.73)	(2.87)	(2.70)	(2.70)	(2.75)	(2.67)
*E * CB*	- 0.0004	0.0007	0.0003	0.0003	0.0008	0.0004
Size	− 0.0255**	− 0.0284***	− 0.0280***	0.0114	0.0126	0.0109
	(− 2.60)	(− 3.03)	(− 2.92)	(0.38)	(0.41)	(0.35)
Beta	− 0.1652***	− 0.1651***	− 0.1654***	− 0.2353***	− 0.2397***	− 0.2385***
	(− 4.79)	(− 4.86)	(− 4.78)	(− 4.72)	(− 4.67)	(− 4.73)
Momentum	− 0.0710***	− 0.0745***	− 0.0734***	− 0.0842***	− 0.0858***	− 0.0854***
	(− 4.64)	(− 4.70)	(− 4.63)	(− 5.27)	(− 4.95)	(− 4.82)
Tobin Q	0.0077	− 0.0223	− 0.0134	0.0504	0.0418	0.0459
	(0.10)	(− 0.30)	(− 0.18)	(0.51)	(0.43)	(0.48)
(Controls: C1)	✓	✓	✓	✓	✓	✓
(Controls: C2)	✓	✓	✓	✓	✓	✓
Constant	0.0885	0.0520	0.0736	− 0.5689	− 0.6289	− 0.5789
	(0.37)	(0.22)	(0.31)	(− 1.02)	(− 1.12)	(− 1.03)
N	426	426	426	155	155	155
Adj. R^2	0.395	0.393	0.394	0.395	0.393	0.394

Robust to clustering at the country-level

Table 11 What might explain the relative performance of some CBs over others?

Efficiency model	Diversification			Liquidity		
	CRS	VRS-INP	VRS-OUT	CRS	VRS-INP	VRS-OUT
	[1]	[2]	[3]	[4]	[5]	[6]
IB	0.2438**	0.2313**	0.2313**	0.2635	0.2377	0.2377
	(2.54)	(2.45)	(2.45)	(1.50)	(1.37)	(1.37)
*FEE_INC * IB*	− 1.1331	− 0.9719	− 0.9719			
	(− 1.36)	(− 1.20)	(− 1.20)			
*FEE_INC * CB*	0.1331**	0.1623**	0.1623**			
	(2.02)	(2.33)	(2.33)			
*LA_TA * IB*				0.1256	0.1091	0.1091
				(1.38)	(1.21)	(1.21)
*LA_TA * CB*				0.0456**	0.0445**	0.0445**
				(2.06)	(2.04)	(2.04)
Size	− 0.0263***	− 0.0285***	− 0.0285***	− 0.0275***	− 0.0295***	− 0.0295***
	(− 4.43)	(− 4.81)	(− 4.81)	(− 4.66)	(− 5.04)	(− 5.04)
Beta	− 0.1633***	− 0.1636***	− 0.1636***	− 0.1616***	− 0.1624***	− 0.1624***
	(− 7.26)	(− 7.45)	(− 7.45)	(− 7.24)	(− 7.42)	(− 7.42)
Momentum	− 0.0720***	− 0.0755***	− 0.0755***	− 0.0710***	− 0.0748***	− 0.0748***
	(− 4.62)	(− 4.80)	(− 4.80)	(− 4.56)	(− 4.74)	(− 4.74)
Tobin Q	− 0.0005	− 0.0211	− 0.0211	− 0.0160	− 0.0346	− 0.0346
	(− 0.00)	(− 0.18)	(− 0.18)	(− 0.13)	(− 0.29)	(− 0.29)
(Controls: C1)	Ex. FEE_INC In. EFFICIENCY	Ex. FEE_INC In. EFFICIENCY	Ex. FEE_INC In. EFFICIENCY	Ex. LA_TA In. EFFICIENCY	Ex. LA_TA In. EFFICIENCY	Ex. LA_TA In. EFFICIENCY

Table 11 (continued)

Efficiency model	Diversification			Liquidity		
	CRS	VRS-INP	VRS-OUT	CRS	VRS-INP	VRS-OUT
	[1]	[2]	[3]	[4]	[5]	[6]
(Controls: C2)	✓	✓	✓	✓	✓	✓
Constant	0.1024	0.0655	0.0655	0.0685	0.0322	0.0322
	(0.75)	(0.48)	(0.48)	(0.49)	(0.22)	(0.22)
N	426	426	426	426	426	426
Adj. R^2	0.387	0.390	0.390	0.382	0.386	0.386

Role of pre-crisis income diversification and liquidity position

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