

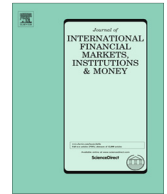


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Global banking stability in the shadow of Covid-19 outbreak

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ABSTRACT

The ongoing Covid-19 pandemic has been exerting negative effects on several economies in 2020. Therefore, it is of paramount importance to examine the impact of this pandemic on the global banking stability and to assess any potential recovery signals. This study is timely, in that we consider 1090 banks from 116 countries for quarterly periods across 2019–20. The results provide strong empirical evidence that, in the global banking sector, the Covid-19 outbreak has had detrimental impacts on financial performance across various indicators of financial performance (i.e., accounting-based and market-based performance measures) and financial stability (i.e., high-risk indicators including default risk, liquidity risk and asset risk). These results are consistently observed for various regions, countries (US, China and others), and different bank-level characteristics, and across income-generation levels among countries. We also find differential effects of the pandemic on alternative banking systems (i.e., conventional and Islamic). Moreover, our trend analysis, based on bank average performance and financial stability over quarterly periods, identifies a signal of recovery for bank stability during the second quarter of 2020. The findings presented in this study offer important financial observations and policy implications to many stakeholders engaging with global banking.

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1. Introduction

The outbreak of the novel coronavirus, named Covid-19 (also known as SARS-CoV-2) by the World Health Organization (WHO), has been declared a global pandemic. The rapid 'globalization' of the Covid-19 pandemic is something that the world has never encountered before. At the end of February, the world began to realise the serious global economic impact of this Covid-19 pandemic, following the developments in China, Europe

and the United States. The global capital markets were severely affected over the first weekend in March, in addition to markets for essential commodities such as oil, and those related to foreign currencies and financial assets. The outbreak has forced major international institutions and banks to cut their growth forecasts (Donthu and Gustafsson, 2020; Sharma, Leung, Kingshott, Davcik and Cardinali, 2020). Due to the unprecedented nature of this crisis, the impacts on economic developments and financial stability are rather complicated to quantify, but they must be urgently addressed. For many economies, this will depend mostly on the ability to restart economic activities while continuing to contain health risks to the population adequately (Moshirian and Wu, 2009; Jutasompakorn, Brooks, Brown and Treepongkaruna, 2014; Daly, Batten, Mishra and Choudhury, 2019). The figures published by international organisations are staggering: the baseline IMF scenario

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in April 2020 pointed to a 3% contraction of the economy in 2020, far more severe than that suffered during the 2007 financial crisis, with particularly acute shocks in specific sectors. The main country-specific forecasts available at the beginning of May, however, referred to a deeper recession in the near future (IMF, 2020).

With the wide-scale global transmission of the coronavirus, all economic players (consumers, suppliers, financial intermediaries, etc.) are facing an unprecedented crisis (Carnevale and Hatak, 2020; Donthu and Gustafsson, 2020; Kirk and Rifkin, 2020; Pantano et al., 2020; Sharma et al., 2020). Financial institutions such as banks have suffered from an immediate exogenous shock, which requires them to be prepared for extremely difficult and diverse future challenges. The spread of this turmoil has already affected banking activities in many countries, and it has triggered precautionary reactions on the part of the depositors (e.g., withdrawal rates) and counterparties of financial intermediaries (e.g., reducing market funding) (Barua, 2020; Baldwin and di Mauro, 2020; Sharma et al., 2020). At the same time, there was an operational impact of maintaining cost-efficient financial operations, profitability, and meeting capital requirements, and hence, the banking services have been running in the midst of the pandemic. Beside these challenges, there are high expectations that banks should not only withstand the shock, which is clearly not endogenous to the financial system, but also become an active part of the wide economic solution, supporting governmental efforts against the recessive factors brought upon the real economy by the pandemic risk. While non-financial institutions have taken over a large share of corporate financing over the past decade, particularly for highly leveraged firms, banks remain the main source of liquidity insurance for economies (González, 2016; Barattieri, Eden and Stevanovic, 2020). Indeed, during this Covid-19 turmoil, major concerns have arisen regarding the resilience of the banking sector with regard to continuing to perform its expected intermediation role (Beck, 2020; Cecchetti and Schoenholtz, 2020).

According to IMF projections, a substantial global recovery in 2021 (5.8%) is subject not only to a continuation of the current extraordinary policy support, but also to the adequate renegotiation of loans granted by banks to households and firms, while maintaining a transparent assessment of credit risk (IMF, 2020). More generally, all financial institutions should be able to actively serve their economies while preserving the stability and robustness of the financial system.

Considerable uncertainty remains regarding the duration and magnitude of the government measures of confinement, and the extent to which they may be implemented in a similar manner across countries, and whether this will have differential cross-country implications for the banking industry (Weill, 2009; Kizys, Paltalidis and Vergos, 2016; Uribe, Chuliá and Guillén, 2017). Even though many lockdown measures were gradually eased during June/July, the extent of any subsequent recovery effect on banking stability will depend on the effectiveness of the policy actions taken to support the global banking industry through the downturn, and the extent to which public confidence in the industry returns.

To date, no empirical work has investigated the effect of the Covid-19 pandemic on the financial performance and financial stability of banks. This paper attempts to identify the likely economic implications of the Covid-19 outbreak on the banking industry in a comprehensive manner, offering systemic analyses for different regions (i.e. across countries). The purpose of this paper is not only to present a quantitative examination of what occurred during the turmoil, but also to deliver a comprehensive and indicative overview of the observed and the possible impacts that could emerge in the coming days. Moreover, the study takes a further step in additionally examining and distinguishing between different banking business models (i.e. Islamic¹ and conventional banks) to identify whether institutional characteristics and business orientation could have differential implications for bank stability during this pandemic period. To the best of our knowledge, empirical evidence on the impact of this pandemic with regard to the two bank types is also meagre.

At this stage of the coronavirus crisis, it is impossible to determine whether the effects of the lockdown will turn out to be even worse than any of the predictions suggested, and whether we will see a V-shaped, U-shaped or L-shaped recovery in the economy. However, in this study, we have used a wide set of alternative measures that represent: (i) accounting-based, (ii) market-based, and (iii) risk-based indicators, before and during the pandemic. In particular, for a sample of 6540 bank-year observations (1090 banks) in 116 countries across the period of the first quarter of 2019 to the second quarter of 2020, we find that the Covid-19 outbreak significantly reduced bank profitability, cost efficiency, stock market valuations and financial stability (i.e. high-risk indicators including default risk, liquidity risk and asset risk). These results are consistently reported for different geographical regions and bank types (i.e., conventional and Islamic), and among countries showing different levels of income classification. Our additional analyses show that financial performance for US banks has been negatively (and severely) affected; however, we observe marginal evidence of low stock market valuations for these banks. The opposite is the case for Chinese banks, but both countries exhibited high asset risk. The UK and European banks, in addition to those of other countries, show significantly low bank stability across all measures during the outbreak. Moreover, we find significant differences between the two bank types. Islamic banks report a higher risk profile, but an enhanced profitability position and lower operational risk during the Covid-19 turmoil, when compared to their conventional counterparts. Furthermore, our preliminary results for average bank performance and financial stability by quarterly periods indicate that the performance and financial stability of banks appear to start recovering in the second quarter of 2020, when countries were exposed to the lockdown restrictions, which are currently being lifted, with economic activity resuming within many countries.

Since the first Covid-19 case was reported in December 2019, only a few academic studies have investigated the economics of the outbreak, and the impacts on stock markets. Some analytical briefs have been increasingly covered by news

¹ We refer to Islamic banking as those banks that follow Islamic Shari'ah principles in their business transactions. These banks operate on a banking model that prohibits usury, excessive uncertainty and speculation while encouraging risk and profit sharing between the bank and its depositors. Conventional banks refer to traditional commercial banks that operate on the interest basis (Elnahass et al., 2020a; Trinh et al., 2020a).

media and policy makers. Although an increasing amount of discussions have been represented by opinions, reviews, perspectives and blogs, contributed by experts and regulators, none of these claims have been empirically and thoroughly examined to identify the unique effect of the Covid-19 turmoil on banking stability.

In this study we were able to build a comprehensive global dataset, which utilises bank-level and macroeconomic data to produce useful quantitative estimates of the outbreak's current and future impacts on the banking industry, as well as different banking systems. Therefore, this is the first study about the impact of the Covid-19 pandemic on a bank's performance and financial stability, offering global evidence to further develop existing attempts (see, Sharif et al., 2020; Zhang et al., 2020; Ji et al., 2020; Salisu and Vo, 2020). Our findings contribute to the broad strands of literature on bank financial stability (e.g., Bitar et al., 2017; Kanas and Molyneux, 2018; Arnaboldi et al., 2020; Trinh et al., 2020a, 2020b). We are presenting the first study to comparatively assess and identify the pandemic's effect on different banking business models, such as conventional and Islamic banks. The latter are generally characterised as taking fewer risks and being more resilient to exogenous shocks (Elnahass et al., 2018). The presence of significant differences between the two bank types, with Islamic banks reporting high insolvency and asset risks, suggests that the constrained banking model of Islamic banking cannot survive such severe macroeconomic turmoil in general terms. Hence, this study adds to the sizeable stream of Islamic and conventional banking literature (e.g., Beck et al., 2013; Mollah et al., 2017; Abdelsalam et al., 2020; Elnahass et al., 2020a, 2020b).

The findings in this study provide valuable policy implications to regulators and market participants engaging with banking sectors across several regions and different banking systems. Our results show a persistent detrimental impact of the Covid-19 turmoil using various financial performance measures and risk indicators, regardless of banks' locations and irrespective of bank type. While policy makers and economists agree regarding a looming recession, and a possible depression across economies, the detrimental effects of this shock on bank stability for some countries could be pervasive, due to the serious disruption to global supply chains, a decline in demand for imported goods and services, and a marked decrease in international tourism and business travel. For example, large economies such as the G7 economies have already announced monetary and fiscal policy supportive measures for their financial industry and capital markets. Many countries have already taken, or are considering, several other measures, for example, quantitative easing, direct market interventions, and fiscal stimulus and bailout packages. However, for many other, less-developed countries, it is not feasible to apply such policies. Hence, survival in the current environment of Covid-19 turmoil for banks located within less-developed economies remains questionable. This study, hence, calls for coordinated responses to support the banking industry, which could be considered among countries located within the same region. A lack of coordination might affect different market participants, who could struggle to engage with their banks in the long term, and who might also lose public trust with regard to the whole intermediation system. The findings are also important to depositors in terms of choosing between Islamic and conventional banks during this stressful financial period, and to bank managers seeking to identify the key drivers of bank financial stability.

The next section presents the background and outlines the hypotheses. Section 3 presents the data and sample construction. Section 4 outlines the methodology and measures. Sections 5 and 6 report empirical results and additional tests. Section 7 reports robustness checks and Section 8 concludes the study.

2. Background and hypotheses development

2.1. Covid-19: The turmoil and shadow

Although it might seem early to quantify the seriousness of the adverse economic consequences of the Covid-19 outbreak, it is pertinent, due to the harm being caused through direct and indirect economic impacts across several countries and many industries. According to Eichengreen (2020), the economic implications of this pandemic have been broadly labelled as 'Corononomics'. The whole world entered into a 'macroeconomic flu' (Baldwin and di Mauro, 2020), a temporary negative supply and demand shock – causing output to fall temporarily, followed by a quick recovery, and possibly a full catch-up on the shortfall. However, under the Covid-19 outbreak, this macroeconomic flu is showing persistence, and severe symptoms for many economies.

Furthermore, the Covid-19 pandemic has forced a sudden 'de-globalization' process through the lockdown of borders among many countries, which has adversely affected the flow of capital, trades, and movement across borders. For 2020/21, the IMF is predicting that the global economy will shrink by 3%, the developed economies will shrink by 6.1%, and the economies of the Euro area will shrink by 7.5% (IMF, 2020). The level of unemployment provides another picture of the depths of this turmoil and its speed. Fernandes (2020) stated that estimated GDP growth could decline by 3–5%, depending on the country, with a cost of about 2–2.5% of global GDP growth for each additional month of shutdown. If the lockdown and restrictive social distancing measures remain for much longer, countries such as Greece and Spain (and others that are largely reliant on tourism) will be more affected by this crisis. The economic effects of the pandemic are currently being underestimated, due to the over-reliance on historical comparisons with SARS and/or the global financial crisis (GFC) of 2007–2009.

The effect of this Covid-19 turmoil is different compared to the primary cause of the GFC. Importantly, the financial distress and negative macroeconomic implications did not originate in the banking sector, as was the case for the GFC. Before the GFC, the banking industry was over-leveraged, and suffering from procyclicality in lending, due to poor underwriting

decisions in the housing sector, while the household sector was over-leveraged, too (Elnahass et al., 2018). Under this pandemic, the virus and the drastic social distancing and quarantine measures that governments have been required to implement have contributed to immediate impacts on the real economy, leading to the simultaneous occurrence of both demand and supply shocks. Although debt repayments will be due, liquidity appears to be challenging for both small and large companies, as economic activity and business models have ground to a virtual halt. Despite better capitalization and liquidity positions relative to pre-GFC, the banking sectors of many developed economies have already been severely under pressure of collapse.

Alongside the increased unemployment, and consequences for tourism and medical health costs, the Covid-19 pandemic is producing massive waves of economic cost burdens for all nations, including the G7 countries (i.e. China, the US, Japan, Germany, Britain, France and Italy). Baldwin and di Munro (2020) indicated that the G7 countries share approximately 60% of world supply and demand GDP, and 65% of world manufacturing. Hence, when they sneeze, the rest of the world will catch a cold, because these economies are now severely affected; therefore, the entire global economy will also be affected.

McKibbin and Fernando (2020) developed seven pandemic scenarios by using Dynamic Stochastic General Equilibrium and showed that under all scenarios GDP growth declines across economies globally, and, as the Covid-19 turmoil continues, the cost in terms of lost economic output begins to escalate into trillions of dollars. According to Boone (2020) at the Organization for Economic Cooperation and Development (OECD), economic growth declined sharply in the first half of 2020, and then recovered modestly. Arezki and Nguyen (2020) explored four channels of the outbreak having an impact on the North Africa and Middle East region. These channels include disruptions in oil price, the value chain, and tourism and travel. Cochrane (2020) argued that a detailed pandemic-induced financial crisis plan with targeted bailout packages should be introduced by governments and regulators as soon as possible to respond to bankruptcies and insolvencies.

Central banks across the globe have moved emphatically to preserve financial stability through international cooperation. In Europe, for example, the European Commission Bank (ECB) developed a set of monetary policy measures to mitigate the impact of the coronavirus pandemic on the Eurozone economy, and launched its €750 billion pandemic emergency purchase programme (PEPP), which aims to lower borrowing costs and increase lending in the Eurozone (Weill, 2009). Moreover, the ECB has further eased the conditions of the targeted longer-term refinancing operations (TLTRO III) and launched a series of new pandemic emergency longer-term refinancing operations (PELTROs) to follow the longer-term refinancing operations (LTROs) conducted since March. All three categories of refinancing operation aim to provide further liquidity to banks and the real economy. Finally, the ECB has increased the amount of money that banks can borrow by easing collateral standards, thereby expanding the list of assets that banks can use as collateral, and by reducing the haircut on collateral accepted. Additionally, European banking supervision has granted more flexibility in the application of the unlikely-to-pay classification for borrowers who are recipients of ad hoc governmental guarantees, or for whom moratoria have been enacted. Furthermore, loans that have government guarantees and turn non-performing will receive more favorable treatment in terms of coverage requirements. European banking supervision is also giving banks more flexibility regarding supervisory timelines, deadlines and procedures. All these measures will help Eurozone banks to focus on playing their vital role as lenders during this extraordinary period. Over 100 countries have already applied for emergency financial aid.² The World Bank focuses largely on providing aid to Africa and developing countries elsewhere and has currently made a maximum of USD 160 billion available (World Bank, 2020).

2.2. Covid-19 and financial stability

Financial markets globally responded negatively to the Covid-19 turmoil. For example, SandP 500, Dow Jones, Russell 2000, Nasdaq Composite, the FTSE 100, and the Nikkei 225 fell about 30–40% by the end of March from their January values (The New York Times, 2020). The Covid-19 crisis has had peculiar effects on many banks worldwide, and multiple impacts on the capital markets side.

Financial institutions are likely to be vulnerable to shocks in terms of both the international and domestic economic systems (Fu et al., 2014; Montgomery, Harimaya and Takahashi, 2014; Wang, Xie, Zhao and Jiang, 2018; Safiullah and Shamsuddin, 2019; Kwabi et al., 2020). Therefore, banks are currently at great risk due to the effects of Covid-19. The unfolding events associated with the Covid-19 virus tend to subject the liquidity insurance function of banks, for many economies, to a real-life test. For example, banks globally might face increased credit and default risk due to cash management and insolvency issues to servicing debt, as a result of many business closures, lockdowns, and lower demand for goods and services both during the pandemic and post-pandemic. Furthermore, the extent of banking lending could be lower, as private sector investment and consumption continue to decline, and may not improve either during the pandemic or after it is over. Many lending or investment decisions are put on hold these days, while the cost of financing may increase due to saving erosion or the lower availability of money to people during this turmoil. Beck (2020) indicated that the effect of the Covid-19 outbreak would depend on three factors – the extent of the pandemic's economic effects globally, the fiscal and monetary policy reactions to the shocks, and regulatory reactions addressing possible bank fragility. Moreover, Cecchetti and Schoenholtz (2020)

² See Kristalina Georgieva, 'Confronting the Crisis: Priorities for the Global Economy' IMF Speech (10 July 2020): www.imf.org/en/News/Articles/2020/04/07/sp040920-SMs2020-Curtain-

stated that banks' business models are highly vulnerable to economic shocks, hence their failure during this pandemic would lead to a wide economic shock.

Proponents of resource dependence theory have argued that, in order for corporations to survive, they need resources from the external environment, as these corporations cannot be entirely reliant on themselves in operating capacity, and the resources are required to add value to the corporation (Pfeffer, 1972; Pfeffer and Salancik, 1978). However, during this pandemic, accessing external market sources has become difficult. While many central banks and public authorities responded proactively to this crisis in order to attempt to support the resilience of the banking industry (e.g. reducing the policy rate to increase liquidity to tackle the impacts), the lockdown measures and consequences have created increased concern for bank stability. These are priority measures that are imposed by a sanitary situation, which leave little room for other options, as health remains the primary concern for many countries. These unprecedented imposed measures by governments have led to many businesses being shut down temporarily or permanently, financial markets in turmoil, an erosion of public confidence in the economic systems, and heightened uncertainty (Tan and Floros, 2013).

Even with such regulatory attempts to rescue banks, we conjecture that bank stability would be likely to be adversely affected during the pandemic, given the high risk-taking attitude of banks and low financial performance. Several prior studies have suggested that the 'bailout-expectation' encourages risk-taking (see, Gropp et al., 2011; Feng et al., 2019), and induces a moral hazard both at the bank level (Mailath and Mester, 1994) and at the aggregate systemic level. According to Duchin and Sosyura (2014), bailed-out banks show excessive risk-taking profiles, as their managers have further guarantees should they fail.

In a rapidly changing environment, it seems challenging to quantify the exact magnitude of the impact of these measures on bank stability but is clear that they imply sharp contractions of financial performance and bank risk. Accordingly, and by considering the above observations, we expect that the Covid-19 turmoil would be more likely to reduce financial performance and increase bank risk-taking. This leads to our main study's hypothesis, stated in alternative forms:

H_{01} : The Covid-19 pandemic features low bank financial performance and high risk-taking.

3. Data and sample construction

Our sample includes 1090 listed banks (1018 Conventional and 72 Islamic banks) across 116 countries worldwide covering data for six quarters from first quarter 2019 to the second quarter of 2020. This generates a panel sample of 6540 bank-quarter observations (6108 Conventional banks-quarter observations and 432 Islamic banks-quarter observations). We consider the four quarters of 2019 as the pre-Covid-19 period and hence, the first two quarters of 2020 represent the period of Covid-19. The quarterly frequency data is preferred because of two reasons: (1) daily and monthly data is not available for accounting and financial data; (2) Covid-19 period covers only 6 months (or, 2 quarters), thereby, our frequency was driven by the availability of the recent data in 2020. We compiled two data sources, i.e., BankScope and DataStream to collect all our financial, accounting and market data. Country-level variables such as Gross Domestic Products (GDP) per capita and Country Governance Index are retrieved from World Bank. Appendix A shows the final sample distributions for the whole sample period by regions and countries. We classified 116 countries into five different regions: Asia (19 countries); Middle East, North Africa, and Greater Arabia (21 countries); Europe (34 countries); America and the Caribbean (17 countries); and other parts of the world (25 countries).

4. Methodology and model

We construct an empirical model to investigate the evident impacts of Covid-19 pandemic on the accounting-based and market-based performance, and financial stability of banks in a global basis. Thus, a generic specification for our panel data regression models are specified as follows:

$$Perf_{it} = \alpha + \beta Covid19_t + \lambda Islamic_t + \delta \emptyset + \varepsilon \quad (1)$$

$$Risk_{it} = \alpha + \beta Covid19_t + \lambda Islamic_t + \delta \emptyset + \varepsilon \quad (2)$$

where:

$Perf_{it}$ represents the accounting-based performance and the market-based performance measures. The accounting-based performance indicators represents return on assets (ROA), return on equity (ROE), return on average assets (ROAA), return on average equity (ROAE), and cost to income (*Cost/Income*) (Mollah and Zaman, 2015; Trinh et al., 2020a). The higher the value of ROA, ROE, ROAA and ROAE, the more profitable the bank is. Also, a higher *Cost/Income* ratio suggests lower bank cost efficiency (Abdelsalam et al., 2020). The market-based performance measures comprise the natural logarithm of Tobin Q (LnQ) calculated by the sum of a bank total debt and market value of equity, divided by its book value of total assets (the market value of equity is computed as the number of outstanding shares multiplied by the stock prices), market to book value (MV/BV), and the natural logarithm of market capitalisation ($LogMV$) (Elnahass et al., 2020a). The higher values of these variables imply higher market valuation for banks.

$Risk_{it}$ represents several types of bank risks; (i) default risk measured by the natural logarithm of Z-score ($LogZScore$); (ii) credit risk estimated by the non-performing loan to loan ($NP/Loan$); (iii) liquidity risk proxied by the deposits and short-term

funding (LA/DSF); (iv) operational risk measured by the three-year rolling standard deviation of ROA ($SDROA$); (v) and asset risk estimated by ROA divided by the standard deviation of ROA ($ROA/SDROA$). Higher values of $LogZScore$, of LA/DSF , of $ROA/SDROA$ imply lower risks, while higher values of $NP/Loan$ and of $SDROA$ suggest higher bank risks. All these common risk indicators represent the overall financial stability of the banking sector (Trinh et al., 2020a).

Both models (1) and (2) include $Covid-19_t$ representing the dummy variable which takes the value of one if the bank is observed during the Covid-19 period (The first two quarters of 2020) and zero otherwise; $Islamic_t$, representing the dummy variable which takes the value of one if the observed bank is classified as Islamic banks and zero if it is classified as conventional banks.

Furthermore, we include a comprehensive set of control variables which potentially affect bank performance and financial stability (Mollah and Zaman, 2015; Mollah et al., 2017; Trinh et al., 2020a; Elnahass et al., 2020a, 2020b). These control factors include bank size ($LogTA$) computed by the natural logarithm of total assets of a bank at the end of the year; bank age ($LogAge$) which is the natural logarithm of the difference between the sample year and the year of a bank's first appearance; financial leverage ($Debt/TA$) measured by total debt scaled by total assets; auditing firms ($Big4$) denoting one if the bank is audited by Big4 company and zero otherwise. We also include macro-economic indicator such as GDP per capita ($LogGDP/capita$) measured by the natural logarithm of gross domestic products per capita. Furthermore, we capture cross-country variations in governance perceptions for our sample by developing a country governance index ($Country_Gov$) which is estimated by the average value of six key country-governance measures consisting of corruption, government effectiveness, political stability, and regulatory quality, the rule of law, and voice and accountability. This variable is widely used in previous studies such as Čihák and Hesse (2010), Elnahass et al. (2020a) and Trinh et al. (2020a, 2020b). Finally, for market-based performance models, we add two additional variables capturing for the bank's liquidity position ($Cash/TA$) measured by the ratio of cash to total assets and for the bank's growth opportunities ($Capex/TA$) estimated by the ratio of capital expenditures to assets.

We winsorise all variables used in our models. See Appendix B for variables' definitions and measurements.

5. Descriptive statistics

Table 1 presents the descriptive statistics for our full sample of global banking sector before and during the outbreak of Covid-19. Overall, the performance and financial stability of the banking sector appears to severely suffer from the adverse impacts of the pandemic. Our preliminary results indicate that the first two quarters of 2020 have witnessed the global banking industry reporting apparently deteriorating financial performance based on both accounting- and market-based performance indicators. Specifically, the means for the ratios of ROA and ROE slump from 1.548% to 0.357%, and from 9.455% to 2.711%, respectively; and the cost efficiency of banking sector also declines as indicated by the increased mean for the ratio of cost to income ($Cost/Income$). In addition, the market valuation of global banking sector shrinks, which is mirrored by the deteriorations of forward-looking approximation of firm value (lower lnQ), market capitalisation (lower $LogMV$), and the ratio of market value relative to book value (lower MV/BV). These findings are evident by our significant two-sample t -test. Taken together, our descriptive statistics initially demonstrate a significantly poorer financial performance and lower cost efficiency for global banking sector after the eruption of Covid-19.

In addition to the deteriorating financial performance, our descriptive findings also reveal the weakening capacity of the banking industry to mitigate financial risks and hence sustain financial stability in the face of Covid-19 crisis. The two-sample t -tests results show that owing to the global pandemic the banking sector is confronted with higher insolvency risk (as reflected by a lower mean $LogZscore$) and higher asset risk (a lower mean $ROA/SDROA$). Yet credit risk is found to be relatively lower for the Covid-19 period in comparison with the prior crisis. This is confirmed by the significant t -test coefficient.

As for the control variables, the global banking sector shows an evident drop in the value of total assets and capital expenditures after the pandemic outbreak in the first quarter of 2020, with the mean $LogTA$ significantly decreasing from 6.936 to 4.161 and that of $Capex/TA$ reducing from 0.204 to 0.092, respectively. This significant depreciation of total assets for the banks might be able to explain why $ROAA$ and $ROAE$ slightly increase after the crisis outbreaks. In addition, the financial leverage of the banking industry raises as the average proportion of debt relative to total assets ($Debt/TA$ ratio) increases from 16% to 76% within two quarters after the outbreak of Covid-19. Moreover, our finding indicates that 48% of our sampled banks are audited by the big four auditing firms ($Big4$). The average GDP *per capita* across our sampled countries is 3.362, ranging from 2.428 to 4.213; and the country governance capability scores range from -1.077 to 1.522, with an average of 0.053.

Table 2 presents the correlation matrix of all independent variables for our full sample of global banks illustrated in Table 1. The results exhibit accepted correlation coefficients (less than 0.8), which alleviates major concerns for multicollinearity.

6. Empirical findings

Table 3 presents the ordinary least square (OLS) estimations with robust standard errors examining the potential effects of the Covid-19 pandemic on bank financial performance, including accounting-based performance (Panel A), market-based

Table 1
Descriptive Statistics.

stats	N	mean	p50	sd	min	max	skewness	kurtosis	Pre-Covid Mean	Covid Mean	Two-Sample T-Test (two-tailed)
ROA	2725	1.264	1.030	1.171	-0.183	4.430	1.175	3.897	1.548	0.357	36.090***
ROE	3519	8.069	7.350	6.924	-3.878	22.860	0.420	2.473	9.455	2.711	37.319***
ROAA	3316	1.153	0.984	1.122	-1.003	3.935	0.606	3.535	1.125	1.176	-1.32
ROAE	3310	9.426	9.337	7.158	-4.405	24.477	0.152	2.658	9.238	9.581	-1.373
Cost/Income	3300	58.088	56.069	19.671	26.512	101.561	0.451	2.589	57.365	58.683	-1.91**
LnQ	2910	-1.075	-0.935	0.583	-2.659	-0.361	-1.207	4.004	-1.067	-1.353	4.533***
MV/BV	4757	0.975	0.780	0.664	0.220	2.770	1.267	4.012	1.000	0.924	3.712***
LogMV	5152	6.186	6.079	2.057	2.588	10.091	0.155	2.216	6.225	6.111	1.875**
LogZscore	1749	1.103	1.355	0.829	-0.749	2.348	-0.948	2.983	1.467	-0.001	38.758***
NP/Loan	1695	4.719	2.910	4.718	0.530	18.720	1.736	5.347	4.724	1.833	10.370***
LA/DSF	3176	29.127	24.009	20.026	5.677	82.486	1.212	3.864	29.322	28.968	0.495
SDROA	3366	0.453	0.335	0.513	0	2.009	1.586	5.287	0.453	0.453	0
ROA/SDROA	1798	2.125	2.592	1.009	0.091	3.312	-0.928	2.340	2.580	0.839	40.930***
Covid-19	6534	0.333	0	0.471	0	1	0.707	1.500	-	-	-
Islamic	6534	0.070	0	0.255	0	1	3.377	12.404	-	-	-
LogTA	3573	6.370	6.721	1.534	2.823	8.465	-0.911	3.023	6.936	4.161	48.505***
LogAge	6534	1.540	1.477	0.336	0.954	2.130	0.088	2.033	-	-	-
Debt/TA	3505	0.285	0.156	0.303	0.008	0.910	1.161	2.836	0.162	0.756	-56.179***
Big4	6534	0.478	0	0.500	0	1	0.086	1.007	-	-	-
Cash/TA	2917	0.102	0.077	0.085	0.012	0.340	1.474	4.519	0.102	0.103	-0.185
Capex/TA	2433	0.200	0.130	0.198	0.020	0.760	1.545	4.617	0.204	0.092	7.410***
LogGDP/capita	6456	3.362	3.354	0.565	2.428	4.213	0.017	1.811	-	-	-
Country_Gov	6516	0.053	-0.193	0.824	-1.077	1.522	0.526	1.928	-	-	-

This table reports descriptive analyses of all variables employed in our empirical models.

Table 2
Correlation matrix.

	Covid-19	Islamic	LogTA	LogAge	Debt/TA	Big4	Cash/TA	Capex/TA	LogGDP/capita	Country_Gov
Covid-19	1									
Islamic	0.000	1								
LogTA	-0.729*	-0.023	1							
LogAge	-0.010	0.005	-0.018	1						
Debt/TA	0.696*	-0.009	-0.674*	0.009	1					
Big4	0.000	-0.038*	0.205*	-0.020	-0.018	1				
Cash/TA	0.003	0.034	-0.261*	-0.065*	-0.160*	-0.065*	1			
Capex/TA	-0.104*	0.072*	-0.328*	-0.015	0.027	-0.002	0.236*	1		
LogGDP/capita	0.000	0.031*	0.031	-0.006	0.009	0.003	-0.024	0.001	1	
Country_Gov	0.000	0.018	0.036*	-0.006	-0.006	-0.006	-0.010	-0.004	0.639*	1

This table reports Pearson correlation matrix of all independent variables employed in our empirical models.

performance (Panel B), and financial stability including risk indicators (Panel C). In general terms, our findings suggest a significantly adverse impact, caused by the outbreak of the Covid-19 pandemic, upon the overall operations of banking systems.

Panel A demonstrates that the coefficients of Covid-19 are significantly and negatively associated with all four variables measuring bank financial performance (*ROA*, *ROE*, *ROAA* and *ROAE*). This suggests that the eruption of Covid-19 has significantly reduced the profitability of banking firms. Economically, bank profits dropped by approximately 2.8% (6.2%, 0.3%, 1.6%) for *ROA* (*ROE*, *ROAA*, *ROAE*, respectively) during the pandemic period in comparison with pre-crisis. However, we find that Covid-19 has had an insignificant effect on bank cost efficiency as measured by the *Cost/Income* ratio.

Turning to the control variables, we generally find that the coefficients of total assets (*LogTA*) are significantly and negatively (positively) associated with *ROA* (*ROE* and *Cost/Income*) for the global banking sector. This implies that larger banks have lower *ROA* and cost efficiency, but higher *ROA* than their smaller peers. This might be due to the high value of the total assets of larger banks in terms of debt capital and other non-equity assets. Similarly, bank age (*LogAge*) also has a significantly negative impact on *ROAA* and *ROAE*, while it positively affects *Cost/Income*. We learned from these findings that older banks are likely to exhibit lower profitability and lower cost efficiency than their young counterparts. Furthermore, the coefficients of the banks' leverage (*Debt/TA*) and the auditing service provided by *Big4* accounting firms are significantly and positively related to the core indicators of banks' profitability, but we found insignificant evidence of the relationships between these two factors (i.e. *Debt/TA* and *Big4*) and the *Cost/Income* ratios. With respect to the country-level variables, during the first two quarters after the Covid-19 outbreak, *GDP* per capita (i.e. *LogGDP/capita*) shows a significantly positive relationship with both the level of profitability and cost efficiency for banking, whereas the country governance capability barely affects

Table 3
Global Analysis: Effects of Covid-19 Pandemic on Bank Performance and Financial Stability.

VARIABLES	Panel A: Accounting-based Performance					Panel B: Market-based Performance			Panel C: Risk Indicators				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-2.806*** (0.000)	-6.196*** (0.000)	-0.266*** (0.006)	-1.559** (0.015)	2.088 (0.251)	-0.148*** (0.005)	-0.320*** (0.000)	-0.742*** (0.000)	-0.753*** (0.000)	-1.977*** (0.004)	-1.616 (0.389)	-0.098 (0.277)	-1.160*** (0.000)
Islamic	-0.177** (0.024)	0.143 (0.784)	-0.179 (0.157)	-0.622 (0.457)	0.081 (0.970)	-0.039 (0.204)	0.294*** (0.000)	0.310*** (0.000)	-0.054 (0.278)	-0.205 (0.614)	-6.712*** (0.001)	-0.042 (0.287)	-0.050 (0.441)
LogTA	-0.274*** (0.000)	0.464*** (0.000)	-0.034 (0.202)	-0.225 (0.190)	0.776* (0.098)	0.107*** (0.000)	0.005 (0.788)	1.943*** (0.000)	0.005 (0.766)	-2.154*** (0.000)	-0.302 (0.554)	-0.045*** (0.000)	0.026 (0.253)
LogAge	0.043 (0.470)	-0.152 (0.631)	-0.287*** (0.000)	-0.869* (0.096)	4.936*** (0.001)	0.035* (0.066)	-0.084** (0.025)	0.093 (0.102)	-0.046 (0.223)	0.349 (0.300)	-5.012*** (0.001)	0.051* (0.076)	-0.014 (0.760)
Debt/TA	1.136*** (0.000)	1.492** (0.011)	0.299** (0.041)	2.214** (0.017)	0.355 (0.890)	2.637*** (0.000)	0.165* (0.075)	0.627*** (0.000)	-1.077*** (0.000)	-0.685 (0.448)	0.316 (0.909)	0.199* (0.051)	-0.779*** (0.000)
Big4	0.083* (0.060)	1.250*** (0.000)	0.083 (0.152)	0.525 (0.158)	-1.253 (0.220)	0.021 (0.146)	0.082*** (0.003)	0.168*** (0.000)	-0.099*** (0.000)	0.648*** (0.008)	0.365 (0.738)	-0.058*** (0.008)	-0.129*** (0.000)
Cash/TA						-0.327*** (0.004)	-0.209 (0.283)	0.585** (0.033)					
Capex/TA						0.258*** (0.000)	0.555*** (0.000)	0.929*** (0.000)					
LogGDP/capita	0.153** (0.015)	1.475*** (0.000)	-0.071 (0.410)	-0.704 (0.205)	3.521** (0.020)	0.037* (0.095)	-0.058 (0.162)	-0.104* (0.093)	0.066* (0.094)	0.638* (0.085)	-1.402 (0.402)	-0.014 (0.677)	0.250*** (0.000)
Country_Gov	-0.057 (0.200)	-0.202 (0.403)	0.105* (0.088)	0.638 (0.106)	-2.549** (0.014)	-0.020 (0.173)	0.101*** (0.000)	0.161*** (0.000)	-0.031 (0.302)	-1.031*** (0.000)	2.089* (0.065)	-0.002 (0.925)	-0.108*** (0.001)
Constant	2.645*** (0.000)	0.588 (0.683)	1.967*** (0.000)	13.827*** (0.000)	34.427*** (0.000)	-2.411*** (0.000)	1.099*** (0.000)	-7.184*** (0.000)	1.548*** (0.000)	17.617*** (0.000)	44.662*** (0.000)	0.725*** (0.000)	1.810*** (0.000)
Observations	2,663	3,368	1,578	1,576	1,568	2,329	2,297	2,308	1,711	1,661	1,499	2,408	1,757
R-squared	0.257	0.189	0.018	0.012	0.014	0.611	0.072	0.733	0.629	0.121	0.017	0.037	0.598

This table reports OLS regression results for the effects of Covid-19 pandemic on bank performance and risks for the full sample. Panel A presents results for accounting-based performance (ROA, ROE, ROAA, ROAE and Cost/Income); Panel B presents results for market-based performance (LnQ; MV/BV; LogMV), and Panel C reports results for risk indicators (LogZscore; NP/Loan; LA/DSF; SDROA: ROA/SDROA). Robust standard errors are used to capture heteroscedasticity. P-values are reported in parentheses. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in appendix B.

banks' profitability and shows a significantly negative relationship with the cost efficiency ratios (*Cost/Income*) for banks throughout the world.

In Panel B of [Table 3](#), our results regarding market-based performance show that the Covid-19 outbreak has significantly reduced bank market valuations, as evidenced by a significantly negative relationship between the Covid-19 variable and all three alternative measures for market-related performance (i.e., *LnQ*, *MV/BV* and *LogMV*). Economically, the Covid-19 pandemic has resulted in a reduction in market value by 0.15% for *LnQ*, 0.32% for *MV/BV*, and 0.7% for *LogMV*.

For the control variables, we find that the coefficients of both bank size (*LogTA*) and age (*LogAge*) are significantly and positively associated with *LnQ*. The results imply that the bigger and older banks may be expected to have higher forward-looking market valuation. However, we find that, while larger banks exhibit higher current market value, older banks show the opposite result. Furthermore, we also find that the coefficients of both bank leverage (*Debt/TA*) and growth opportunity (*Capex/TA*) are significantly positive across all market valuation models. The results indicate that the adverse impact of the external shock might be buffered by appropriate debt-to-equity structure and continued *RandD* activities, which are positively valued by investors. We further find that, if a bank is audited by a *Big4* company, it tends to have higher market value, as evidenced by the significantly positive relationships between the *Big4* and both *MV* and *LogMV*. The liquidity position (*Cash/TA*) of banks has been found to be significantly and negatively associated with market valuations proxied by the forward-looking measure (*LnQ*), yet the opposite result is the case for current market valuation, which is *LogMV*. This implies that banks' holding of more cash relative to total assets tends to affect their forward-looking (current) market valuations negatively (positively). Moreover, our results pertaining to country-level indicators prove that banks operating in countries with higher GDP per capita tend to have higher forward-looking market valuation (*LnQ*), but lower current market value (*LogMV*) in the aftermath of the crisis. In addition, country governance shows a significantly positive relationship with the existing market values (*MV/BV* and *LogMV*), because investors might give more credits to and show more confidence in banks operating in better-governed jurisdictions.

Regarding the investigations into bank financial stability in Panel C, our findings reveal that our sampled banks, on average, encountered a substantial increase in bank risks, which adversely affected their financial stability during the outbreak of the Covid-19 pandemic. In particular, the coefficients of *Covid-19* are significantly and negatively associated with *LogZscore* (i.e. higher insolvency risk), *NP/Loan* (i.e. lower credit risk) and *ROA/SDROA* (i.e. higher asset risk). This implies that banks experienced higher default and asset risk, showing low financial stability during this turmoil. In contrast, the significantly low credit risk for our sampled banks can be justified by the fact that banks had to apply rigorous credit policies and follow restrictive regulatory requirements throughout this outbreak to preserve sound capital and liquidity positions. In many countries, banks reduced the number of approved credit applications, and reduced overdraft limits for their customers (Beck et al., 2020). In addition, with several ongoing government bailouts and emergency financial aid packages, banks located in many regions have managed to preserve high asset quality (i.e. lower credit risk).

For the control variables, the coefficient of *LogTA* is negatively and significantly related to *NP/Loan* and *SDROA*, which means that larger banks measured by the value of total assets have lower credit risk (*NP/Loan*), but higher operational risk (*SDROA*) after the pandemic outbreak. However, our results indicate that banks' liquidity (*LA/DSF*) and operational (*SDROA*) risks have significantly increased as a function of bank age (*LogAge*). In addition, highly leveraged banks are subjected to more heightened default risk, asset risk and operational risk, which is reflected by the evidence that the coefficient of *Debt/TA* is significantly and negatively associated with *LogZscore*, *SDROA* and *ROA/SDROA*. The involvement of the *Big4* auditing firms also raises financial risks (higher insolvency, credit and asset risks) for banks, because the coefficients of the *Big4* are significantly and positively associated with *NP/Loan*, and negatively related to *LogZscore* and *SDROA*. Our results are consistent with the findings of [Trinh et al. \(2020a\)](#), which show an adverse effect of the *Big4* on bank financial stability. However, the *Big4* firms appear to help banks to avoid operational risks to a significant level. Finally, the results concerning country-level variables suggest that economic prosperity prevents banks from suffering from insolvency risk, credit risk and asset risk, reflected by the positive signs of the coefficients of *LogGDP/capita* on *LogZscore*, *NP/Loan* and *ROA/SDROA*. With respect to the average country governance, *Country_Gov* is significantly and negatively associated with *NP/Loan* and *ROA/SDROA*, but positively related to *LA/DSF*. Therefore, in countries possessing better overall governance, banks appear to hold stronger ability to tackle both credit and liquidity risks but have limited capacity in asset risk mitigation.

Taken together, our results show that, on average, the Covid-19 period has significantly harmed bank financial stability, financial performance and stock market valuations. These findings support our main study's hypothesis, *H01*, showing that the Covid-19 turmoil is more likely to reduce financial performance and increase bank risk-taking. Our findings also confirm our expectation that banks tend to be vulnerable to exogenous shocks related to both the international and domestic economic systems, due to their lack of resources (e.g. being unable to access external market sources), and thereby, their stability has been weakened during the Covid-19 outbreak. In addition, the existing government bailout attempts tend to promote high risk-taking (see, [Gropp et al., 2011](#); [Feng et al., 2019](#)) and induce moral hazard both at the bank level ([Mailath and Mester, 1994](#)) and at the aggregate systemic level. Hence, our findings are in line with those of [Cecchetti and Schoenholtz \(2020\)](#), who stated that bank failure during this pandemic would lead to a wide economic shock.

By conducting a trend analysis of average performance and risk measures (see Appendix C), we find an early signal of stability recovery. Indeed, accounting-based performance (i.e. *ROA*, *ROE*; *Cost/Income*) and forward-looking market valuation (*LnQ*) appear to have improved during the second quarter of 2020. Similarly, some risk measures (i.e. *LogZscore*; *NP/Loan*; *LA/DSF*) seem also to have been mitigated during this second quarter of 2020, compared to the previous quarter(s). However, we still observed a reduction in current market value (i.e., *MV/BV* and *LogMV*), and an increase in other risk indicators. Although

this recovery signal of global banking stability is still weak, and we also understand that it is too early to conclude the complete recovery of the banking sector, our trend analysis findings partly confirm the initial successes of lifting lockdown rules and restrictions, and increasing trading and economic activities (e.g., in China, Vietnam, the UK). More importantly, the signal may confirm the initial efficacy of policy responses and regulatory rescue plans from governments in promoting future stability for the banking industry worldwide. However, we warn that this is only a short-term effect, with the long-term effects on global banking still vague and uncertain. Therefore, the overall findings in this study provide timely empirical evidence for banking regulators, informing their development of future policies for the industry. The evidence presented in this section can also inform future investment plans and manage expectations for many other market participants and stakeholders regarding the Covid-19 pandemic.

7. Additional testing

7.1. Comparisons among different geographic regions

Table 4 (a, b, c) shows the impact of the Covid-19 pandemic on the financial performance and stability of banking systems across five major regions of the globe: Asia (Panel I), the Middle East, North Africa and Greater Arabia (Panel II), Europe (Panel III), America and the Caribbean (Panel IV), and other parts of the world (Panel V).

First and foremost, our results clarify the ubiquitously destructive impact of the outbreak of Covid-19 on the overall operations of the global banking industry, irrespective of the clustered region. The coefficients of Covid-19 are economically significant, as well as negatively associated with the profitability ratios (*ROA* and *ROE*) of banks across every region of the world. In addition, the results in Panel II show that this pandemic has led to a significant decrease in both *ROAE* and *ROAA* for banks in the Middle East, North Africa and Greater Arabia, as well as those of Europe (in Panel III). However, we consistently find insignificant evidence regarding the effect of Covid-19 on bank cost efficiency (i.e. *Cost/Income* ratio).

As for the stock market valuation indicators, our results show insignificant evidence on the impact of Covid-19 on prospective market value (*LnQ*) among different regions. We find strong evidence for other market valuation indicators, with significant and negative associations between Covid-19 and both ratios of market value (*LogMV*) and market value to book value (*MV/BV*) for our sampled banks across the five regions, implying that the pandemic has generated a destructive impact on the ongoing market value of global banking systems.

With respect to bank risk, our findings suggest that banks across the world have encountered substantial problems in their liquidity (i.e. high insolvency risk) and their operational risk, caused by the outbreak of Covid-19. These findings are represented by the significant and negative coefficients of Covid-19 under the *LogZscore* and *ROA/SDROA* estimates. However, we still observe significant and negative associations between Covid-19 and the *SDROA (NP/Loan)* ratio for banks located in Asia and the Middle East (North Africa and Greater Arabia) regions, respectively. This result provides primary evidence that Asian banks appear to have a strong ability to mitigate asset risk, while banks from the Middle East, North Africa and Greater Arabia have shown high asset quality compared to other regions over the first two quarters following the pandemic outbreak. These findings are attributable to the excessive bailout plans offered by local governments to support the banking sector during this crisis.

7.2. Tests for the US, China and other countries

Table 5 presents our extended analyses to further identify the Covid-19 implications for bank stability, particularly during the first two quarters of the outbreak for our sampled banks, which are located within some of the most highly infected countries, such as the US and China, compared to other areas such as the UK/Europe and others, which have been less severely affected by Covid-19.

In general terms, we have observed some variations in the detrimental impact of Covid-19 on the stability of US banks, and those of other countries, which are not consistently identified for the Chinese banks. For example, for the US banks, both the accounting-based and market-based performance measures show, consistently, the expected associations with the Covid-19 indicator, emphasising poor profitability positions during the outbreak. However, the Chinese banks show marginal evidence of the negative impact of Covid-19 on their return on equity (*ROE* ratios), but we find insignificant evidence from other accounting-based measures (i.e. *ROA* and *Cost/Income* ratios). However, the Chinese banks report significantly low market value during the Covid-19 outbreak, which is marginal for US banks. The two countries show a significant and negative association between Covid-19 and *ROA/SDROA*, suggesting high operational risk, but such an association is marginal for the Chinese banks, which implies that the US banks suffer from relatively higher asset risk than Chinese banks.³

For the UK/Europe and other parts of the world, our sample banks show significantly low financial performance (i.e. consistently poor profitability and low stock market valuations), high insolvency and high asset risk when compared to China and the US. While the results show that insolvency risk has been the dominant risk for all these countries during the pandemic, the insignificant coefficient of *LogZscore* for Chinese banks is evidential and suggests no major impact of this pandemic on banks' liquidity.

³ Due to the limited data availability for the Covid-19 periods, we are unable to test for credit risk for Chinese banks.

Table 4

Comparing Geography Regions: Effects of Covid-19 Pandemic on Bank Performance and Financial Stability.

Panel I: Asia													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-2.487*** (0.000)	-4.703*** (0.000)	-0.206 (0.223)	-1.658 (0.120)	1.793 (0.570)	-0.128 (0.100)	-0.385*** (0.003)	-0.923*** (0.000)	-0.702*** (0.000)	-0.751 (0.168)	-3.001 (0.254)	-0.318** (0.045)	-0.821*** (0.000)
Constant	2.355*** (0.000)	-1.609 (0.568)	2.806*** (0.000)	19.142*** (0.000)	15.078 (0.215)	-2.355*** (0.000)	2.584*** (0.000)	-5.726*** (0.000)	0.827** (0.026)	14.983*** (0.000)	48.349*** (0.000)	1.732*** (0.000)	0.473 (0.350)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	984	1,252	588	587	586	819	803	808	627	619	566	888	659
R-squared	0.252	0.187	0.022	0.016	0.026	0.653	0.126	0.720	0.625	0.196	0.018	0.092	0.563
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel II: Middle East, North Africa, and Greater Arabia													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-2.116*** (0.000)	-6.116*** (0.000)	-0.291 (0.116)	-2.369* (0.083)	1.505 (0.711)	-0.123 (0.181)	-0.231 (0.199)	-0.672*** (0.009)	-0.973*** (0.000)	-1.902*** (0.002)	5.503 (0.199)	0.283 (0.168)	-1.430*** (0.000)
Constant	3.383*** (0.000)	6.027* (0.079)	1.235* (0.094)	10.529** (0.048)	45.85*** (0.003)	-2.163*** (0.000)	0.549 (0.321)	-8.222*** (0.000)	0.038 (0.928)	28.024*** (0.000)	31.873** (0.030)	1.438*** (0.000)	1.136** (0.040)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	526	660	314	314	314	477	473	474	337	334	300	470	341
R-squared	0.227	0.173	0.047	0.036	0.038	0.639	0.102	0.693	0.619	0.161	0.076	0.102	0.595
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel III: Europe													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-3.057*** (0.000)	-6.376*** (0.000)	-0.456** (0.039)	-1.945 (0.171)	2.898 (0.399)	-0.068 (0.401)	-0.334*** (0.000)	-0.565*** (0.009)	-0.730*** (0.002)	-	-1.482 (0.710)	-0.087 (0.574)	-1.121*** (0.000)
Constant	4.799*** (0.000)	3.743 (0.300)	1.904** (0.037)	15.263** (0.011)	19.388 (0.174)	-1.940*** (0.000)	0.626 (0.249)	-7.168*** (0.000)	2.319*** (0.000)	4.015 (0.481)	15.274 (0.366)	-0.092 (0.761)	3.163*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	599	764	347	347	345	540	531	536	394	390	331	553	400
R-squared	0.325	0.256	0.045	0.061	0.069	0.629	0.095	0.758	0.636	0.108	0.063	0.141	0.645
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel IV: America and the Caribbean													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-3.325*** (0.000)	-7.513*** (0.000)	-0.348 (0.161)	-0.935 (0.589)	-0.523 (0.916)	-0.250 (0.219)	-0.280 (0.139)	-0.576* (0.096)	-0.762*** (0.003)	-0.102 (0.822)	-5.216 (0.286)	-0.146 (0.485)	-1.541*** (0.000)
Constant	-1.324	18.238**	4.415**	42.729***	7.322	-2.465***	1.927**	-6.538***	4.402***	-0.079	74.889*	-2.36***	3.052***

(continued on next page)

Table 4 (continued)

Panel III: Europe													
	Panel A: Accounting-based Performance					Panel B: Market-based Performance			Panel C: Risk Indicators				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Controls	(0.264)	(0.016)	(0.011)	(0.000)	(0.772)	(0.000)	(0.013)	(0.000)	(0.000)	(0.991)	(0.069)	(0.000)	(0.001)
Observations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	433	543	259	258	255	388	385	385	288	254	241	395	291
Wald Chi 2	0.351	0.233	0.075	0.079	0.033	0.592	0.185	0.798	0.748	0.207	0.040	0.168	0.733
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel V: Other parts of the world													
	Panel A: Accounting-based Performance					Panel B: Market-based Performance			Panel C: Risk Indicators				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
VARIABLES	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-5.368***	-11.94***	-0.093	-2.239	10.701	-0.162	-0.236**	-0.569**	-1.478*	-	-9.324	-0.071	-4.758***
	(0.000)	(0.000)	(0.833)	(0.409)	(0.176)	(0.559)	(0.016)	(0.042)	(0.094)		(0.478)	(0.743)	(0.000)
Constant	4.102***	9.394	-0.175	-2.741	75.094**	-2.976***	2.015***	-7.086***	1.014	13.135**	-17.822	1.891***	5.336***
	(0.001)	(0.117)	(0.941)	(0.860)	(0.018)	(0.000)	(0.008)	(0.000)	(0.370)	(0.040)	(0.745)	(0.005)	(0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	121	149	70	70	68	105	105	105	65	64	61	102	66
R-squared	0.460	0.314	0.059	0.145	0.235	0.747	0.527	0.877	0.754	0.393	0.205	0.295	0.818
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table (4a, b, c) reports OLS regression results for the effects of Covid-19 pandemic on bank performance and risks across five different regions. Panel I presents the results for Asia; Panel II presents results for Middle East, North Africa, and Greater Arabia; Panel III presents results for Europe; Panel IV presents results for America and the Caribbean ; and Panel V presents results for other parts of the world. For each Panel (I, II, III, IV, and V), we present three sub-panels as follows: Panel A presents results for accounting-based performance (ROA, ROE, ROAA, ROAE and Cost/Income); Panel B presents results for market-based performance (LnQ; MV/BV; LogMV), and Panel C reports results for risk indicators (LogZscore; NP/Loan; LA/DSF; SDROA: ROA/SDROA).. Robust standard errors are used to capture heteroscedasticity. P-values are reported in parentheses. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in *appendix B*.

Table 5
Comparing US/China and other Parts: Effects of Covid-19 Pandemic on Bank Performance and Financial Stability.

Panel I: US													
VARIABLES	Panel A: Accounting-based Performance					Panel B: Market-based Performance			Panel C: Risk Indicators				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-1.743*** (0.002)	-7.541*** (0.000)	-0.733 (0.110)	-2.154 (0.444)	-4.618 (0.634)	-0.381 (0.216)	-0.517* (0.082)	-1.007** (0.016)	-0.949** (0.026)	0.251 (0.538)	-7.416 (0.308)	0.331 (0.133)	-1.334*** (0.004)
Constant	1.107 (0.311)	-1.013 (0.792)	2.559** (0.016)	22.181*** (0.001)	63.671*** (0.002)	-2.129*** (0.000)	0.209 (0.646)	-8.515*** (0.000)	3.099*** (0.000)	1.728 (0.337)	44.729* (0.077)	-1.524*** (0.000)	3.727*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	219	266	122	121	120	194	194	194	148	131	110	204	148
R-squared	0.301	0.307	0.068	0.093	0.043	0.581	0.181	0.821	0.785	0.201	0.021	0.322	0.844
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel II: China													
VARIABLES	Panel A: Accounting-based Performance					Panel B: Market-based Performance			Panel C: Risk Indicators				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-2.994 (0.101)	-4.279* (0.077)	0.080 (0.811)	0.878 (0.735)	-0.345 (0.944)	-0.039 (0.679)	-0.288*** (0.000)	-0.658*** (0.000)	-0.405 (0.282)	-	3.328 (0.555)	-0.744 (0.158)	-1.107* (0.061)
Constant	2.314* (0.052)	-8.390* (0.076)	4.898*** (0.004)	10.818 (0.319)	-48.280*** (0.005)	-1.334*** (0.000)	-0.018 (0.971)	-8.626*** (0.000)	2.992*** (0.005)	24.348*** (0.000)	18.959 (0.307)	1.770** (0.014)	1.937 (0.232)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	120	154	75	75	75	109	109	109	62	84	72	105	65
R-squared	0.287	0.136	0.261	0.056	0.336	0.769	0.419	0.886	0.705	0.544	0.385	0.295	0.698
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel III: UK/Europe and Others													
VARIABLES	Panel A: Accounting-based Performance					Panel B: Market-based Performance			Panel C: Risk Indicators				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-2.884*** (0.000)	-6.108*** (0.000)	-0.246** (0.016)	-1.626** (0.016)	2.143 (0.266)	-0.141*** (0.009)	-0.304*** (0.000)	-0.716*** (0.000)	-0.735*** (0.000)	-1.991*** (0.008)	-1.331 (0.509)	-0.108 (0.264)	-1.149*** (0.000)
Constant	2.802*** (0.000)	1.095 (0.465)	1.660*** (0.000)	11.896*** (0.000)	39.440*** (0.000)	-2.466*** (0.000)	1.187*** (0.000)	-6.946*** (0.000)	1.495*** (0.000)	18.084*** (0.000)	41.989*** (0.000)	0.837*** (0.000)	1.883*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,324	2,948	1,381	1,380	1,373	2,026	1,994	2,005	1,501	1,446	1,317	2,099	1,544
R-squared	0.263	0.190	0.018	0.014	0.016	0.618	0.065	0.720	0.626	0.102	0.023	0.047	0.583
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table reports OLS regression results for the effects of Covid-19 pandemic on bank performance and risks comparing US, China, and other countries. Panel I presents the results for US; Panel II presents results for China; Panel III presents results for UK/Europe and Others. For each Panel (I, II, and III), we present three sub-panels as follows: Panel A presents results for accounting-based performance (ROA, ROE, ROAA, ROAE and Cost/Income); Panel B presents results for market-based performance (LnQ; MV/BV; LogMV), and Panel C reports results for risk indicators (LogZscore; NP/Loan; LA/DSF; SDROA; ROA/SDROA). Robust standard errors are used to capture heteroscedasticity. P-values are reported in parentheses. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in appendix B.

7.3. Comparisons between high and low income-generating countries

Table 6 indicates additional results from the examination of the effect of Covid-19 on bank stability across different classifications of income-generation economies: (i) banks located in high-income countries, and (ii) banks in middle- and low-income countries. The income classification is based on the measure of national income per person, or GNI per capita, calculated using the Atlas method. As of 1 July 2019, low-income economies are defined as those with GNI per capita (calculated using the World Bank Atlas method) of \$1,025 or less in 2018; lower-middle-income economies are those with GNI per capita between \$1,026 and \$3,995; upper-middle-income economies are those with GNI per capita between \$3,996 and \$12,375; and high-income economies are those with GNI per capita of \$12,376 or more. Therefore, we categorised our sampled banks, in line with the World Bank's classification, into high (in Panel I) versus middle and low (in Panel II) income levels of countries.

Our findings show that across all indicators for accounting-related and market-based performance, the two categories of economies have been severely and negatively influenced by the outbreak of the Covid-19 pandemic, suggesting low financial performance and poor stock market valuations. Additionally, we find that the Covid-19 emergency has led banks affiliated to middle- and low-income economies to report poor cost efficiency (i.e. the significantly positive coefficient of Covid-19 related to Cost/Income), with insignificant results for high-income countries. Moreover, in Panel II, for bank risk, there is a lack of variation in the results across the two categories. Both sets of bank classifications show significantly high-risk profile among the alternative risk indicators. The overall findings are in line with the predictions and main findings, suggesting the substantial adverse impact of the outbreak on bank stability, regardless of the income classification of countries.

7.4. The effect of bank type

Given the structured differences between conventional and Islamic banks, in terms of business models, corporate governance and agency relationships, we expect that their capacity to handle the Covid-19 outbreak would be significantly different. For example, previous studies (e.g., Beck et al., 2013; Mollah et al., 2017) stated that Islamic banks are more complicated than their conventional counterparts and were better shielded during the recent GFC of 2007. In addition, Islamic banks have a distinctive survival rate as compared to their conventional counterparts (Pappas et al., 2017). Moreover, recent studies (e.g. Abdelsalam et al., 2020; Elnahass et al., 2020a; Trinh et al., 2020a) have provided strong evidence that differential effects on the bank stability of the two bank types do exist, as well as the respective stock market valuations, which are mainly attributable to the distinct governance structure, institutional characteristics and extended agency costs associated with Islamic banking, relative to conventional counterparts. However, under the unprecedented exogenous shock of Covid-19, it is unclear whether these previous findings will still hold, and whether the Islamic banking model can remain sufficiently robust and resilient to mitigate such turmoil. Accordingly, we take a further step in our analyses to examine our main study hypothesis while assessing the effect of the bank type. We do that by clustering the full sample into Islamic and conventional banks, using an interaction variable (i.e., *Islamic*Covid-19*) to assess the effect of the bank type during the Covid-19 outbreak.

Table 7 in Panel A reports accounting-based performance, while Panel B presents bank risk indicators for both bank types. Our results are consistent with the main findings that our sampled banks, on average, have had low financial performance and high insolvency and asset risks during the Covid-19 period, represented by our test variable the *Covid-19*. The Islamic dummy variable indicates that during the non-Covid-19 period, Islamic banks report significantly low ROA, high liquidity and high operational risks when compared to conventional banks. These results are consistent with the findings of Beck et al. (2013) and Trinh et al. (2020a), who stated that Islamic banks face a challenging liquidity position and low efficiency relative to conventional banks. Čihák and Hesse (2010) found that larger Islamic banks are less financially stable than their conventional counterparts, due to the challenges in controlling credit risks.

During the Covid-19 outbreak, for the interaction term *Islamic*Covid-19*, we have found that Islamic banks have reported significantly high asset risk, with a marginally high insolvency risk. However, Islamic banks have exhibited a marginally positive ROA with significantly low operational risk relative to their conventional counterparts. Yet we have not found any significant results for other measures of profitability and cost efficiency.

Taken together, these findings imply differential effects of the Covid-19 bank stability of Islamic banking versus conventional banking. Moreover, the significant sum of the coefficients of *Covid-19* and *Islamic*Covid-19* for ROA, *LogZscore*, *SDROA*, and *ROA/SDROA* provides strong evidence for the presence of significant differences between the two bank types across these stability measures. Based on these p-values, we can observe that *Covid-19* has generally had a negative effect on banks' profitability position, but this effect is much lower for Islamic banks than for conventional banks. Furthermore, the high insolvency risk and high asset risk observed for our sample banks during the Covid-19 outbreak are more prevalent for Islamic banks than conventional banks. From the significant sum of the coefficients of *Covid-19* and *Islamic*Covid-19* for *SDROA*, we have found that operational risk has been much lower for Islamic banks than conventional banks during the outbreak. The enhanced profitability position for Islamic banks, alongside the low operational risk, could be justified by the nature of the constrained banking business model used by Islamic banks, which incorporates profit-loss sharing and prohibits speculative investment activities. Such a banking model, alongside the extended governance mechanisms (e.g., double governance by board of directors and Sharia supervisor boards) employed in this banking sector, seem to have promoted better profitability performance for this bank type during the Covid-19 pandemic (see Elnahass et al., 2018). However, Islamic banks appear not

Table 6

Comparing higher-income and lower-income countries: Effects of Covid-19 Pandemic on Bank Performance and Financial Stability.

Panel I: High Income Countries													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA	
Covid-19	-2.478*** (0.000)	-6.762*** (0.000)	-0.388** (0.023)	-1.274 (0.259)	-3.193 (0.352)	-0.167** (0.040)	-0.353*** (0.007)	-0.748*** (0.000)	-0.612*** (0.001)	-1.607*** (0.006)	0.061 (0.986)	0.135 (0.295)	-0.948*** (0.000)
Constant	2.179*** (0.005)	-0.450 (0.919)	1.536 (0.202)	12.582* (0.098)	54.544*** (0.005)	-2.214*** (0.000)	0.064 (0.898)	-9.572*** (0.000)	2.732*** (0.000)	12.771*** (0.005)	32.165 (0.162)	-0.299 (0.430)	2.173*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,022	1,257	568	567	563	912	892	898	651	637	526	943	665
R-squared	0.260	0.211	0.033	0.036	0.015	0.616	0.109	0.749	0.676	0.090	0.063	0.060	0.689
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel II: Middle and Low Income Countries													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA	
Covid-19	-3.003*** (0.000)	-6.085*** (0.000)	-0.178 (0.123)	-1.582** (0.041)	4.367** (0.041)	-0.133** (0.045)	-0.322*** (0.000)	-0.754*** (0.000)	-0.827*** (0.000)	-2.064*** (0.000)	-3.557 (0.113)	-0.226* (0.073)	-1.290*** (0.000)
Constant	2.651*** (0.000)	-2.087 (0.225)	2.097*** (0.000)	14.275*** (0.000)	26.802*** (0.000)	-2.535*** (0.000)	1.484*** (0.000)	-6.835*** (0.000)	1.453*** (0.000)	19.545*** (0.000)	49.261*** (0.000)	1.031*** (0.000)	1.743*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,641	2,111	1,010	1,009	1,005	1,417	1,405	1,410	1,060	1,024	973	1,465	1,092
R-squared	0.276	0.177	0.023	0.016	0.035	0.617	0.090	0.730	0.610	0.145	0.013	0.049	0.552
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table reports OLS regression results for the effects of Covid-19 pandemic on bank performance and risks comparing high-income, and middle- and low-income countries. Panel I presents the results for high-income countries while Panel II presents results for middle- and low-income countries. For each Panel (I and II), we present three sub-panels as follows: Panel A presents results for accounting-based performance (ROA, ROE, ROAA, ROAE and Cost/Income); Panel B presents results for market-based performance (LnQ; MV/BV; LogMV), and Panel C reports results for risk indicators (LogZscore; NP/Loan; LA/DSF; SDROA: ROA/SDROA). Robust standard errors are used to capture heteroscedasticity. P-values are reported in parentheses. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in appendix B.

Table 7
Comparing Conventional and Islamic banks: Effects of Covid-19 Pandemic on Bank Performance and Financial Stability.

VARIABLES	Panel A: Accounting-based Performance					Panel B: Risk Indicators			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ROA	ROE	ROAA	ROAE	Cost/ Income	LogZscore	LA/DSF	SDROA	ROA/SDROA
Covid-19	-2.828*** (0.000)	-6.263*** (0.000)	-0.257*** (0.009)	-1.476** (0.022)	1.760 (0.337)	-0.733*** (0.000)	-1.629 (0.391)	-0.130 (0.153)	-1.135*** (0.000)
Islamic	-0.224** (0.016)	-0.086 (0.884)	-0.114 (0.450)	-0.073 (0.940)	-2.092 (0.410)	0.014 (0.694)	-6.792*** (0.007)	-0.110*** (0.005)	0.045 (0.524)
Islamic*Covid-19	0.263* (0.057)	1.484 (0.197)	-0.202 (0.466)	-1.702 (0.360)	6.729 (0.152)	-0.281* (0.092)	0.247 (0.957)	0.437*** (0.000)	-0.375** (0.012)
LogTA	-0.275*** (0.000)	0.467*** (0.000)	-0.035 (0.195)	-0.231 (0.179)	0.799* (0.089)	0.005 (0.771)	-0.301 (0.556)	-0.046*** (0.000)	0.025 (0.257)
LogAge	0.043 (0.472)	-0.154 (0.628)	-0.287*** (0.000)	-0.864* (0.098)	4.917*** (0.001)	-0.046 (0.229)	-5.013*** (0.001)	0.051* (0.076)	-0.014 (0.757)
Debt/TA	1.143*** (0.000)	1.496** (0.011)	0.297** (0.042)	2.201** (0.017)	0.407 (0.875)	-1.082*** (0.000)	0.319 (0.908)	0.205** (0.045)	-0.783*** (0.000)
Big4	0.084* (0.056)	1.253*** (0.000)	0.082 (0.156)	0.519 (0.163)	-1.229 (0.228)	-0.099*** (0.000)	0.366 (0.738)	-0.058*** (0.009)	-0.128*** (0.000)
LogGDP/capita	0.151** (0.016)	1.467*** (0.000)	-0.069 (0.423)	-0.687 (0.216)	3.456** (0.022)	0.065* (0.096)	-1.404 (0.401)	-0.017 (0.597)	0.250*** (0.000)
Country_Gov	-0.056 (0.210)	-0.198 (0.414)	0.104* (0.091)	0.630 (0.111)	-2.516** (0.016)	-0.030 (0.308)	2.090* (0.065)	0.000 (0.987)	-0.108*** (0.001)
Constant	2.659*** (0.000)	0.612 (0.671)	1.961*** (0.000)	13.774*** (0.000)	34.637*** (0.000)	1.546*** (0.000)	44.671*** (0.000)	0.743*** (0.000)	1.806*** (0.000)
Covid-19 + Islamic*Covid-19 = 0	-2.565*** (0.000)	-4.779*** (0.000)	-0.459 (0.102)	-3.178* (0.093)	8.489* (0.080)	-1.014*** (0.000)	-1.382 (0.766)	0.307** (0.031)	-1.510*** (0.000)
Observations	2,663	3,368	1,578	1,576	1,568	1,711	1,499	2,408	1,757
R-squared	0.257	0.189	0.019	0.013	0.015	0.630	0.017	0.044	0.599
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table reports OLS regression results for the effects of Covid-19 pandemic on bank performance and risks comparing Conventional and Islamic banks. Panel A presents results for accounting-based performance (ROA, ROE, ROAA, ROAE and Cost/Income) while Panel B reports results for risk indicators (LogZscore; LA/DSF; SDROA: ROA/SDROA). Due to missing data when we interacted Islamic with Covid-19 (Islamic*Covid-19), we are unable to run regressions for market-based performance, and NP/Loan. Robust standard errors are used to capture heteroscedasticity. P-values are reported in parentheses. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in *appendix B*

to be wholly shielded from this turmoil, and this banking sector still suffers from the macroeconomic flu symptoms of Covid-19, just as conventional banks do.

7.5. The effect of the bank size

Table 8 shows our additional tests to identify the differential effects of Covid-19 on bank stability for large (in Panel I) and small banks (in Panel II). We used the mean of firm size (*LogTA*: 6.37) as the cut-off for classifying large and small banks.

According to the significantly negative coefficients of Covid-19 associated with *ROA* and *ROE* for both groups of banks, we find that both large and small banks have been affected severely by the outbreak of Covid-19 in relation to profitability performance. However, our results show the insignificant impact of *Covid-19* upon the banks' cost efficiency (*Cost/Income*). Based on the results in sub-panel B of Panel I, the coefficients of Covid-19 of both large and small banks are significantly and negatively associated with all three measures of market-based performance (i.e., *LnQ*, *MV/BV* and *LogMV*). The results imply that, irrespective of bank size, the market value of banks has been significantly reduced during the Covid-19 outbreak.

With respect to the bank risk indicators, the findings show significantly high asset risk management for both large and small banks as a result of Covid-19, with a significant and negative coefficient of Covid-19 under *ROA/SDROA*. However, our results suggest that large banks, in comparison with small banks, demonstrate stronger capability of tackling credit and operational risks during the early period of the Covid-19 crisis, with negative coefficients of *Covid-19* in association with both *NP/Loan* and *SDROA*. Small banks appear to have a weaker ability in mitigating insolvency risk than large banks, in line with the negative coefficient of *Covid-19* related to *LogZscore* for small banks (i.e. Panel II, Panel C)⁴.

7.6. The effect of bank age

Table 9 presents our results concerning the Covid-19 impacts on bank stability for old banks (Panel I) and young banks (Panel II). We used the mean of firm age (*LogAge*: 1.54) as the cut-off for classifying old and young banks. Under the

⁴ Due to the limited data availability for the Covid-19 periods, we are unable to test credit risk for small banks.

Table 8
Comparing Large and Small Banks: Effects of Covid-19 Pandemic on Bank Performance and Financial Stability.

Panel I: Large Banks													
VARIABLES	Panel A: Accounting-based Performance					Panel B: Market-based Performance			Panel C: Risk Indicators				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-1.218*** (0.000)	-5.970*** (0.000)	-0.219* (0.071)	-0.985 (0.241)	0.037 (0.987)	-0.144** (0.010)	-0.268*** (0.001)	-0.504*** (0.006)	-0.360 (0.299)	-2.019** (0.017)	-3.145 (0.185)	-0.304*** (0.000)	-0.694* (0.064)
Constant	0.849*** (0.001)	6.763*** (0.000)	2.226*** (0.000)	13.444*** (0.000)	35.87*** (0.000)	-1.601*** (0.000)	0.948*** (0.000)	7.733*** (0.000)	1.719*** (0.000)	0.672 (0.675)	40.148*** (0.000)	0.392*** (0.001)	2.407*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,619	2,111	781	781	776	1,949	1,933	1,935	1,099	1,520	732	1,539	1,099
R-squared	0.035	0.058	0.032	0.027	0.036	0.613	0.113	0.070	0.128	0.027	0.025	0.013	0.103
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel II: Small Banks													
VARIABLES	Panel A: Accounting-based Performance					Panel B: Market-based Performance			Panel C: Risk Indicators				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-2.639*** (0.000)	-7.128*** (0.000)	0.043 (0.834)	-0.392 (0.745)	0.685 (0.825)	-0.186** (0.017)	-0.453*** (0.001)	-0.721** (0.027)	-0.516*** (0.004)	-	1.167 (0.768)	0.016 (0.911)	-1.008*** (0.000)
Constant	0.796** (0.042)	-0.769 (0.709)	1.243*** (0.004)	11.012*** (0.000)	43.28*** (0.000)	-1.928*** (0.000)	2.345*** (0.000)	4.411*** (0.000)	1.305*** (0.000)	7.673* (0.052)	44.601*** (0.000)	0.431* (0.060)	1.328*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,044	1,257	797	795	792	380	364	373	612	141	767	869	658
R-squared	0.407	0.222	0.014	0.004	0.009	0.575	0.124	0.104	0.525	0.161	0.043	0.029	0.440
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table reports OLS regression results for the effects of Covid-19 pandemic on bank performance and risks comparing large and small banks. We use the mean of firm size (LogTA: 6.37) as the cut-off for classifying large and small banks. Panel I presents the results for large banks while Panel II presents results for small banks. For each Panel (I and II), we present three sub-panels as follows: Panel A presents results for accounting-based performance (ROA, ROE, ROAA, ROAE and Cost/Income); Panel B presents results for market-based performance (LnQ; MV/BV; LogMV), and Panel C reports results for risk indicators (LogZscore; NP/Loan; LA/DSF; SDROA: ROA/SDROA). Robust standard errors are used to capture heteroscedasticity. P-values are reported in parentheses. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in *appendix B*.

Table 9
Comparing Old and Young Banks: Effects of Covid-19 Pandemic on Bank Performance and Financial Stability.

Panel I: Old Banks													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA	
Covid-19	-2.835*** (0.000)	-5.548*** (0.000)	-0.418*** (0.001)	-1.977** (0.017)	4.954** (0.048)	-0.119 (0.130)	-0.366*** (0.000)	-0.754*** (0.000)	-0.626*** (0.000)	-	-2.287 (0.387)	-0.324** (0.013)	-0.969*** (0.000)
Constant	3.342*** (0.000)	-0.179 (0.935)	1.977*** (0.000)	13.72*** (0.000)	41.27*** (0.000)	-2.597*** (0.000)	0.737** (0.027)	-7.586*** (0.000)	1.187*** (0.000)	10.055*** (0.000)	42.744*** (0.000)	1.290*** (0.000)	1.647*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,262	1,559	727	726	724	1,075	1,063	1,068	790	771	702	1,152	811
R-squared	0.262	0.191	0.027	0.022	0.018	0.626	0.089	0.748	0.621	0.090	0.020	0.083	0.625
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel II: Young Banks													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA	
Covid-19	-2.755*** (0.000)	-6.555*** (0.000)	-0.161 (0.272)	-1.302 (0.169)	-0.333 (0.900)	-0.165** (0.018)	-0.280*** (0.008)	-0.736*** (0.000)	-0.925*** (0.000)	-2.198*** (0.000)	-1.771 (0.502)	0.131 (0.265)	-1.368*** (0.000)
Constant	2.097*** (0.000)	0.612 (0.722)	1.141** (0.022)	12.000*** (0.000)	40.30*** (0.000)	-2.136*** (0.000)	1.349*** (0.000)	-6.338*** (0.000)	1.799*** (0.000)	25.806*** (0.000)	31.704*** (0.001)	0.331* (0.061)	1.922*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,401	1,809	851	850	844	1,254	1,234	1,240	921	890	797	1,256	946
R-squared	0.267	0.197	0.007	0.011	0.010	0.604	0.087	0.726	0.644	0.176	0.028	0.032	0.583
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table reports OLS regression results for the effects of Covid-19 pandemic on bank performance and risks comparing old and young banks. Panel I presents the results for old banks while Panel II presents results for young banks. For each Panel (I and II), we present three sub-panels as follows: Panel A presents results for accounting-based performance (ROA, ROE, ROAA, ROAE and Cost/Income); Panel B presents results for market-based performance (LnQ; MV/BV; LogMV), and Panel C reports results for risk indicators (LogZscore; NP/Loan; LA/DSF; SDROA: ROA/SDROA). Robust standard errors are used to capture heteroscedasticity. P-values are reported in parentheses. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in *appendix B*.

accounting-based performance measures we find that old banks (in Panel I) show significant and negative associations between Covid-19 and all profitability alternative measures. In addition, the Covid-19 pandemic has had an immensely adverse effect on the cost efficiency of old banks, with a significantly positive coefficient of Covid-19 under the Cost/Income ratio. In contrast, younger banks (in Panel II) show no strong evidence for cost efficiency but have reported significantly poor profitability positions.

With respect to the market-based performance indicators, the current market valuations (i.e., MV/BV and $LogMV$) of both old and young banks have been significantly and negatively affected by Covid-19. We also find that the pandemic outbreak has had a significantly negative impact on the forward-looking market valuations of investors, as represented by the negative relationship between Covid-19 and LnQ . However, our results show insignificant evidence regarding whether, and to what extent, the pandemic has impacted the prospective market value of old banks.

Panels I and II in Table 7 show the significant impacts of Covid-19 on both insolvency and asset risks for both old and young banks, indicating that our sampled banks face high probability of defaulting, and have high asset risks during this outbreak, regardless of their age. Our results also indicate that, during the Covid-19 pandemic outbreak, old banks have reduced their operational risk, as confirmed by the significantly negative relationship between the variables for Covid-19 and $SDROA$. Moreover, Panel II also exhibits a significantly negative coefficient of Covid-19 with regard to $NP/Loan$ for small banks. This means that young banks are capable of maintaining high asset quality and a reduced level of credit risk through the implementation of effective credit policies and loan default plans when facing a crisis such as the Covid-19 pandemic.⁵

7.7. High-risk and low-risk banks

Additionally, we cluster our sample banks into high-risk (in Panel I) versus low-risk banks (in Panel II), using the cut-off of the mean of insolvency risk ($LogZscore$: 1.103). Our aim is to further investigate how respective financial performance and stability could be differentially represented across high- and low-risk banks during the Covid-19 turmoil. Table 10 reveals the significantly adverse impact of the pandemic on the financial performance and risk-taking of both groups of banks, as represented by the significantly negative coefficients of Covid-19 for alternative measures of profitability ratios. However, we find insignificant evidence of the impact of Covid-19 on the Cost/Income ratio for both groups. In addition, we discover that low-risk banks have significantly low stock market valuations (i.e., LnQ , MV/BV and $LogMV$), which cannot be compared with high-risk banks, due to missing data for these three indicators.

Panel C of Table 10 shows that the asset risk related to both groups has been high during the Covid-19 crisis. However, high-risk banks show significantly low operational risk (i.e. the coefficients of Covid-19 are significantly and negatively associated with $SDROA$), with the opposite being the case for low-risk banks. Furthermore, low-risk banks exhibit significantly low credit risk, which again cannot be compared with high-risk banks due to limited data availability.

8. Robustness checks

8.1. Two-step system Generalized Method of Moments (GMM) estimations

Prior studies (e.g., Mollah et al., 2017; Elnahass et al., 2020a; Trinh et al., 2020b, 2020c) have claimed that potential endogeneity problems exist, possibly the result of: (1) the causal relationships between independent variable(s) and bank financial performance/risk; (2) measurement errors; and/or (3) omitting variables. Therefore, we employ a two-step system, the Generalized Method of Moments (GMM) estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) to reduce this issue. This method captures the unobserved influences through the transformation of the variables into first-differences, which helps to decrease heterogeneity and omitted variable bias. By applying this technique, we orthogonally use lagged values of possible endogenous variables as their Instrument Variables (IVs). This allows us to treat all bank-level factors as endogenous, while treating all country-level variables as strictly exogenous. Our rationale behind this approach is that lagged values of endogenous variables in earlier quarters could not have resulted from bank performance, and risk in subsequent quarters. Therefore, endogeneity issues are unlikely in these transformed models. Table 11 (Panels A, B and C) shows these GMM estimations, and we find that our main results remain unchanged even after we capture unobserved heterogeneity, simultaneity and dynamic endogeneity.

8.2. Propensity score matching estimations

Finally, we utilize an alternative technique to account for possible endogeneity issues within our empirical models, as well as sample selection bias. This method is widely described as "Propensity Score Matching" or PSM. It was originated in the study of Rosenbaum and Rubin (1983), and has been adopted by several studies, such as Elnahass et al. (2020a) and Trinh et al. (2020b; 2020c). In keeping with these studies, we perform a three-step process of PSM, starting with an estimation of the propensity scores (PS) for any banks observed in Covid-19 periods (i.e., treatment group), and those observed before those Covid-19 periods (i.e., control group). As the dependent factor in these estimations is a binary variable, we

⁵ Due to the limited data availability for the Covid-19 periods, we are unable to test credit risk for old banks.

Table 10
Comparing High-Risk and Low-Risk Banks: Effects of Covid-19 Pandemic on Bank Performance and Financial Stability.

Panel I: High-Risk Banks													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-3.089*** (0.000)	-6.689*** (0.000)	0.243 (0.425)	1.022 (0.602)	-1.837 (0.711)	-	-	-	-	-	4.003 (0.441)	-0.988*** (0.000)	-1.529*** (0.000)
Constant	4.228*** (0.000)	6.270** (0.030)	0.850 (0.289)	4.103 (0.440)	44.790*** (0.002)	-0.606 (0.280)	-2.427*** (0.009)	-5.627*** (0.001)	-	-43.000** (0.015)	49.121*** (0.001)	2.519*** (0.000)	1.836*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes
Observations	503	499	385	384	382	96	96	96	-	44	374	503	503
R-squared	0.679	0.302	0.014	0.009	0.008	0.826	0.516	0.852	-	0.719	0.068	0.478	0.419
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000
Panel II: Low-Risk Banks													
VARIABLES	<i>Panel A: Accounting-based Performance</i>					<i>Panel B: Market-based Performance</i>			<i>Panel C: Risk Indicators</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ROA	ROA	ROE	ROAA	ROAE	Cost/Income	LnQ	MV/BV	LogMV	LogZscore	NP/Loan	LA/DSF	SDROA	ROA/SDROA
Covid-19	-2.410*** (0.000)	-5.958*** (0.000)	-0.331*** (0.002)	-1.887*** (0.007)	2.421 (0.228)	-0.130*** (0.010)	-0.312*** (0.000)	-0.741*** (0.000)	-	-1.978*** (0.003)	-2.252 (0.273)	0.527*** (0.000)	-0.845*** (0.001)
Constant	2.382*** (0.000)	-0.690 (0.668)	2.207*** (0.000)	16.573*** (0.000)	31.673*** (0.000)	-2.487*** (0.000)	1.166*** (0.000)	-7.384*** (0.000)	-	17.831*** (0.000)	41.827*** (0.000)	0.358** (0.015)	1.506*** (0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes
Observations	2,160	2,869	1,193	1,192	1,186	2,233	2,201	2,212	-	1,617	1,125	1,905	1,254
R-squared	0.162	0.145	0.023	0.018	0.020	0.643	0.080	0.727	-	0.124	0.012	0.037	0.197
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000

This table reports OLS regression results for the effects of Covid-19 pandemic on bank performance and risks comparing high-risk and low-risk banks. Panel I presents the results for high-risk banks while Panel II presents results for low-risk banks. For each Panel (I and II), we present three sub-panels as follows: Panel A presents results for accounting-based performance (ROA, ROE, ROAA, ROAE and Cost/Income); Panel B presents results for market-based performance (LnQ; MV/BV; LogMV), and Panel C reports results for risk indicators (NP/Loan; LA/DSF; SDROA: ROA/SDROA). Robust standard errors are used to capture heteroscedasticity. P-values are reported in parentheses. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in *appendix B*.

Table 11

Robustness Check: GMM Effects of Covid 19 Pandemic on Bank Performance and Financial Stability.

VARIABLES	Panel A: Accounting-based Performance			Panel B: Market-based Performance			Panel C: Risk Indicators	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Covid	ROA -1.691*** (0.001)	ROE -6.099** (0.010)	Cost/Income 35.238*** (0.002)	LnQ -1.062* (0.085)	MV/BV -0.733** (0.048)	LogMV -0.303** (0.017)	LogZscore -2.358*** (0.001)	ROA/SDROA -3.298* (0.066)
Perf _{t-1}	0.791*** (0.000)	0.801*** (0.000)	1.012*** (0.000)	0.583*** (0.009)	0.656* (0.099)	0.186* (0.093)		
Risk _{t-1}							0.573*** (0.000)	-0.112** (0.011)
Constant	1.441 (0.451)	-3.700 (0.558)	-57.949 (0.661)	2.792 (0.100)	2.624 (0.625)	-5.807** (0.035)	3.773* (0.069)	-0.441 (0.969)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,833	2,489	616	1,741	1,716	1,723	1,315	1,355
Number of banks	550	734	526	562	554	556	379	390

This table reports GMM regression results for the effects of Covid-19 pandemic on bank performance and risks for the full sample. Panel A presents GMM results for accounting-based performance (ROA; ROE; Cost/Income); Panel B presents GMM results for market-based performance (LnQ; MV/BV; LogMV), and Panel C reports GMM results for risk indicators (LogZscore; ROA/SDROA). Due to missing data, we are unable to run GMM regressions for ROAA, ROAE, NP/Loan, LA/DSF and SDROA. Robust standard errors are used to capture heteroscedasticity. P-values are reported in parentheses. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in *appendix B*.

employ the probit approach to investigate PS. After completing this step and obtaining PS, we proceed to the second step, which is to match samples utilising 1:1 nearest neighbour matching without replacement.⁶ In other words, this method helps us to match each bank-period observation of the treatment group with that of the control group. Appendix D indicates strong evidence for the high quality of matching, that is, the distribution figure of the PS before and after matching.

We then test the average effects of Covid-19 on bank performance and financial stability. In *Table 12*, Panel A and B present univariate findings for (i) the average treatment effects (i.e., ATE) with the 1:1 nearest neighbour matching method, and (ii) the average treatment effect on the treated (ATT) with 1:1 nearest neighbour matching and bootstrapping of standard errors (100 replications)⁷, respectively. The overall results reveal that bank performance (i.e., ROA; Cost/Income; and LnQ) and financial stability (*LogZscore*)⁸ are significantly lower for the treatment group, or lower for banks observed in Covid-19 periods, than the control group, or banks observed before Covid-19 periods. Consistently, multivariate regression results for the matched sample further indicate that Covid-19 is negatively and significantly associated with all bank performance and risk measures across all models (1 to 4) (*Table 12*, Panel C). Consequently, our results obtained from the PSM approach are in line with our main results in *Table 3*, showing the robustness of the overall findings in this study.

9. Conclusion

Existing available global observations and discussions so far suggest that the Covid-19 pandemic will generate long-run and possibly persistent recession across economies, which could trigger global economic depression. This paper offers a novel attempt to examine the effect of Covid-19 on banking stability. This study's context is particularly interesting with regard to the ongoing debate of the influence of the Covid-19 pandemic on global economies, on both different regions and different bank types.

By employing several measures of financial performance and risk indicators for a comprehensive dataset of global banks located in 116 countries, we find consistent with our expectations, that the Covid-19 outbreak has significantly harmed bank financial performance (i.e. accounting-based and market-based performance) and bank financial stability (i.e. high default risk, high liquidity risk and high asset risk). These results are consistently observed for various geographical regions (five regions), individual countries (e.g. US/China versus UK/European countries and others), bank sizes (large vs small), bank ages (old vs young), bank risk levels (high-risk vs low-risk), and countries' income classifications (high-income vs middle- and low-income). We also observe differential effects of the Covid-19 outbreak on the stability of Islamic banks versus conventional banks. Our main results persist across different model specifications, such as GMM and the propensity score matching method, which capture the potential endogeneity issues and sample selection bias. Remarkably, our preliminary results of average bank performance and financial stability by quarterly periods further reveal that there is a sign of recovery of bank performance and financial stability in the second quarter of 2020, when several governments brought their entire countries into a lockdown period, and then eventually eased their restrictions.

⁶ Other three alternative methods, i.e., 1:1 nearest neighbour matching with replacement, and nearest neighbour matching with n=2 and n=3 with replacement, show the same results. Unreported tables for these tests will be available upon request.

⁷ We also test for 1000 and 10,000 replications. Unreported tables for these tests will be available upon request.

⁸ Results for other measures are consistent, and unreported tables for these tests will be provided upon request.

Table 12

Robustness Check: Propensity Score Matching - Effects of Covid 19 Pandemic on Bank Performance and Financial Stability.

Panel A: Average treatment effects (ATE) with 1:1 nearest neighbour matching without replacement						
		Treated	Control	Δ	S.E.	T-stat
ROA	Unmatched	0.255	1.614	-1.359***	0.150	-9.08
	Matched	0.268	3.475	-3.207***	0.332	-9.67
Cost/Income	Unmatched	58.817	58.457	0.360	1.006	0.36
	Matched	59.202	57.002	2.201	2.148	1.02
LnQ	Unmatched	-1.355	-1.067	-0.288***	0.064	-4.50
	Matched	-1.355	-1.099	-0.255***	0.088	-2.88
LogZscore	Unmatched	0.003	1.471	-1.467***	0.030	-48.90
	Matched	-0.244	1.161	-1.405***	0.062	-22.57
Panel B: Average treatment effect on the treated (ATT) with 1:1 nearest neighbour matching and bootstrapping of standard errors						
	No of obs.	Replications	Observed (Δ)	Bias	S.E.	T-stat
ROA	6534	100	-7.269***	1.755	2.845	-2.555
Cost/Income	6534	100	14.984***	0.199	6.333	2.366
LnQ	6534	100	-0.288***	0.016	0.077	-3.732
LogZscore	6534	100	-1.397***	-0.042	0.087	-16.132
Panel C: Regressions on matched samples						
	(1)	(2)	(3)	(4)		
Variables	ROA	Cost/Income	LnQ	LogZscore		
Covid-19	-4.976*** (0.000)	2.927 (0.183)	-0.255*** (0.004)	-0.464*** (0.000)		
Controls	Yes	Yes	Yes	Yes		
Constant	0.189 (0.932)	32.687** (0.016)	-2.114*** (0.000)	0.356 (0.316)		
Adjusted R-squared	0.165	0.039	0.050	0.741		
Observations	586	312	170	384		
Wald Chi 2	0.000	0.000	0.000	0.000		

Note: The table reports PSM results which show the average treatment effects (ATE) and the average treatment effect on the treated (ATT) with 1:1 nearest neighbour matching and bootstrapping of standard errors. The ATE and ATT of the Covid-19 pandemic on the bank performance and financial stability (Δ) is calculated as the difference between the mean changes of banks during Covid-19 period (column "Treated") and that of matched banks before Covid-19 period (column "Non-treated"). P-value is presented in parentheses. T-statistics based on standard errors are presented in final column. ***, **, and * denote the significance level of 1%, 5% and 10% respectively. See variable definitions in *appendix B*.

The findings of this study contribute to the ongoing debate related to the Covid-19 implications for economies. We have presented important implications for existing research and regulatory efforts to explore and identify the likely broad-based, short-run and long-run impacts on global banking stability, while indicating signs of recovery in some economies. While the macro effect symptoms of Covid-19 are becoming increasingly visible in different economies, the impact of this pandemic on banking stability can be commonly observed across our sampled countries. The study also provides valuable insights to inform the debates raised by the IMF about the future of the banking industry, post-Covid-19. The results of this study can inform both investors' investment choices and regulators, regarding the distinct implications that Covid-19 could have for the two bank types. Moreover, we find strong evidence that the implications of Covid-19 for banking stability are mediated by institutional factors and the type of banking business model employed among alternative banking systems (i.e. Islamic versus conventional). Therefore, for countries operating on dual-banking systems, standard setters will be informed by the findings presented in this study that institutional differences represented by different banking business models are dominant during this pandemic. Although both bank types are significantly and negatively affected by Covid-19, Islamic banks revealed a higher risk profile.

The findings (notably for regulators and policymakers) indicate the need for immediate responses and action plans to set up banking unions among affiliated regions, which is an essential requisite to mitigate different types of financial risks that could be presented by an evolving idiosyncratic crisis in the near future, which, hence, affects financial stability in developed economies and beyond. Our study has revealed the signals of recovery of banks in some economies; however, we have argued that even though the lockdown restrictions are currently being cautiously lifted, the financial impact on the banking industry will be felt for a long time to come. Future research could extend our study to capture extended financial periods and other financial indicators.

Acknowledgment

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Appendix A. Final sample distributions for the whole sample period by regions and countries

Region	Country	Number of Banks			Total Observations			Percentage		
		Conventional Banks	Islamic Banks	Full Sample	Conventional Banks	Islamic Banks	Full Sample	Conventional Banks	Islamic Banks	Full Sample
Asia	Bangladesh	31	1	32	186	6	192	3.05%	1.39%	2.94%
	China	49	0	49	294	0	294	4.81%	0.00%	4.50%
	Hong Kong	4	0	4	24	0	24	0.39%	0.00%	0.37%
	India	30	2	32	180	12	192	2.95%	2.78%	2.94%
	Indonesia	38	6	44	228	36	264	3.73%	8.33%	4.04%
	Japan	63	4	67	378	24	402	6.19%	5.56%	6.15%
	Kazakhstan	13	0	13	78	0	78	1.28%	0.00%	1.19%
	Laos	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Malaysia	6	1	7	36	6	42	0.59%	1.39%	0.64%
	Myanmar	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Nepal	57	2	59	342	12	354	5.60%	2.78%	5.41%
	Philippines	13	0	13	78	0	78	1.28%	0.00%	1.19%
	Re. Korea	2	0	2	12	0	12	0.20%	0.00%	0.18%
	Singapore	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Sri Lanka	18	0	18	108	0	108	1.77%	0.00%	1.65%
	Taiwan	11	0	11	66	0	66	1.08%	0.00%	1.01%
	Thailand	8	0	8	48	0	48	0.79%	0.00%	0.73%
	Uzbekistan	19	0	19	114	0	114	1.87%	0.00%	1.74%
	Vietnam	14	0	14	84	0	84	1.38%	0.00%	1.28%
Middle East, North Africa, and Greater Arabia	Azerbaijan	7	1	8	42	6	48	0.69%	1.39%	0.73%
	Bahrain	10	1	11	60	6	66	0.98%	1.39%	1.01%
	Cyprus	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Egypt	11	1	12	66	6	72	1.08%	1.39%	1.10%
	Iraq	16	1	17	96	6	102	1.57%	1.39%	1.56%
	Iran	7	1	8	42	6	48	0.69%	1.39%	0.73%
	Israel	7	2	9	42	12	54	0.69%	2.78%	0.83%
	Jordan	17	1	18	102	6	108	1.67%	1.39%	1.65%
	Kuwait	13	0	13	78	0	78	1.28%	0.00%	1.19%
	Lebanon	5	1	6	30	6	36	0.49%	1.39%	0.55%
	Libya	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Morocco	5	0	5	30	0	30	0.49%	0.00%	0.46%
	Oman	8	0	8	48	0	48	0.79%	0.00%	0.73%
	Pakistan	24	1	25	144	6	150	2.36%	1.39%	2.29%
Palestine	3	0	3	18	0	18	0.29%	0.00%	0.28%	
Qatar	9	0	9	54	0	54	0.88%	0.00%	0.83%	

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Final sample distributions for the whole sample period by regions and countries (continued)

Region	Country	Number of Banks			Total Observations			Percentage		
		Conventional Banks	Islamic Banks	Full Sample	Conventional Banks	Islamic Banks	Full Sample	Conventional Banks	Islamic Banks	Full Sample
Europe	Saudi Arabia	10	1	11	60	6	66	0.98%	1.39%	1.01%
	Syria	12	1	13	72	6	78	1.18%	1.39%	1.19%
	Tunisia	10	0	10	60	0	60	0.98%	0.00%	0.92%
	Turkey	18	3	21	108	18	126	1.77%	4.17%	1.93%
	UAE	20	0	20	120	0	120	1.96%	0.00%	1.83%
	Armenia	2	0	2	12	0	12	0.20%	0.00%	0.18%
	Austria	4	0	4	24	0	24	0.39%	0.00%	0.37%
	Bosnia and Herzegovina	14	1	15	84	6	90	1.38%	1.39%	1.38%
	Bulgaria	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Croatia	7	0	7	42	0	42	0.69%	0.00%	0.64%
	Czech	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Denmark	18	2	20	108	12	120	1.77%	2.78%	1.83%
	Finland	4	0	4	24	0	24	0.39%	0.00%	0.37%
	France	4	0	4	24	0	24	0.39%	0.00%	0.37%
	Georgia	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Germany	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Greece	4	0	4	24	0	24	0.39%	0.00%	0.37%
	Hungary	2	0	2	12	0	12	0.20%	0.00%	0.18%
	Iceland	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Ireland	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Italy	15	3	18	90	18	108	1.47%	4.17%	1.65%
	Lithuania	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Macedonia	10	0	10	60	0	60	0.98%	0.00%	0.92%
	Malta	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Montenegro	5	2	7	30	12	42	0.49%	2.78%	0.64%
	Netherlands	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Norway	4	0	4	24	0	24	0.39%	0.00%	0.37%
	Poland	10	0	10	60	0	60	0.98%	0.00%	0.92%
	Portugal	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Moldova	5	0	5	30	0	30	0.49%	0.00%	0.46%
	Romania	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Russia	36	1	37	216	6	222	3.54%	1.39%	3.39%
Serbia	3	1	4	18	6	24	0.29%	1.39%	0.37%	
Slovakia	5	0	5	30	0	30	0.49%	0.00%	0.46%	
Spain	5	1	6	30	6	36	0.49%	1.39%	0.55%	
Sweden	3	0	3	18	0	18	0.29%	0.00%	0.28%	
Switzerland	4	0	4	24	0	24	0.39%	0.00%	0.37%	
Ukraine	30	3	33	180	18	198	2.95%	4.17%	3.03%	

Final sample distributions for the whole sample period by regions and countries (continued)

Region	Country	Number of Banks			Total Observations			Percentage		
		Conventional Banks	Islamic Banks	Full Sample	Conventional Banks	Islamic Banks	Full Sample	Conventional Banks	Islamic Banks	Full Sample
America and the Caribbean	UK	2	1	3	12	6	18	0.20%	1.39%	0.28%
	Argentina	4	0	4	24	0	24	0.39%	0.00%	0.37%
	Bermuda	2	1	3	12	6	18	0.20%	1.39%	0.28%
	Bolivia	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Brazil	14	2	16	84	12	96	1.38%	2.78%	1.47%
	Canada	8	1	9	48	6	54	0.79%	1.39%	0.83%
	Chile	5	1	6	30	6	36	0.49%	1.39%	0.55%
	Colombia	7	0	7	42	0	42	0.69%	0.00%	0.64%
	Costa Rica	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Ecuador	5	1	6	30	6	36	0.49%	1.39%	0.55%
	El Salvador	6	2	8	36	12	48	0.59%	2.78%	0.73%
	Jamaica	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Mexico	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Panama	0	1	1	0	6	6	0.00%	1.39%	0.09%
	Peru	13	3	16	78	18	96	1.28%	4.17%	1.47%
	Trinidad and Tobago	2	0	2	12	0	12	0.20%	0.00%	0.18%
Other parts of the world	USA	74	9	83	444	54	498	7.27%	12.50%	7.61%
	Venezuela	4	1	5	24	6	30	0.39%	1.39%	0.46%
	Australia	6	0	6	36	0	36	0.59%	0.00%	0.55%
	Benin	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Botswana	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Burkina Faso	2	0	2	12	0	12	0.20%	0.00%	0.18%
	Cape Verde	2	0	2	12	0	12	0.20%	0.00%	0.18%
	Cote D'Ivoire	2	2	4	12	12	24	0.20%	2.78%	0.37%
	Gambia	1	1	2	6	6	12	0.10%	1.39%	0.18%
	Ghana	3	0	3	18	0	18	0.29%	0.00%	0.28%
	Kenya	4	0	4	24	0	24	0.39%	0.00%	0.37%
	Malawi	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Mali	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Mauritius	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Namibia	1	0	1	6	0	6	0.10%	0.00%	0.09%
	Niger	1	0	1	6	0	6	0.10%	0.00%	0.09%
Nigeria	10	0	10	60	0	60	0.98%	0.00%	0.92%	
Rwanda	2	0	2	12	0	12	0.20%	0.00%	0.18%	
Senegal	1	0	1	6	0	6	0.10%	0.00%	0.09%	
South Africa	1	0	1	6	0	6	0.10%	0.00%	0.09%	
Sudan	1	0	1	6	0	6	0.10%	0.00%	0.09%	

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Final sample distributions for the whole sample period by regions and countries (continued)

Region	Country	Number of Banks			Total Observations			Percentage		
		Conventional Banks	Islamic Banks	Full Sample	Conventional Banks	Islamic Banks	Full Sample	Conventional Banks	Islamic Banks	Full Sample
	Uganda	2	0	2	12	0	12	0.20%	0.00%	0.18%
	Tanzania	3	1	4	18	6	24	0.29%	1.39%	0.37%
	Zambia	2	0	2	12	0	12	0.20%	0.00%	0.18%
	Zimbabwe	1	0	1	6	0	6	0.10%	0.00%	0.09%
Total	116	1018	72	1090	6108	432	6540	100.00%	100.00%	100.00%

Appendix B. Variable definitions

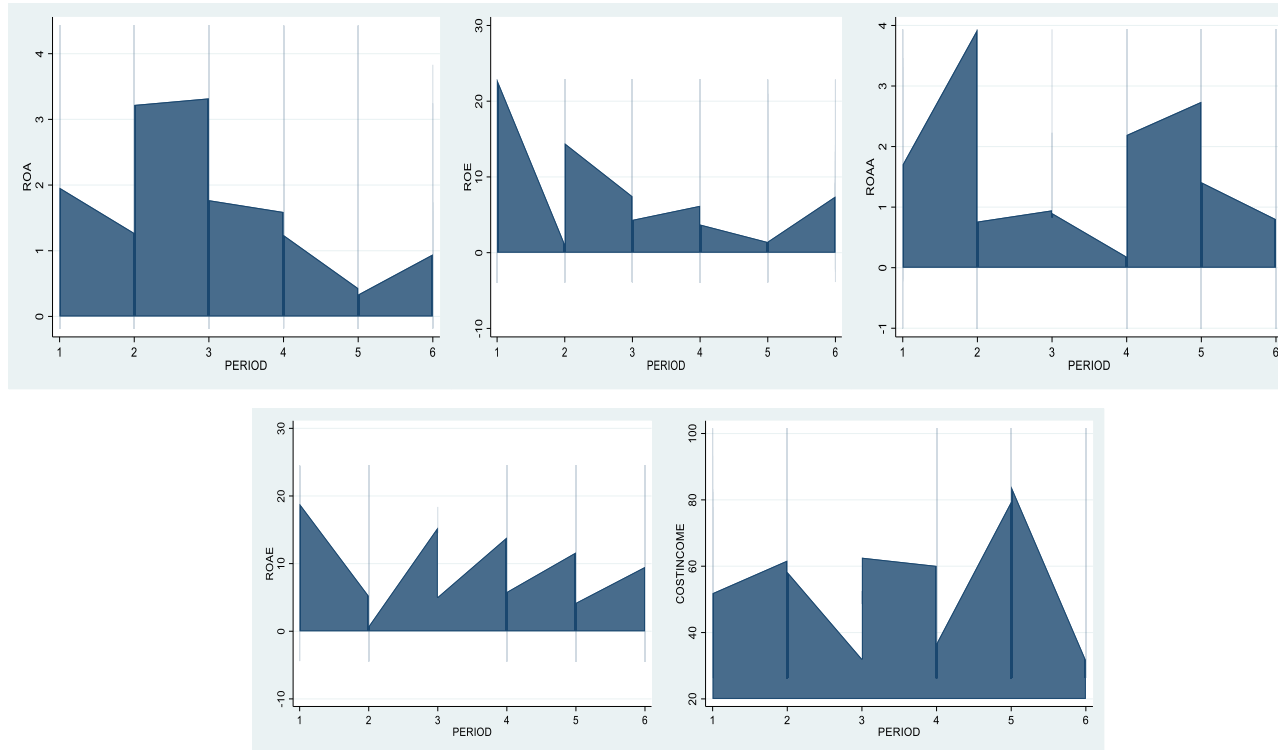
Variables	Abbreviations	Definitions
Return on Assets	ROA	Net income scaled by total assets
Return on Equity	ROE	Net income scaled by total Equity
Return on Average Assets	ROAA	Net income scaled by average total assets
Return on Average Equity	ROAE	Net income scaled by average total equity
Cost to Income	Cost/Income	Cost to Income ratio
Tobin's Q	LnQ	Tobin's Q ratio in the form of natural logarithm. It is computed by the sum of a bank total debt and market value of equity, scaled by its book value of total assets. Higher value of LnQ implies higher forward-looking market valuation.
Market to Book Value	MV/BV	Market value of equity scaled by book value of equity. Higher value of MV/BV implies higher current market valuation.
Market Value of Equity	LogMV	Market value of equity in the natural logarithm form. Higher value of LogMV implies higher current market valuation.
Insolvency Risk	LogZscore	Z-score in the natural logarithm form. It is defined as the distance to default and estimated by a sum of ROA and equity to assets, all divided by the standard deviation of ROA. The greater value of LogZscore implies lower default risk.
Credit Risk	NP/Loan	Non-performing loans scaled by total loans. The higher value of NP/Loan implies higher credit risk.
Liquidity Risk	LA/DSF	Liquidity assets scaled by bank's deposits and short-term funding. The higher value of LA/DSF implies lower liquidity risk.
Operational Risk	SDROA	Standard deviation of ROA. The greater value of SDROA suggests greater operational risk.
Asset Risk	ROA/SDROA	ROA scaled by the SDROA. The greater value of ROA/SDROA suggests lower asset risk.
Covid-19 dummy	Covid-19	Denotes value of one if the observed period is either first or second quarter of 2020, and zero otherwise.
Islamic bank dummy	Islamic	Denotes value of one if the observed bank is classified as Islamic banks, and zero otherwise.
Bank Size	LogTA	Total assets in the natural logarithm form
Bank Age	LogAge	Bank age in the natural logarithm form
Bank Leverage	Debt/TA	Total debt scaled by total assets
Big 4 Audited dummy	Big4	Denotes value of one if the observed bank is audited by a Big4 company, and zero otherwise.

Variable definitions (continued)

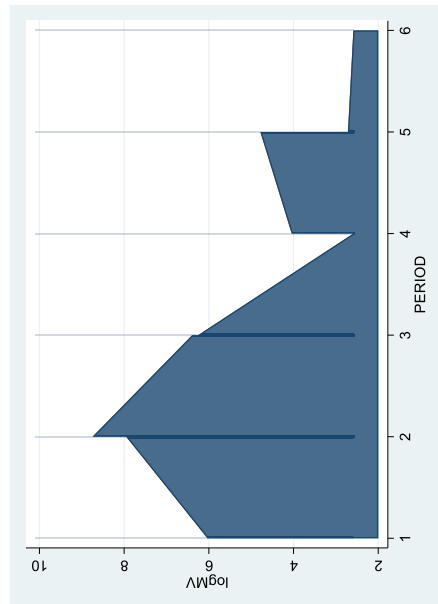
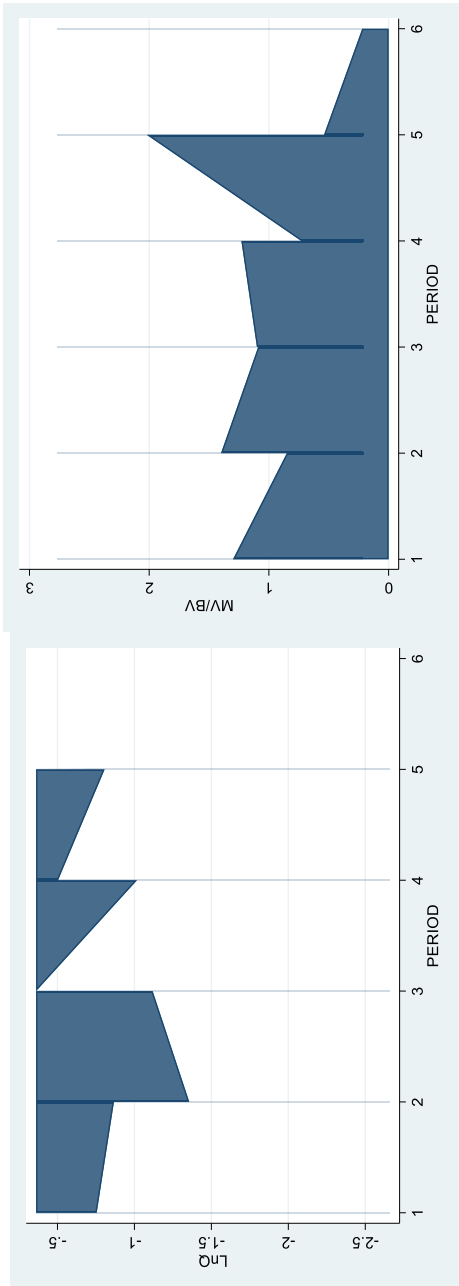
Variables	Abbreviations	Definitions
Cash to total assets	Cash/TA	Cash scaled by total assets
Capital expenditure to total assets	Capex/TA	Capital expenditures scaled by total assets
GDP per capita	LogGDP/capita	Gross domestic products per capita, in the natural logarithm form
Average country governance index	Country_Gov	The average value of six key country-governance measures consisting of corruption, government effectiveness, political stability, and regulatory quality, the rule of law, and voice and accountability.

Appendix C

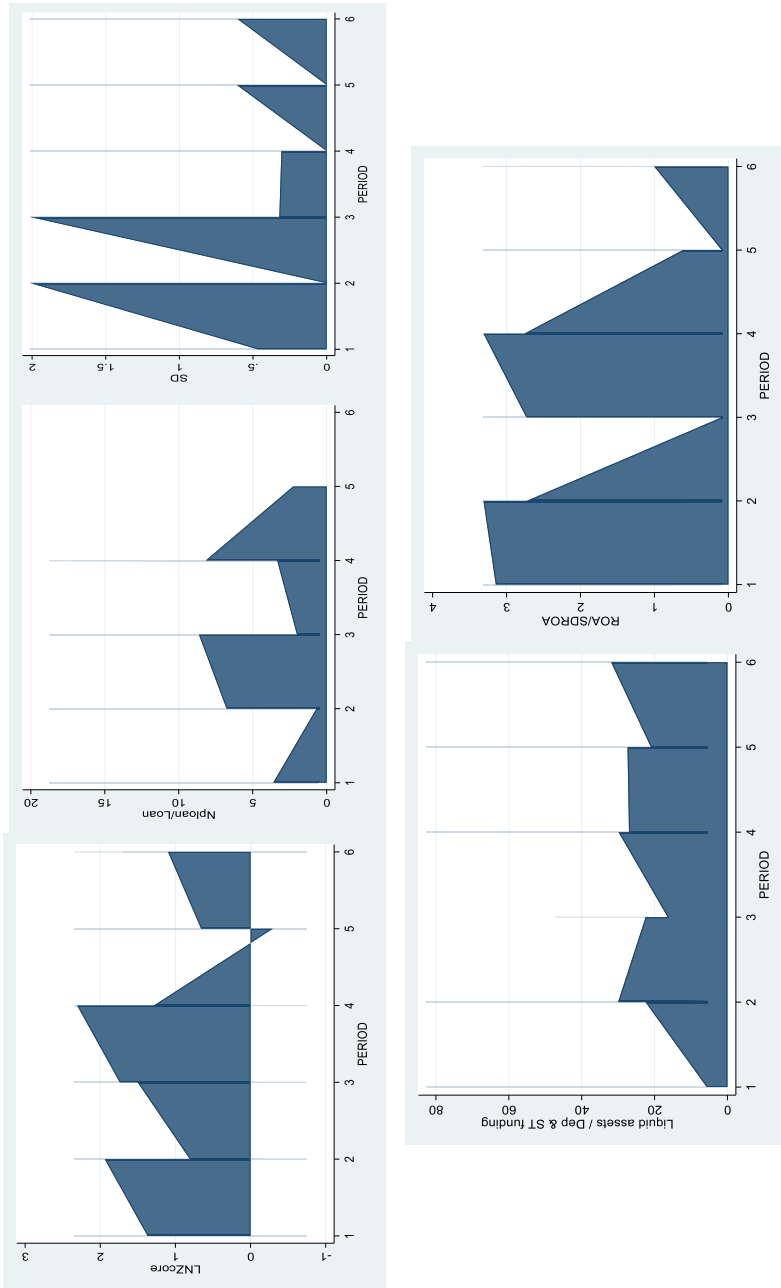
a: Average bank accounting-based performance by quarterly periods.



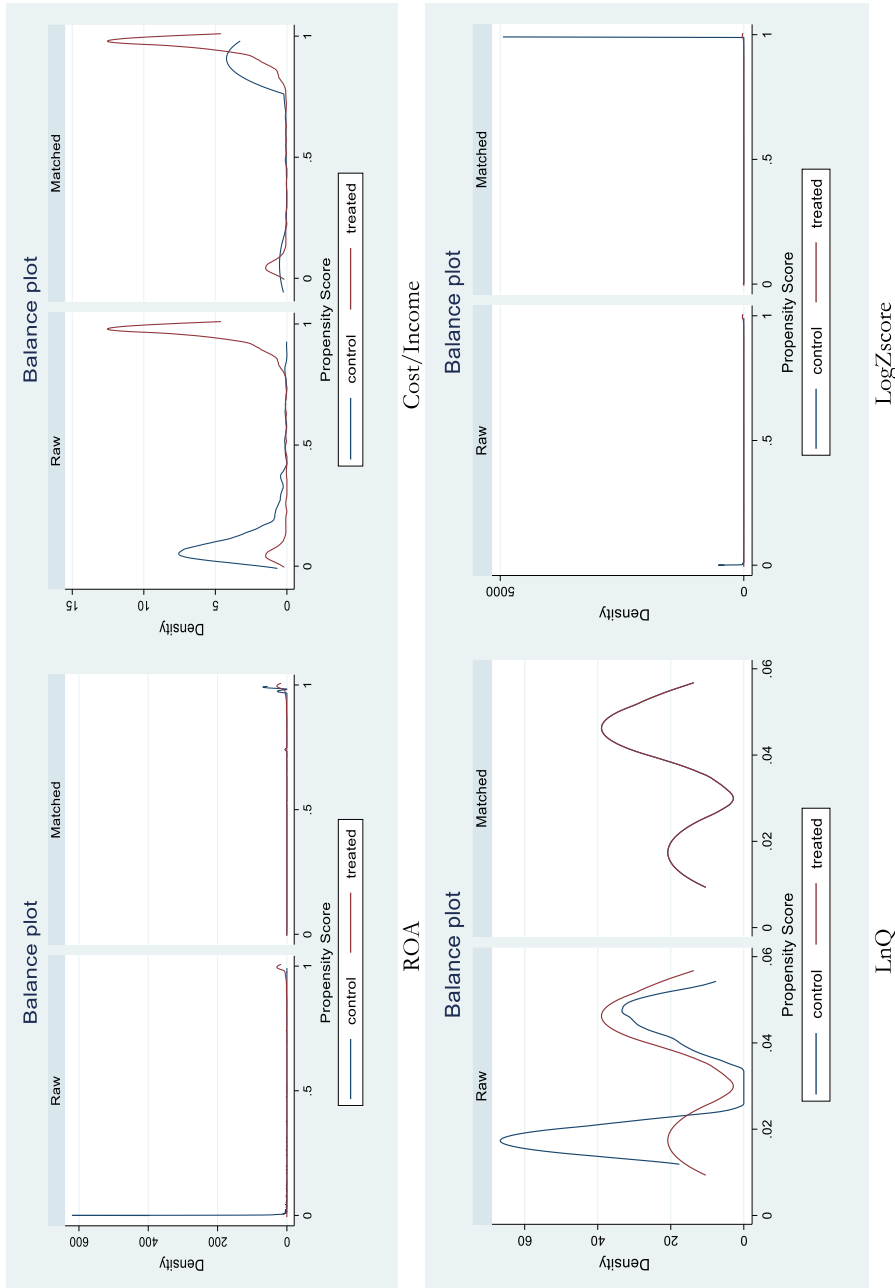
b: Average bank market-based performance by quarterly periods.



c: Average bank financial stability by quarterly periods.



Appendix D. Distributions of propensity score before and after matching



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