Bank performance and financial stability during the COVID-19 pandemic: lessons from the MENA region

Miroslav Mateev
Department of Research, Abu Dhabi School of Management, Abu Dhabi, United Arab Emirates
Ahmad Sahyouni
Higher Institute for Administrative Development, Damascus University, Damascus, Syrian Arab Republic
Syed Moudud-Ul-Huq
Mawlana Bhashani Science and Technology University, Tangail, Bangladesh, and
Kiran Nair
College of Business, Abu Dhabi University, Abu Dhabi, United Arab Emirates

Received 13 July 2023
Revised 18 November 2023
13 January 2024
20 January 2024
Accepted 3 February 2024

Abstract

Purpose – This study investigates the role of market concentration and efficiency in banking system stability during the COVID-19 pandemic. We empirically test the hypothesis that market concentration and efficiency are significant determinants of bank performance and stability during the time of crises, using a sample of 575 banks in 20 countries in the Middle East and North Africa (MENA).

Design/methodology/approach – The main sources of bank data are the BankScope and BankFocus (Bureau van Dijk) databases, World Bank development indicators, and official websites of banks in MENA countries. This study combined descriptive and analytical approaches. We utilize a panel dataset and adopt panel data econometric techniques such as fixed/random effects and the Generalized Method of Moments (GMM) estimator.

Findings – The results reveal that market concentration negatively affects bank profitability, whereas improved efficiency further enhances bank performance and contributes to the banking sector's overall stability. Furthermore, our analysis indicates that during the COVID-19 pandemic, bank stability strongly depended on the level of market concentration, but not on bank efficiency. However, more efficient banks are more profitable and stable if the banking institutions are Islamic. Similarly, Islamic banks with the same level of efficiency demonstrated better overall financial performance during the pandemic than their conventional peers did.

Research limitations/implications – The main limitation is related to the period of COVID-19 pandemic that was covered in this paper (2020–2021). Therefore, further investigation of the COVID-19 effects on bank profitability and risk will require an extended period of the pandemic crisis, including 2022.

Practical implications – This study provides information that will enable bank managers and policymakers in MENA countries to assess the growing impact of market concentration and efficiency on the banking sector stability. It also helps them in formulating suitable strategies to mitigate the adverse consequences of the COVID-19 pandemic. Our recommendations are useful guides for policymakers and regulators in countries where Islamic and conventional banking systems co-exist and compete, based on different business models and risk management practices.

Originality/value – The authors contribute to the banking stability literature by investigating the role of market concentration and efficiency as the main determinants of bank performance and stability during the COVID-19 pandemic. This study is the first to analyze banking sector stability in the MENA region, using both individual and risk-adjusted aggregated performance measures.

Keywords Efficiency, Profitability, Concentration, COVID-19 pandemic, Bank stability

Paper type Research paper

JEL Classification — D40, G21, G28, L11

EuroMed Journal of Business

1450-2194
DOI 10.1108/EMJB-07-2023-0182

1. Introduction

This study investigates the effects of banking market concentration and efficiency on bank performance and stability in the Middle East and North Africa (MENA) region. The global economic crisis resulting from the COVID-19 pandemic has triggered another financial crisis. Capital markets have been affected worldwide, as evident from the remarkable drop in stock market returns and bond yields. Moreover, the pandemic impacted "institutions and individuals who may experience liquidity stress, including limited access to credit" (Deloitte Insights, 2020, p. 2). Consequently, the probability of default for financial institutions worldwide has increased significantly. Therefore, investigating banking sector stability in the context of the current global (COVID-19) crisis is an important issue for both researchers and policymakers.

Economic literature emphasizes that market competition and concentration are the main factors affecting the performance of the banking industry. For example, the efficient structure (ES) hypothesis predicts that in concentrated market structures, more dominant banks achieve higher profitability with an increase in efficiency. Despite the theory advancement, there is a research gap in understanding the specific impact of market concentration and efficiency on bank stability, especially in the developing context of the MENA region. Our study focuses on the MENA region for two reasons. *First*, a growing number of empirical studies have examined the impact of the COVID-19 outbreak on banking sector stability in different countries and regions (Barua and Barua, 2021; Feyen *et al.*, 2021; Colak and Öztekin, 2021; Miklaszewska *et al.*, 2021; Xie *et al.*, 2021; Borri and di Giorgio, 2021; Kapan and Minoiu, 2021; Mateev *et al.*, 2022b). However, much less attention has been given to different banking systems, namely Islamic and conventional banking systems that co-exist in developing regions, such as MENA. Our study aims to fill this gap by examining the main factors (i.e. concentration and efficiency) that affect bank performance and stability during the COVID-19 pandemic.

Second, most studies focusing on banking sector stability highlight the effects of efficiency on bank performance (Isnurhadi *et al.*, 2021; Mirzaei *et al.*, 2022; Mateev *et al.*, 2022b). However, prior research has not examined the effect of market concentration on bank stability and the risk of failure, which significantly increased during the COVID-19 pandemic. Simultaneously, banking market concentration in the MENA region is expected to play a significant role in enhancing bank stability. This phenomenon can be attributed to the rapid pace of bank consolidation observed in many Middle East and North Africa (MENA) countries. This trend resulted in a decrease in the total number of banks and an increase in market concentration (Hamadi and Awdeh, 2020). Therefore, it is important to understand the influence of market concentration and efficiency on bank stability before and during the pandemic. Such an analysis requires further investigation of the "competition-efficiency-stability paradigm" in the specific context of banking systems in the MENA region. To address this issue, we examine the relationship between concentration, efficiency, and bank stability using a large dataset of 575 banks in 20 MENA countries.

When analyzing MENA banks' performance, certain issues deserve specific attention. First, previous studies highlight that the effects of competition and efficiency are particularly pronounced in Islamic Banks (IBs). This is partly attributed to the fact that IBs demonstrated higher efficiency levels and stability than their conventional counterparts during the pandemic outbreak (Mateev *et al.*, 2023). Further investigation of competitive IBs performance during the pandemic will shed light on the relative advantages of the Islamic banking system compared with the conventional banking (CB) system. Second, MENA countries with dominant Islamic banking markets have seen an increase in concentration levels as a result of the COVID-19 pandemic, similar to other developing regions (see, e.g. Miklaszewska *et al.*, 2021). Because of these dynamics, IBs operating in concentrated markets exhibit higher levels of financial stability, indicating that they may be more resilient to the

pandemic crisis than their traditional peers. Therefore, investigating the determinants of the financial soundness of different banking systems (Islamic and conventional) in the MENA region during the pandemic provides new insights into the banking stability paradigm. Finally, the significance of Islamic finance and banking in the post-COVID-19 period has emerged as a pivotal factor driving economic recovery and growth in the MENA region (Hassan *et al.*, 2020; Syed *et al.*, 2020). Consequently, the insights derived from our analysis provide valuable guidance for regulators and policymakers in countries and regions with dominant Islamic banking markets.

To investigate the effects of market concentration and efficiency on bank performance and stability, we use a large dataset of 575 banks located in 20 MENA countries over the 2006–2021 period. We employed random effects (RE) specifications consistent with Aslam *et al.* (2020) and Abdulla and Ebrahim (2022). Following prior research, we estimate RE models with "clustered standard errors to account for the possibility of heteroscedasticity and autocorrelation" (Abdulla and Ebrahim, 2022, p. 245). In our robustness tests, we also applied the one-step Generalized Method of Moments (GMM) estimation approach, which provides more accurate and robust results (Tan *et al.*, 2017; Otero *et al.*, 2020; Mateev *et al.*, 2022b). Both tests indicate that our results are robust to alternative specifications and model constructions.

Our study contributes to empirical literature on financial stability in several ways. *First*, prior studies that focus on banking sector performance have investigated the role of specific bank characteristics such as bank size, capital adequacy, liquidity, and credit risk (Ali *et al.*, 2011; Berger and Bouwman, 2013; Tan, 2016). However, recent studies have considered the effects of competition and efficiency on bank performance and stability (Cristian *et al.*, 2020; Hamadi and Awdeh, 2020; Mateev *et al.*, 2022b) [1]. They reported a positive association between bank performance and efficiency levels (Assaf *et al.*, 2019; Mirzaei *et al.*, 2022) but failed to provide conclusive evidence on the role of banking market concentration. To the best of our knowledge, no empirical study has addressed the importance of this factor during the COVID-19 pandemic in the MENA region. Therefore, we contribute to the literature on bank stability by showing that concentrated markets play a significant role in explaining bank performance and stability in times of crisis.

Second, much of the empirical literature in this area suggests that efficiency helps banks increase their profitability and financial stability and overcome the negative impact of financial crises (Cristian *et al.*, 2020; Mirzaei *et al.*, 2022). Conversely, some studies consider more efficient banks less profitable than their low-efficiency counterparts (Kozak, 2021). Most of these studies employ either market indicators or accounting ratios as performance indicators. Following Miklaszewska *et al.* (2021), we adopted a novel approach and included aggregate performance measures in our analysis. This is a relevant approach because using "aggregate stability and risk-adjusted performance measures" (Miklaszewska *et al.*, 2021, p. 10) improves the reliability of financial stability analysis. We find that, in addition to concentration, efficiency is the main driving force of bank stability and the overall financial performance of banks in the MENA region.

Third, an increasing number of studies have focused on the performance and financial stability of banks within a dual banking system comprising Islamic and conventional banking institutions (Abdelsalam *et al.*, 2022; Elnahass *et al.*, 2021; Elnahass *et al.*, 2022; Mateev *et al.*, 2022b). We further investigated whether there is a strong differential impact of concentration and efficiency on IBs performance, with a primary focus on the MENA region. Specifically, we aim to determine whether these effects depend on the type of business model used by different banks in MENA countries and whether they are more pronounced during the COVID-19 period. Our main finding is that the bank consolidation caused by the recent global crisis might lead to an increase in the financial stability of the entire banking sector, with more benefits accruing to Islamic banking institutions because of their operations within highly regulated environments guided by the Sharia's principles. However, further increases

in operational efficiency do not necessarily improve bank performance. This effect depends on the bank's business model. For instance, better profitability and stability are associated with improved efficiency only if the banking institutions are Islamic.

Finally, prior research has investigated the relationship between bank capital, efficiency, and risk-taking behavior, with an emphasis on IBs (Isnurhadi *et al.*, 2021). However, the relationship between market concentration and bank capitalization remains unclear. This study is the first to analyze the impact of COVID-19 on banks' capital ratios in the MENA region. We find that during the COVID-19 pandemic, both efficiency and market capitalization had a strong positive influence on banks' capitalization but a negative impact on leverage. These effects are not significantly different between the two banking systems. The negative impact of non-interest income on banks' capital ratios indicates that the traditional business model is still dominant, and MENA banks do not rely heavily on non-interest revenue sources as part of their risk diversification strategy during the COVID-19 pandemic.

The remainder of this paper is organized as follows. Section 2 summarizes the outcomes of the most relevant studies, akin to the objectives of this study, and presents the main hypotheses based on this analysis. Section 3 describes the dataset and empirical model. Section 4 presents the results obtained from the regressions and their interpretation. Section 5 describes the robustness checks and alternative specifications. Finally, Section 6 presents conclusions and directions for future research.

2. Theoretical background and hypotheses

2.1 The impact of concentration and efficiency on bank stability

Empirical literature frequently refers to competition in the banking industry as one of the main factors affecting efficiency and stability. Two theoretical models explain the influence of competition on bank behavior. According to the first model, initially developed by Mason (1939), the Structure-Conduct-Performance (SCP) theory seeks to explain different aspects of a firm's conduct and performance in terms of the structural characteristics of the market in which they operate. The most important insight of the SCP paradigm is that the more concentrated a market, the easier it is for firms to operate in an uncompetitive manner (Leon, 2014). Therefore, under the SCP hypothesis, "an increase in concentration is regarded as increasing collusive opportunities between firms, and hence would lead to higher prices and profitability" (Leon, 2014, p. 12). The second model, the so-called efficient structure (ES) hypothesis (Demsetz, 1973; Peltzman, 1977), "entails the notion that the structure of the market may reflect differences in efficiency rather than a competitive situation" (Leon, 2014, p. 12). The ES hypothesis "also predicts that in concentrated market structure, the more dominant banks get the higher profitability with the increase of the efficiency" (Cristian *et al.*, 2020, p. 408). In other words, "a market becomes more efficient as it becomes more concentrated" (Tetsushi *et al.*, 2014, p. 1).

Based on the predictions of the efficient structure (ES) hypothesis that more efficient banks obtain both higher profitability and market share, we assume that efficiency plays a significant role in explaining banks' profitability and risk-taking behavior. However, no previous study has examined this effect during the COVID-19 pandemic in the context of Islamic banking in the MENA region. To fill this gap, we focus on efficiency as an important factor driving bank risk and profitability together with market concentration as a complementarity factor. Our analysis of the role of concentration in enhancing bank stability is supported by predictions of the structure-conduct-performance (SCP) paradigm. The SCP hypothesis suggests that "banks are able to extract monopolistic rents in concentrated markets by their ability to offer lower deposit rates and charge higher loan rates" (Goldberga and Rai, 1996, p. 746). Empirical literature that tests SCP predictions

reports a positive relationship between profitability and market concentration, "indicating non-competitive behavior in concentrated markets" (Goldberga and Rai, 1996, p. 746). For instance, Miklaszewska *et al.* (2021) who investigated the impact of the pandemic and 2020 economic crisis on banking system stability in Central, Eastern, and Northern European (CENE) countries confirmed that bank concentration positively influences profitability but has an opposite effect on cost inefficiency, whereas its effect on bank stability is insignificant. Furthermore, Kozak and Wierzbowska (2021) reported that "the relationship between concentration and stability is ambiguous and that the concentration may both improve and deteriorate the quality of banks' loan portfolio" (p. 40). To fill this gap, we tested the prediction that market concentration has a strong influence on bank performance and stability using a sample of 575 banks from 20 MENA countries.

A significant amount of research has focused on investigating the impact of capital rather than competition and efficiency on bank stability. For example, Isnurhadi *et al.* (2021) "confirmed previous findings that bank capital positively affects bank stability (the natural logarithm of the Z-score) and negatively affects credit risk (loan loss provision to total liabilities). The findings show that efficiency has the same effect (p. 1). Furthermore, "the interaction test of bank capital and efficiency shows that efficiency encourages banks to reduce risk, including when bank capital is relatively low" (Isnurhadi *et al.*, 2021, p. 1). However, previous research failed to investigate the impact of efficiency on bank stability in terms of proper capitalization. To fill this gap, we assess the impact of efficiency (and market concentration) on the capital adequicy of banks in the MENA region. We also explore whether efficiency and concentration effects differ depending on the type of a bank's business model (i.e. Islamic or conventional). The main argument is that CBs and IBs share similarities in their banking practices, but their objectives and operational nature differ significantly, including the pricing of their products. The distinction between the two banking systems is rooted in the fact that CBs are compelled to adhere to local rules, regulations, and Basel requirements, while IBs are "required to comply with Shariah principles in both the design of products, and also in continually monitoring compliance to these rules from this additional supervisory layer" (Sun *et al.*, 2017, p. 195). According to Mirzaei *et al.* (2022) and Viphindrartin *et al.* (2022), IBs' unique financial structures may account for their greater resilience to the COVID-19 pandemic than that of their conventional peers.

An increasing number of studies compare the performance and financial stability of banks within a dual banking system comprising Islamic and conventional banking institutions. For instance, Abdelsalam *et al.* (2022) present compelling evidence that banks engaged in asset securitization generally exhibit higher risk levels and reduced financial stability. Notably, an examination of various securitization models reveals a distinct pattern: while conventional securitization is associated with significantly lower bank stability, Islamic securitization is linked to a decrease in overall bank risk. Elnahass *et al.* (2021) demonstrated that the COVID-19 pandemic has negatively affected banks' financial performance. These findings hold consistently across different regions, countries (including the US and China), and bank-level characteristics. Additionally, the study identifies a significant differential impact of the pandemic on alternative banking systems (i.e. conventional and Islamic). Finally, Trinh *et al.* (2022) explored the connection between bank tail risk and the ongoing COVID-19 pandemic. The findings reveal that both the systematic and idiosyncratic components of bank tail risk increased during the pandemic, although this effect is weaker for stronger banks characterized by higher profitability, greater market valuation, and lower stock volatility. The authors concluded that financial stability serves as a 'vaccine' against bank tail risk in the context of the pandemic. To distinguish ourselves from these studies, we focus our analysis on banking systems in the MENA region because our findings may provide strong policy implications for government authorities and banking regulatory institutions in other developing regions.

2.2 Hypotheses development

Empirical studies that investigate the impact of market concentration and efficiency on bank profitability test whether the efficient-structure (ES) hypothesis or structure-conduct-performance (SCP) paradigm holds. For example, Tan *et al.* (2017), using a sample of Chinese commercial banks over the period 2003–2013, confirm that the Chinese banking industry is in line with the SCP hypothesis. Specifically, the study concluded that "cost efficiency is shown to have a significant and negative impact on bank profitability (ROA), but positive impact on ROE and NIM" (Tan *et al.*, 2017, p. 12). Moreover, the effect of concentration ratio on profitability is significantly negative, indicating that "lower competition leads to higher bank profitability which is different from the results reported from Lerner index" (p. 13). In the MENA region, like in other developing regions, banking market concentration is expected to play a significant role in explaining bank profitability. This is due to the fact that "bank consolidations in many Middle East and North Africa (MENA) countries have been proceeding at a rapid pace, leading to a decline in the number of banks and an increase in market concentration" (Hamadi and Awdeh, 2020, p. 1). Recently, Mateev *et al.* (2022b) tested whether the assumptions of the EM hypothesis hold for MENA banks and reported that, in concentrated markets, increased marker power and less aggressive competition positively influence bank profitability when measured by earnings to total assets. In contrast, Otero *et al.* (2020) reported that "cost efficiency is positively related to bank performance, but the level of concentration and market share has a negative influence on the former" (p. 1). Thus, the evidence is inconclusive.

Despite the extensive research literature on this topic, the analysis of the impact of market concentration and efficiency on bank profitability during the COVID-19 pandemic has received little attention. While previous studies have confirmed that efficiency has a positive impact on bank performance during the pandemic outbreak (Mirzaei *et al.*, 2022; Mateev *et al.*, 2022b), the role of market concentration in explaining bank profitability and risk remains ambiguous. In line with the predictions of the SCP hypothesis, we expect a positive association between concentration and profits. However, the rise in banking market concentration due to the COVID-19 pandemic will most likely affect the efficiency of bank operations and their ability to finance the economy (Kozak and Wierzbowska, 2021). Thus, the positive effect of efficiency on bank profitability is expected to weaken with the increased concentration during the pandemic. To test the validity of these assumptions for the MENA region, we formulated the following hypotheses:

H1a. Market concentration and efficiency have a positive impact on bank profitability.

H1b. These effects are expected to be less pronounced during the COVID-19 pandemic.

Most previous studies provide evidence of the competition-stability nexus. Supporters of the competition-stability theory or risk-shifting views (Boyd and De Nicolo, 2005; Boyd *et al.*, 2006; Schaeck *et al.*, 2006) argue that concentrated banks (with more market power) "tend to increase their interest rates; in turn, high rates of interest can lead to moral hazard problems by increasing the non-performing loan ratio of banks. So, under this theory, competition increases financial stability" (Mateev *et al.*, 2022a, p. 1). However, empirical literature that tests the predictions of this theory reports contradictory results. For example, Anginer *et al.* (2014), who analyzed "the impact of bank competition on systemic stability" (p. 1) using a large sample of banks located in 63 countries, provide evidence in support of the competition-stability nexus. The authors argue that "greater competition encourages banks to take on more diversified risks, making the banking system less fragile to shocks" (Anginer *et al.*, 2014, p. 25). By contrast, Miklaszewska *et al.* (2021) who examined banking sector performance in Central and Eastern European regions during the pandemic, found no relationship between market concentration and a bank's probability of default. Finally, Mateev *et al.* (2022a)

analyzed banking systems in the MENA region and reported a positive and nonlinear association between concentration and bank stability (measured by the Z-score) for CBs but negative for IBs. The positive impact of concentration is supported by the arguments of competition-fragility hypothesis [2].

Based on the assumptions of the competition-stability nexus, we may assume that efficient banks operating in less competitive markets are inclined to take more risk and thus become vulnerable to financial shocks. Therefore, greater competition in less competitive markets encourages banks to diversify their risks, thereby enhancing their financial stability. Moreover, a reasonable risk-taking behavior should be expected during the COVID-19 pandemic when the banking system is more fragile and vulnerable to financial shocks. However, with the increased consolidation in the banking sector caused by the pandemic, concentrated banks may be inclined to adopt riskier strategies to boost their profits, thus increasing the size of non-performing loans (NPLs) and the overall risk of the banking system. Therefore, we may expect the positive effect of market concentration (and efficiency) on bank stability to weaken during the pandemic. To test the validity of these assumptions for the MENA region, we formulated the following hypotheses:

H2a. Bank stability is positively associated with market concentration and efficiency.

H2b. This relationship is expected to be less pronounced during the COVID-19 pandemic.

Previous studies reported that MENA banks entered the 2020 economic crisis with strong fundamentals and high capital-adequacy ratios. The significant improvement in capital ratios of banks that have been seen in many regions and countries was due to "adjustment strategies that banks adopted in the various jurisdictions in the period 2007 to 2016 to comply with stricter capital regulation" (Carletti *et al.*, 2020, p. 47). However, there is limited evidence on how efficiency and market concentration affect banks' capitalization levels during the pandemic. For example, Miklaszewska *et al.* (2021) in their analysis of banking sector performance in the CENE region failed to find a significant relationship between market concentration and banks' capital ratios. Moreover, their findings indicate that bank size, loan dynamics, and non-performing loans are negatively correlated with bank capital ratios. In the developing context of the MENA region, the expected consolidation imposed by the pandemic reduces competition and create oligopolistic market structures (Hamadi and Awdeh, 2020). As a result, COVID-19 intensifies the effect of market concentration on banks' capital ratios and hence improve their financial stability. However, prior research failed to provide strong evidence of the role of efficiency in increasing bank stability through proper capitalization. To fill this gap, we compare the impact of efficiency and market concentration on bank capitalization before and during the pandemic. More importantly, our main focus is on the response of banks in the MENA region to the increased concentration during the pandemic. Building on theoretical arguments and the concentrated nature of the MENA banking sector, we formulate the following hypotheses:

H3a. Both market concentration and efficiency are strongly associated with bank capital ratios.

H3b. Both effects are expected to be less pronounced during the COVID-19 pandemic.

Prior research focusing on the performance and financial stability of banks with different business models (i.e. Islamic and conventional) has reported that the COVID-19 pandemic negatively affected the financial performance of either type of banks. However, research has identified a significant differential impact of the pandemic on Islamic banking systems (see, e.g. Abdelsalam *et al.*, 2022; Elnahass *et al.*, 2021; Mateev *et al.*, 2022b). We take a step further by examining the differential impact of concentration and efficiency on IBs performance during COVID-19, with a primary focus on the MENA region. Prior studies suggest that

Islamic banking institutions are less vulnerable than their conventional peers to the COVID-19 pandemic (Alabbad and Schertler, 2022; Aliani *et al.*, 2022). Moreover, it has been reported that the superior performance of IBs during the pandemic was determined by their pre-crisis levels of efficiency (Mirzaei *et al.*, 2022). We may expect that the increased concentraiton during the pandemic might also have a positive effect on IBs performance. However, the question of how concentration and efficiency impact IBs during the COVID-19 pandemic remains unaddressed. To test the validity of these assumptions for the MENA region, we formulated the following hypotheses:

H4a. Market concentration and efficiency effects are more pronounced for Islamic banking institutions.

H4b. These effects are not significantly different between the two banking systems during COVID-19.

3. Data and methodology

3.1 Sample selection

The main sources of our data are the BankScope and BankFocus (Bureau van Dijk) databases, World Bank development indicators, and official websites of banks in MENA countries. Our sample consists of 575 banks located in 20 countries in the MENA region [3], with annual data covering 2006–2021. Banks with missing information for any year during the observation period are excluded. In addition, all observations with negative equity or operating expenses and zero fixed assets are canceled to prevent potential misinterpretations or biases. After cleaning the sample from outliers by eliminating extreme bank-year observations, we arrive at a dataset comprising 575 banks. This dataset includes both Islamic and conventional banks that co-exist in the MENA region. Table 1 presents an overview of the data, showing the distribution of banks by country and type as well as the total number of observations. The number of banks ranged from 8 in Yemen to 54 in Egypt, with an average of 29. All the variables were winsorized at the 1 and 99% levels to mitigate the influence of outliers.

3.2 Empirical specification

The econometric model used to investigate the relationship between market concentration, efficiency, and bank performance is as follows.

$$BP_{it} = \alpha_0 + \beta_1 Concentration_{it} + \beta_2 Concentration_{it} \times COVID-19 + \beta_3 Efficiency_{it} + \beta_4 Efficiency_{it} \times COVID-19 + \beta_5 IB_t + \beta_6 COVID-19 + \psi X_{it-1} + \upsilon_{it} \quad (1)$$

$$BC_{it} = \alpha_0 + \beta_1 Concentration_{it} + \beta_2 Concentration_{it} \times COVID-19 + \beta_3 Efficiency_{it} + \beta_4 Efficiency_{it} \times COVID-19 + \beta_5 IB_t + \beta_6 COVID-19 + \psi X_{it-1} + \upsilon_{it} \quad (2)$$

in model (1), BP_{it} is the measure of financial performance (profitability and risk) of bank i in year t Similarly, BC_{it} in model (2) is the measure of capitalization stability of bank i in year t. Banking market concentration is proxied by the HH-index and the level of efficiency is proxied by the Data Envelopment Analysis (DEA) efficiency score (ES). In addition to the HH index, we use the concentration ratio (the share of the top three banks in the total assets of a country's banking sector, CR3) as the second measure of the banking market concentration. Following Miklaszewska *et al.* (2021), we extend the traditional analysis of bank profitability and capital adequacy ratios [4] by using two aggregate comprehensive measures of bank performance and stability, namely the Multilevel performance score (MLPS) index and the

Table 1. Composition of banks by country

Country/Banks	Total	Number of conventional banks	Number of Islamic banks	Observations (conventional)	Observations (Islamic)	Average no. of years of observations	Observations (all bank)
United Arab Emirates	39	27	12	288	131	15.1	419
Bahrain	51	36	15	277	129	14.6	406
Egypt	54	51	3	504	33	19.4	537
Israel	14	14	0	151	0	5.4	151
Jordan	32	28	4	275	32	11.1	307
Kuwait	44	34	10	340	106	16.1	446
Lebanon	41	38	3	284	16	10.8	300
Oman	24	22	2	213	16	8.3	229
Qatar	19	12	7	115	73	6.8	188
Saudi Arabia	30	23	7	218	53	9.8	271
Iran	33	20	13	113	107	7.9	220
Morocco	23	23	0	211	0	7.6	211
Algeria	18	18	0	153	0	5.5	153
Iraq	53	35	18	257	131	14.0	388
Malta	17	17	0	97	0	3.5	97
Palestine	12	10	2	82	23	3.8	105
Syria	16	13	3	123	33	5.6	156
Tunisia	37	35	2	332	19	12.6	351
Yemen	8	6	2	26	10	1.3	36
Libya	10	9	1	46	3	1.8	49
Total	*575*	*471*	*104*	*4,105*	*915*	*9.0*	*5,020*

Note(s): There are two reasons to include Malta in our dataset. First, Bankfocus Database, which we downloaded data from, includes Malta in the MENA region dataset, see https://bankfocus.bvdinfo.com/. Second, as of January 2021, the World Bank website groups the same set of 21 countries/territories as MENA: Algeria; Bahrain; Djibouti; Egypt, Arab Rep.; Iran, Islamic Rep.; Iraq; Israel; Jordan; Kuwait; Lebanon; Libya; Malta; Morocco; Oman; Qatar; Saudi Arabia; Syrian Arab Republic; Tunisia; United Arab Emirates; West Bank and Gaza; Yemen, Rep., see: https://data.worldbank.org/country/ZQ. Djibouti was excluded due to unavailability of data
The total sample includes 575 banks in 20 countries in the MENA region. The analysis uses country-specific and bank-level data over a period of 16 years (2006–2021). The table indicates the total number of banks, the number of conventional banks and Islamic banks per country, and the average number of years of observation. The last column represents the total number of observations per country and for the whole sample
Source(s): Table created by authors

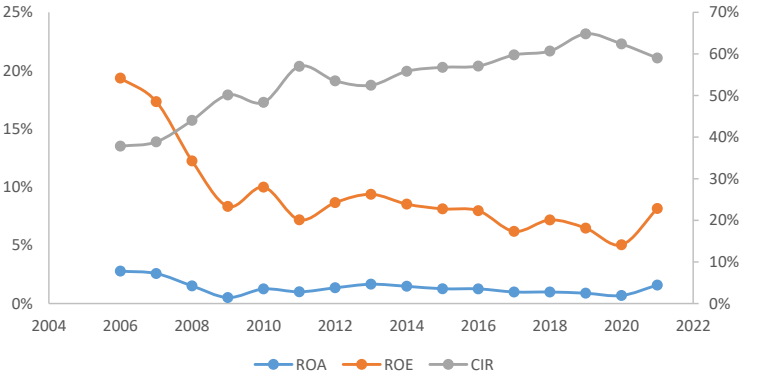
Financial Stability Indicator (FSI). X_{it} is a vector that includes the control variables outlined in Section (3.6). Following Mateev *et al.* (2022b) we include "a crisis time dummy (COVID-19) that takes the value of 1 for the years 2020–2021, and 0 otherwise" (p. 11). In addition, we employ an interaction term between our variables of main interest and an ISLAMIC dummy to study the differential effect on the Islamic banking system. Appendix 1 (Table A1) provides a description of the dependent and explanatory/control variables, and their data sources.

3.3 Dependent variables

Bank profitability is measured using two variables: return on assets (ROA) and return on equity (ROE). These accounting variables have been used in other similar studies (Naceur and Omran, 2011; Kozak and Wierzbowska, 2021; Mateev *et al.*, 2022b). Moreover, they "are considered to be two of the best measures of bank profitability in the related literature" (Abdulla and Ebrahim, 2022, p. 7). We also use the cost-to-income (C/I) ratio to control for "any cross-bank differences in terms of efficiency; a higher value indicates a lower level of efficiency" (Bitar *et al.*, 2016, p. 5). Following Mateev and Bachvarov (2021), we employ the net interest margin (NIM) as an alternative profitability measure. Capital adequacy ratio (CAR), total capital requirements (TCR), and equity to total assets (E/TA) have been used as measures of a bank's capitalization.

Our analysis in Appendix 2 (see Table A2) shows that banks in the MENA region entered the financial crisis of 2020 with a strong capital base, high profitability (ROE around 9%), and moderate cost-to-income (C/I) ratio of approximately 58% in the pre-crisis period (2006–2019). We found strong evidence of accumulated resilience, as demonstrated by the high capitalization levels during the crisis period (TCR of over 29%). Similar to other developing countries, the MENA region has experienced negative consequences from the economic crisis caused by the COVID-19 pandemic, which is expected to have long-term implications for banking institutions. These expectations were confirmed by the data presented in Appendix 2. In analyzing the ratios for 2020–2021, we observed a decline in bank profitability, as measured by ROE (from 9.38% to 5.70%). This decline was observed in almost 60% of the sample countries and was most noticeable in 2020. Moreover, some countries, such as Bahrain, Lebanon, Tunisia, and the United Arab Emirates, have recorded negative figures. For the first two, efficiency also deteriorated, as demonstrated by the remarkable increase in cost inefficiency with C/I ratios of 77.5 and 72.8%, respectively (Table A2). However, profitability and cost efficiency are expected to improve in 2021 (Figure 1).

Moreover, banks in all MENA countries have managed to maintain high capital adequacy ratios in 2020 and 2021. An important assumption of our analysis is that the capitalization



Source(s): Figure created by authors

Figure 1.
Bank profitability (ROA, ROE) and cost efficiency (C/I) in the MENA region (2006–2021)

level should have increased during the COVID-19 period, with the capital adequacy ratio rising from 2020-2021 onwards. Indeed, Table A2 in Appendix 2 indicates that CAR increased during that period, although in some countries, we observed a negative tendency (e.g. Egypt, Palestine, and Qatar). Total capital ratio (TCR) also witnessed an increase from 21.4% before the crisis to 29.4% during the pandemic. Based on the analysis of bank profitability and capital adequacy, we may conclude that the impact of the COVID-19 pandemic in the MENA region was not as profound as in other developing regions (see, e.g. Miklaszewska *et al.*, 2021 for the CENE region). This indicates a high level of resilience of the banking systems in the MENA region (see Appendix 2 for the average performance ratios per country). Our analysis also indicates significant differences in bank performance across MENA countries, with Bahrain, Lebanon, and Tunisia being the most affected countries and Egypt, Kuwait, and the Syrian Arab Republic being the least affected. However, the bank capitalization levels in all the countries remained strong, thereby not raising concerns about financial stability in the MENA region. Thus, our analysis reveals an overall strength of the banking systems in the MENA region during the COVID- 19 pandemic.

3.4 Bank stability and aggregate performance measures

As a measure of bank stability, we compute the Z-score using the following formula: $Z = (ROA + CAR)/\sigma(ROA)$, where "ROA is the return on assets, σ(ROA) is the standard deviation of ROA, and CAR is the capital-to-asset ratio" (Mateev *et al.*, 2021, p. 10). High values of this measure imply a high distance from default or a low default risk.

Previous studies have reported that the effective performance of banking institutions may be measured not only by individual ratios, but also by "aggregate comprehensive indices, taking into account indicators of bank financial strength-performance and capital adequacy, and major risks-credit and liquidity risk" (Miklaszewska *et al.*, 2021, p. 10). Therefore, we extend the traditional performance analysis by using two complex measures of bank stability and risk-adjusted performance: the Multilevel Performance Score (MLPS) and the Financial Stability Indicator (FSI) [5]. The aggregate performance measures (MLPS and FSI) were computed according to the methodology described by Miklaszewska *et al.* (2021). Appendix 2 presents the results of our calculations (Table A3). Aggregate performance measures have either a long-term risk-adjusted nature (MLPS) or short-term stability focus (FSI). Appendix 2 summarizes the results for the stability score (Z-score) and aggregate performance measures (MLPS and FSI) over the 2006–2019 period and compares them with the 2020–2021 figures. Based on the results reported in Table A3, the following conclusions can be drawn.

(1) The results for bank soundness (measured by the Z-score) in the pre-crisis (2006–2019) and crisis (2020–2021) periods indicate an overall improvement in MENA bank stability, which was less affected by the COVID-19 pandemic. The exceptions were Iran, Libya, and Yemen, with Z-scores much below the average, and Palestine with a very high bank stability score.

(2) Regarding the MLPS index, we can conclude that banks in Israel, Morocco, Tunisia, Qatar, Saudi Arabia, and Tunisia demonstrated stable high-performance values. However, steady deterioration in bank performance is observed in Iraq, Lebanon, Libya, and Yemen.

(3) The FSI values were not homogeneous across the samples. For some countries, the values are higher in the 2020–2021 period than in the preceding years (e.g. the Syrian Arab Republic and Yemen), indicating the strong and stable financial positions of banks in these countries. For others (e.g. Iran and Tunisia), we find evidence of substantial credit risk related to the NPL portfolio.

(4) In the majority of the MENA countries included in our analysis, the pandemic has mostly affected bank profitability, while financial stability and bank capitalization remained relatively strong.

3.5 Explanatory variables

Our main explanatory variables are market concentration (proxied by the HH-index) and the efficiency index (see Eq. (1) and Eq. (2)). We applied a non-parametric Data Envelopment Analysis (DEA) to calculate the efficiency index (ES). The DEA technique proposed by Charnes *et al.* (1978) "represents a mathematical programming methodology that is an estimation of measuring relative efficiency score unit of assessment based on the multiple used for inputs to produce multiple outputs" (Hamid *et al.*, 2017, p. 2). DEA scores were computed by country, year, and bank. Our study empirically followed the intermediation approach for inputs and outputs (Chaffai and Hassan, 2019) [6]. The efficiency estimate was produced as an average of the efficiency scores calculated based on three different estimation models (CRS, VRS, and SCALE) [7]. In line with the predictions of efficient structure (EH) hypothesis, we expect bank efficiency to be positively correlated with bank profitability.

Following previous research, we use the HH-index (HHI) to measure the level of banking market concentration. The HHI is calculated by "adding the squares of the market shares of every bank in the market or a country, and it varies between zero (situation of pure and perfect competition) and 10,000 (100^2: monopoly position)" (Hamza and Kachtouli, 2014, p. 35). Our second measure of market concentration is the concentration ratio (CR3) computed as the share of the three largest banks in the total assets of a country's banking industry. The extant literature finds that market concentration can affect banks' profitability and risk, either positively or negatively. For instance, Tan *et al.* (2017) used the Lerner index and 'three-bank' concentration ratio as competition measures in their analysis of bank profitability in the Chinese banking sector. The study finds that "the concentration ratio is significant and negative, indicating that lower competition leads to higher bank profitability, which differs from the results reported for the Lerner index" (Tan *et al.*, 2017, p. 13). However, Agustini and Viverita (2012) report that concentration has a positive effect on bank performance in Indonesia, while González *et al.* (2017) claim a positive association between concentration and bank stability in non-Gulf Cooperation Council (GCC) countries but an opposite effect in GCC countries. Therefore, the significance of this association remains unclear.

3.6 Control variables

Guided by previous studies (Miklaszewska *et al.*, 2021; Mateev *et al.*, 2022b; Mirzaei *et al.*, 2022), we employed several bank-level characteristics identified as significant determinants of bank performance. These include deposits, loans, non-interest income, non-financial loan growth rate, liquid assets, size, capital adequacy ratio, and leverage (equity to total assets). Bank-level attributes are used as control variables in our analysis and are listed in Appendix 1. Prior research identifies size as one of the most commonly used determinants of bank profitability; however, the results are mixed. According to Kozak and Wierzbowska (2021), "larger banks take advantage of economies of scope and provide a broader spectrum of financial products, other than loans and deposits, thereby generating additional revenue streams" (p. 47). However, Sarsour and Daoud (2015) claim that large banks have lower cost efficiency than their smaller counterparts, indicating diseconomies of scale. Following Abdulla and Ebrahim's (2022) findings on the GCC region, we expect a positive relationship between size and bank performance.

Previous empirical studies (Berger and Mester, 1997; Andries and Ursu, 2016; Kozak, 2020) employed the leverage ratio (equity to total assets) as "an input to control for differences in risk preferences across banks" (Kozak, 2020, p. 35). The liquidity ratio (liquid assets to total

assets) was included as an indicator that "banks with more liquid assets are in a better position to reduce their balance sheet and to cope with financing difficulties" (Beltratti and Stulz, 2012, p. 10) [8]. Finally, we used the capital adequacy ratio (CAR) to capture a bank's financial strength (Bitar *et al.*, 2016; Ghanem, 2017). In line with previous studies, we employed three macroeconomic variables - real GDP growth, inflation rate, and domestic credit to the private sector as a percentage of GD - to control for the differences in the macroeconomic environment across our sample countries. The empirical literature provides inconclusive results regarding the impact of these variables on bank profitability. While some authors have found that higher GDP growth contributes to improved efficiency and profitability (Kozak and Wierzbowska, 2021), others have reported a negative influence (Mateev *et al.*, 2022b). Similarly, Pasiouras (2008) claims that inflation may adversely affect bank profitability, whereas Bourke (1989) and Molyneux and Thornton (1992) find a positive correlation between inflation index and bank profitability. Therefore, the significance of this relationship remains unclear. Following Miklaszewska *et al.* (2021), we expect an increase in domestic credit to positively affect bank profitability.

Table 2 presents the results of univariate analysis of bank performance in the MENA region. Bank performance is evaluated for two main periods: pre-crisis (2006–2019) and crisis (2020–2021). The results in the table indicate significant differences in bank risk and profitability between the two periods, as indicated by the *t*-test results in the last column of Table 2. We observe a slight improvement in bank performance during the pandemic period (2020–2021) in terms of profitability (ROA and MLPI) and stability (Z-score) but a deterioration in cost efficiency (C/I) and liquidity position (LA). Credit risk, measured by the ratio of NPLs to total loans, also increased during the COVID-19 pandemic in conjunction with a decline in banks' efficiency levels (from 0.85 to 0.68). Market concentration remained relatively high, with an average concentration ratio of 60%. Finally, we provide evidence that banks in MENA countries significantly decreased their reliance on non-interest income sources during the pandemic (a drop from 9.8% to 4.6%). This trend underscores the dominance of traditional business models in the MENA region. The correlation matrix (not presented here to conserve space) indicates a lack of significant correlation between the dependent and independent (control) variables used in our analysis.

4. Empirical results and discussions

4.1 The effect of concentration and efficiency on bank profitability

We estimate the panel data regressions using the model specifications in Eq. (1) to test our first hypothesis, with bank profitability as the dependent variable. We used two alternative measures of bank profitability (ROA and ROE), and the cost-to-income (C/I) ratio as an indicator of cost efficiency. Table 3 presents the results of the analysis.

As Table 3 shows that the estimated coefficient of the market concentration variable is insignificant and negative, contradicting our first hypothesis (H1a). The negative sign of our variable of main interest aligns with the findings of Tan *et al.* (2017) for a sample of Chinese commercial banks but contradicts the outcomes of Miklaszewska *et al.*'s (2021) analysis for the CENE region. Thus, we are not able to provide support for the Structure-Conduct-Performance (SCP) theory, according to which "market power or market concentration is the main driving force to gain higher performance of a bank" (Cristian *et al.*, 2020, p. 408). In contrast, our analysis indicates that concentration creates favorable conditions for banks with market power to increase their efficiency but not necessarily their profitability. Moreover, the concentration effect enhances the cost of bank operations (Model 3). Consistent with our expectations, efficiency is positively associated with bank profitability (ROA and ROE), and negatively correlated with cost inefficiency. These findings align with the ES

Table 2.
Descriptive statistics of banks

	Full period (2006–2021)					Pre-crisis (2006–2019)					Crisis (2020–2021)					
	# obs	*Min*	*Max*	*Mean*	*SD*	*# obs*	*Min*	*Max*	*Mean*	*SD*	*# obs*	*Min*	*Max*	*Mean*	*SD*	*T*-test
Stability measures																
Z-Score	3,333	−3.00	6.73	2.59	1.23	2,714	−3.00	6.73	2.52	1.24	619	−0.80	6.73	2.87	1.16	0.000***
Multi-level performance index (MLPI)	4,906	−25.00	23.00	0.92	9.55	4,026	−25.00	23.00	0.50	9.56	880	−15.00	23.00	2.84	9.29	0.000***
Financial stability indicator (FSI)	4,934	−0.40	0.60	0.01	0.17	4,157	−0.40	0.60	0.01	0.17	777	−0.40	0.60	0.02	0.18	0.000***
Profitability measures																
Return on assets	4,901	−63.3%	91.3%	1.2%	5.0%	4,133	−62.6%	53.8%	1.1%	4.5%	768	−63.3%	91.3%	1.5%	7.0%	0.043**
Return on equity	4,893	−98.0%	94.0%	7.7%	14.2%	4,126	−98.0%	94.0%	7.8%	13.2%	767	−97.9%	89.6%	7.1%	18.8%	0.013**
Cost-to-income ratio	4,739	26.0%	94.5%	54.6%	22.0%	3,973	26.0%	94.5%	54.0%	21.8%	766	26.0%	94.5%	57.5%	23.0%	0.000***
Efficiency measures																
ES (Average)	5,091	0.01	1.00	0.82	0.24	4,182	0.01	1.00	0.85	0.23	909	0.01	1.00	0.68	5,091	0.000***
Market concentration																
HH-index	5,050	0.04	1.00	0.20	0.13	4,182	0.05	1.00	0.20	0.13	868	0.04	0.74	0.19	0.14	0.014**
Concentration ratio	5,051	0.22	1.00	0.60	0.15	4,182	0.30	1.00	0.60	0.15	869	0.22	1.00	0.60	0.17	0.000***
Bank-level characteristics																
Loans/Deposits	5,082	15.8%	99.1%	61.4%	34.1%	4,175	15.8%	99.1%	62.8%	33.6%	907	15.8%	99.1%	54.9%	35.8%	000***
Loans/Total assets	4,827	0.0%	98.7%	46.2%	26.3%	4,127	0.0%	98.7%	45.8%	26.2%	700	0.0%	98.3%	48.3%	26.9%	0.333
Non-interest income	5,089	−64.8%	98.8%	8.9%	16.2%	4,180	−64.8%	98.8%	9.8%	17.6%	909	−29.1%	41.0%	4.6%	4.9%	0.000***
Size	4,956	2.91	11.87	8.51	1.63	4,175	2.94	11.87	8.93	1.35	781	2.91	8.68	6.26	1.05	0.000***
Non-financial loan growth	3,994	−100.0%	99.3%	−4.6%	38.7%	3,307	−100.0%	99.3%	−6.2%	40.2%	687	−99.8%	96.8%	3.3%	28.7%	0.000***
Liquid assets	3,996	0.0%	99.7%	42.9%	23.1%	3,375	0.0%	99.7%	43.0%	22.9%	621	0.0%	99.7%	42.2%	23.7%	0.077*
Capital adequacy ratio	4,377	0.0%	99.8%	22.2%	23.2%	3,950	0.0%	99.8%	22.1%	23.9%	427	0.9%	91.0%	23.2%	15.1%	0.000***
Total capital ratio	1,508	0.5%	99.8%	21.2%	13.0%	1,151	0.5%	99.8%	20.8%	12.4%	357	0.9%	89.7%	22.3%	14.6%	0.173
Equity/Total assets	4,039	−7.0%	100.0%	26.7%	26.1%	3,716	−7.0%	100.0%	26.5%	26.0%	323	0.0%	98.8%	29.6%	27.3%	0.303

(*continued*)

Table 2.

	Full period (2006–2021)					Pre-crisis (2006–2019)					Crisis (2020–2021)					
	# obs	*Min*	*Max*	*Mean*	*SD*	*# obs*	*Min*	*Max*	*Mean*	*SD*	*# obs*	*Min*	*Max*	*Mean*	*SD*	*T*-test
Credit risk measures																
Non-performing loans	2,908	0.0%	99.7%	11.0%	15.6%	2,520	0.0%	99.7%	10.7%	15.4%	388	0.1%	96.8%	13.0%	16.4%	0.000***
Regulation and institution																
Institution	4,843	−2.01	0.88	−0.31	0.70	3,970	−1.99	0.88	−0.29	0.70	873	−2.01	0.65	−0.41	0.71	0.000***
Macroeconomic variables																
GDP growth	320	−28.0%	32.5%	2.1%	5.7%	280	−28.0%	32.5%	2.8%	4.9%	40	−23.9%	31.4%	−2.2%	7.8%	0.000***
Inflation	320	−4.9%	98.8%	4.9%	10.0%	280	−4.9%	39.9%	4.5%	6.6%	40	−2.5%	98.8%	6.7%	19.7%	0.231
Domestic credit to private sector as % GDP	320	−45.4%	34.9%	2.5%	11.0%	280	−45.4%	34.9%	1.6%	10.5%	40	0.0%	32.6%	15.7%	10.0%	0.000***

Note(s): The sample includes 575 banks in 20 countries in the MENA region which are either Islamic or conventional banks. The sample is divided into two periods: pre-crisis (2006–2019) and crisis (2020–2021). We use Return on Assets (ROA) and Return on Equity (ROE) as measures of bank profitability, and for the level of cost effectiveness – Cost-to-Income ratio (C/I). Z-Score, Multi-Level Performance Index (MLPS) and Financial Stability Indicator (FSI) are used as measures of bank risk and stability. Bank efficiency is measured as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-index (HHI) and the concentration ratio (CR3). All the variables except market concentration indices and institutions are in percentages. Bank characteristics for different groups of banks were computed using data for the period 2006–2021. Appendix 1 describes bank-level characteristics, regulation, and macroeconomic variables

Source(s): Table created by authors

Performance measures	ROA Model (1)	ROE Model (2)	C/I Model (3)
Constant	0.006	0.001	0.444***
	(0.934)	(0.924)	(0.000)
COVID-19	−0.019**	−0.049***	0.026**
	(0.016)	(0.002)	(0.350)
HHI	−0.003	−0.032	0.217***
	(0.670)	(0.145)	(0.000)
HHI COVID-19*	−0.003	−0.009	0.171**
	(0.813)	(0.803)	(0.010)
Efficiency	0.004**	0.011*	−0.175***
	(0.044)	(0.061)	(0.000)
Efficiency COVID-19*	−0.024***	−0.074***	0.022**
	(0.001)	(0.000)	(0.018)
Institution	0.001	0.001	0.002
	(0.314)	(0.812)	(0.571)
Loans/Deposits	0.005**	0.036***	−0.036***
	(0.039)	(0.000)	(0.003)
Loans/Total assets	0.000	0.004	0.023
	(0.981)	(0.511)	(0.070)
Non-interest income	0.040***	0.100***	−0.153***
	(0.000)	(0.000)	(0.000)
Size	0.003*	0.002*	−0.020***
	(0.056)	(0.059)	(0.000)
(Non-financial) Loan growth	0.040***	0.031***	−0.078***
	(0.001)	(0.000)	(0.000)
Liquid assets	0.002	0.045***	0.077***
	(0.386)	(0.000)	(0.000)
CAR	−0.002	0.071***	−0.103***
	(0.724)	(0.000)	(0.001)
E/TA	0.004*	0.003	−0.049***
	(0.087)	(0.696)	(0.000)
NPL/GL	−0.015***	−0.027*	0.084***
	(0.008)	(0.075)	(0.002)
GDP growth	−0.023*	−0.075**	−0.165**
	(0.095)	(0.048)	(0.015)
Inflation	−0.010	−0.015	−0.078**
	(0.164)	(0.468)	(0.039)
Domestic credits	−0.001	0.011	−0.035
	(0.894)	(0.599)	(0.349)
Islamic	−0.007***	−0.008*	0.068**
	(0.000)	(0.104)	(0.013)
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Number of observations	5,006	5,006	5,006
R-squared (Overall)	0.0662	0.1339	0.1737

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank performance during the period 2006–2021 while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Return on Assets (ROA) and Return on Equity (ROE) as measures of bank profitability, and for the level of cost effectiveness – Cost-to-Income ratio (C/I). Bank efficiency is measured as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-index (HHI). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables

Source(s): Table created by authors

Table 3.
Panel regressions of bank profitability (All banks, 2006–2021)

hypothesis and Cristian *et al.* (2020), who report that "competition in non-interest income markets negatively influences bank performance. Cost and revenue efficiency do not affect bank performance. Profit efficiency positively affects net interest margin, but not return on assets" (p. 1) [9]. The positive effect of efficiency weakens during the recent financial crisis, which supports hypothesis (H1b). In other words, the COVID-19 pandemic has reduced the profitability of efficient banks and increased their cost inefficiency.

Our results hold when controlling for different bank-specific characteristics. Specifically, the analysis indicates that loans (as a percentage of deposits), non-interest income, and (non-financial) loan growth rates contribute to increasing bank efficiency and positively influence profitability. Bank size positively influences profitability (ROE) but negatively impacts the cost-to-income ratio (C/I). The positive and significant coefficient of the size variable is in line with "the economies of scale market-power hypothesis" (Berger, 1995, p. 1). Our findings support Flamini *et al.* (2009), who claim that "larger banks make efficiency gains that can be captured as higher earnings due to the fact that they do not operate in very competitive markets" (p. 13). Finally, the increase in the NPLs portfolio negatively affects bank profitability, which is supported by the data in Table 2. The analysis of country-level variables indicates that macroeconomic conditions and, more specifically, GDP dynamics have a negative influence on bank profitability, whereas inflation and domestic credit effects are insignificant.

Finally, we investigate whether bank performance differs across different banking systems that co-exist in the MENA region. The negative sign of IB dummy variable indicates the lower profitability of Islamic banking institutions when measured relative to their conventional counterparts. This can be interpreted as a consequenceof the changing environment and tightening regulations in the MENA countries. Thus, IBs are forced to operate in accordance with best practices and increase their operational efficiency to become more competitive (Otero *et al.*, 2020). If competitive bank performance is determined by the levels of market concentration and efficiency, we would like to know if these effects vary according to the business model (i.e. Islamic vs conventional). Additionally, we aim to determine whether these effects are more pronounced in times of crisis (e.g. COVID-19) than in normal times. Therefore, we further investigate these issues in Section 4.3.

4.2 The effect of market concentration and efficiency on bank stability

In this section, we assess the impact of concentration and efficiency on bank stability. Aligned with prior research (Isnurhadi *et al.*, 2021; Mateev *et al.*, 2022b), we anticipate a positive association between banking stability and efficiency/ concentration. Table 4 presents the results of this analysis.

We noticed that bank stability (proxied by the distance to default or Z-score) is positively influenced by both market concentration and bank efficiency (Model 1). This finding strongly supports our second hypothesis (H2a). Similar positive effect is observed for the aggregate MLPS indicator but negative for the FSI. These findings are consistent with those reported for other developing economies. For example, Miklaszewska *et al.* (2021) find an insignificant relationship between market concentration (measured by the HH-index) and banks' probability of default. However, the link between concentration and their aggregate performance indicator (MLPS) is significant and positive but negative for the FSI, which aligns with our results. In addition, we observe a strong moderating role of COVID-19 in the relationships between concentration, efficiency, and bank stability. The coefficient estimates of the two interaction terms with the crisis dummy are significant and negative (see Models 1 and 2), indicating that the positive effects of concentration and efficiency on bank stability diminished during the pandemic. Although the COVID-19 pandemic had an overall negative

Risk measures	Z-Score Model (1)	MLPS Model (2)	FSI Model (3)
Constant	0.115	−8.741***	0.130***
	(0.608)	(0.000)	(0.000)
COVID-19	−0.897***	−5.762***	0.064***
	(0.000)	(0.000)	(0.000)
HHI	0.559**	4.157***	−0.033
	(0.028)	(0.002)	(0.146)
HHI COVID-19*	−1.227***	−2.187**	0.029
	(0.004)	(0.039)	(0.443)
Efficiency	0.088*	2.738***	−0.133***
	(0.055)	(0.000)	(0.000)
Efficiency COVID-19*	−0.356*	−4.181***	0.083***
	(0.100)	(0.000)	(0.000)
Institution	0.113***	0.317*	−0.003
	(0.001)	(0.070)	(0.912)
Loans/Deposits	0.568***	8.939***	–
	(0.000)	(0.000)	
Loans/Total assets	0.573***	3.894***	−0.056***
	(0.000)	(0.000)	(0.000)
Non-interest income	−0.067	−1.284*	0.056***
	(0.607)	(0.069)	(0.000)
Size	0.005**	0.045*	−0.004***
	(0.030)	(0.087)	(0.000)
(Non-financial) Loan growth	−0.416***	−1.548***	0.003
	(0.000)	(0.000)	(0.609)
Liquid assets	−0.496***	−1.232**	0.205***
	(0.000)	(0.011)	(0.000)
CAR	1.640***	11.679***	−0.180***
	(0.186)	(0.000)	(0.000)
E/TA	−0.295***	−1.086**	–
	(0.001)	(0.024)	
NPL/GL	−0.165	–	0.110***
	(0.351)		(0.000)
GDP growth	−0.906**	−9.475***	−0.032**
	(0.039)	(0.000)	(0.020)
Inflation	0.444*	1.225	−0.001
	(0.069)	(0.349)	(0.960)
Domestic credits	−0.830***	−1.649	−0.005
	(0.001)	(0.209)	(0.801)
Islamic	0.577***	0.513*	−0.019***
	(0.000)	(0.098)	(0.000)
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Number of observations	5,006	5,006	5,006
R-squared (Overall)	0.1324	0.2951	0.3611

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank performance during the period 2006–2021 while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Z-Score, Multi-Level Performance Index (MLPS) and Financial Stability Indicator (FSI) as measures of bank risk and stability. Bank efficiency is measured as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-index (HHI). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables

Source(s): Table created by authors

Table 4. Panel regressions of bank stability (All banks, 2006–2021)

effect on banks performance, this effect was not detrimental to MENA banks' stability (see Appendix 2, Table A3).

Further analysis indicates that stability and the MLPS indicator are positively influenced by bank size but negatively affected by leverage (equity to total assets) and GDP growth (see Models 1 and 2). Moreover, there is a positive association between loans (as a percentage of deposits), loan size, capital adequacy, and different measures of bank performance and stability. Finally, for FSI, the negative impact is due to bank size, capital adequacy, NPLs, and the share of loans in total assets (see Model 3) [10]. The positive sign of the IB dummy variable validates the better financial stability of Islamic banking institutions compared to their conventional counterparts. This result can be explained by the notion that "higher levels of equity are reducing the probability of financial distress, which reduces costs by lowering the risk premium" (Otero *et al.*, 2020, p. 337). Moreover, IBs are much better capitalized than their conventional peers (Mateev *et al.*, 2022b), which makes them more resilient to adverse shocks, such as the COVID-19 pandemic. This is in accordance with Isik and Hassan (2002), who also reported that high capital requirements increase bank efficiency and profitability. Thus our findings provide valuable insights for policymakers and regulators in MENA countries, promtping them to initiate policies that allocate a more decisive and important role to IBs in the post-COVID-19 recovery phase.

Table 5 presents the results of the analysis related to banks' capital positions. Our analysis has yielded several important findings. First, we present evidence in support of our third hypothesis (H3a), that market concentration and efficiency are strongly correlated with banks' capital ratios. While previous research failed to find a significant relationship between concentration and capital ratios, our study reveals a strong (negative) association between market concentration and banks' capitalization levels. This implies that concentrated banks in the MENA region maintain lower capital ratios indicating improved financial stability, as discussed earlier (see Table 4). By contrast, efficiency is positively associated with CAR and is more pronounced for IBs. This can be explained by the fact that "the increase in capital follows an increase in the level of risk borne by banks and increases capital adequacy ratios, which leads to a rise in the loan portfolio" (Hafez, 2018, p. 1). Therefore, it "increases the level of loan provisions, which confirms the high level of efficiency for [Islamic] banks" (p. 1). However, during the pandemic, the strength of this relationship has weakened due to the adverse effect of COVID-19 on MENA banks' performance. Second, GDP dynamics are positively related to banks' leverage levels and negatively associated with their total capital requirements. The GDP growth became negative in the 2020–2021 period (see Table 2), which caused a decrease in equity and an increase in regulatory capital. This was in response to the need to "build a sufficient capital conservation buffer to limit the impact of downside risk from the depletion of capital buffer, which is perceived to be significant during the COIVD-19 pandemic" (Mateev *et al.*, 2021, p. 36). Third, loans (as a percentage of deposits), liquid assets, and non-performing loans are positively associated with bank capitalization, whereas the effect of bank size is negative. One important outcome of this analysis is the negative impact of non-interest income on banks' capital ratios (see Models 2 and 3). This finding contradicts the notion "that traditional bank business models based on intermediation do not guarantee satisfactory profitability [..] but also deplete banks' capital bases" (Miklaszewska *et al.*, 2021, p. 17).

Our findings yield several important implications for the financial stability of MENA banks. First, bank managers should prioritize strategies that promote bank efficiency as our findings demonstrate a positive association with bank performance. Second, regulatory authorities and policymakers should carefully design policies that support further increases in banking market concentration to improve the overall stability considering their potential negative effects on competition, consumers, and systemic risk. Finally, our analysis does not call for a reexamination of existing business models based on intermediation in order to improve efficiency and bank stability. However, the low interest rate environment during the pandemic crisis will induce bank managers to seek alternative sources of non-interest revenue.

Capitalization measures	E/TA Model (1)	CAR Model (2)	TCR Model (3)
Constant	0.526***	−0.055***	−0.083***
	(0.000)	(0.000)	(0.000)
COVID-19	−0.034**	−0.030**	0.007*
	(0.036)	(0.017)	(0.081)
HHI	−0.193***	−0.062***	−0.043*
	(0.000)	(0.000)	(0.102)
HHI COVID-19*	−0.083	−0.034	0.204***
	(0.218)	(0.252)	(0.000)
Efficiency	0.099***	0.005**	−0.002
	(0.000)	(0.049)	(0.861)
Efficiency COVID-19*	−0.355***	−0.010**	0.006
	(0.000)	(0.031)	(0.774)
Institution	0.005	−0.001	0.001
	(0.259)	(0.491)	(0.625)
Loans/Deposits	0.046***	0.071***	0.097***
	(0.000)	(0.000)	(0.000)
Loans/Total assets	−0.120***	0.015***	0.019**
	(0.000)	(0.000)	(0.026)
Non-interest income	0.015	−0.028***	−0.018**
	(0.448)	(0.002)	(0.045)
Size	−0.029***	−0.001*	−0.009
	(0.000)	(0.067)	(0.534)
(Non-financial) Loan growth	0.168***	0.022	−0.015**
	(0.000)	(0.964)	(0.031)
Liquid assets	0.029**	0.053***	0.075***
	(0.038)	(0.000)	(0.000)
LogZ	−0.007***	0.008***	0.008***
	(0.000)	(0.000)	(0.000)
NPL/GL	0.124***	0.003*	−0.018**
	(0.000)	(0.053)	(0.025)
GDP growth	0.207***	−0.005	−0.013*
	(0.003)	(0.857)	(0.063)
Inflation	0.120***	0.015	−0.021
	(0.002)	(0.362)	(0.402)
Domestic	0.142***	0.033**	0.057**
	(0.000)	(0.048)	(0.023)
Islamic	0.023**	0.021***	0.024***
	(0.012)	(0.000)	(0.000)
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Number of observations	5,006	5,006	5,006
R-squared (Overall)	0.1773	0.2271	0.1857

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank capitalization during the period 2006–2021 while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Equity to Total Assets (E/TA) ratio, Capital Adequacy Ratio (CAR), and Total Capital Requirements (TCR) as measures of bank capitalization. Bank efficiency is measured as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-index (HHI). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables

Source(s): Table created by authors

Table 5.
Panel regressions of bank capitalization (All banks, 2006–2021)

4.3 The impact of COVID-19 pandemic on bank performance and stability

An increasing number of studies have focused on the performance and financial stability of banks within a dual banking system comprising Islamic and conventional banking institutions (Abdelsalam *et al.*, 2022; Elnahass *et al.*, 2021, 2022; Mateev *et al.*, 2022b). We further investigated whether there is a strong differential impact of concentration and efficiency on IBs performance, with a primary focus on the MENA region. Specifically, we analyze and compare these effects before and during the pandemic and present the results in Tables 6–8.

Table 6 indicates that in the pre-crisis period (2006–2019), market concentration and efficiency have no significant influence on bank profitability when measured by ROA but have a strong association with ROE and cost effectiveness (C/I). However, during the crisis period (2020–2021), both concentration and efficiency significantly influenced bank profitability and cost efficiency. An interesting observation is that banks operating in concentrated markets have higher profitability, whereas more efficient banks suffer from decreased profitability (and enhanced cost inefficiency). This striking result can be explained by the fact that the rise in banking market concentration caused by the COVID-19 pandemic mostly affects the efficiency of banks' operations and their ability to finance the economy, similar to other developing countries (see Kozak and Wierzbowska, 2021 for the CENE region). We also examine whether these effects are significantly different between alternative banking systems (Islamic and conventional). Therefore, we introduce an interaction term between concentration/efficiency and the IB dummy variable. We find that, during the pre-crisis period, both effects are more pronounced in financial systems with dominant Islamic banking markets. This aligns with our hypothesis (H4a), that the impact of market concentration and efficiency on bank profitability is stronger for Islamic banking institutions. During the COVID-19 pandemic, these effects remained consistent regardless of business model type, which supports our last hypothesis (H4b).

Our results lead to two important conclusions. First, potential bank consolidation triggered by the recent global crisis (the COVID-19 pandemic) could result in an increase in the financial stability of the entire banking sector. Moreover, Islamic banking institutions are expected to gain more benefits from this trend because of their operations within highly regulated environments guided by Sharia's principles. However, a further increase in market concentration "may raise concerns regarding the impact of such an increase in concentration on the behavior of banks and, consequently, on the financial development [of the MENA region]" (Hamadi and Awdeh, 2020, p. 1). Therefore, regulatory authorities and policymakers in the MENA region should consider adopting policies aimed at preventing further increases in market concentration (and bank size) caused by the pandemic. *Second*, further improvement in operational efficiency may not necessarily translate to improved bank performance during the pandemic. This effect depends on a bank's business model. For example, the negative and significant sign of the IB dummy variable in the pre-crisis period suggests that IBs are less profitable than their conventional peers during normal times. However, efficient banks are performing better if the banking institutions are Islamic (a positive and significant coefficient of the interaction term Efficiency $\times$ IB). To check the validity of this finding, we tested the null hypothesis that the coefficient of (IB + Efficiency $\times$ IB) = 0, using the Wald test. The results are presented in the bottom lines of Table 6 [11]. Similarly, the Wald test shows that concentrated banks are more profitable only if they follow the Islamic business model. However, during the crisis period (2020–2021) both effects remained consistent, regardless of the business model type.

Table 7 illustrates the differences in the effects of concentration and efficiency on banks' financial stability before and during the crisis. While both concentration and efficiency play significant roles in shaping banks' risk-taking behavior in the pre-crisis period (see Model 1), the efficiency effect is less pronounced in the crisis period (see Model 4). The results for aggregate bank performance (MLPS) confirm the significant impact of market concentration

Table 6.
Panel regressions of bank profitability (2006–2019 and 2020–2021)

	Panel A: Pre-COVID-19			Panel B: COVID-19		
Profitability measures	ROA Model (1)	ROE Model (2)	C/I Model (3)	ROA Model (4)	ROE Model (5)	C/I Model (6)
Constant	−0.001	0.036	0.689***	−0.037	−0.103	0.679
	(0.886)	(0.307)	(0.000)	(0.406)	(0.307)	(0.154)
HHI	−0.013	−0.073***	0.061*	0.046*	0.238***	−0.260***
	(0.158)	(0.005)	(0.095)	(0.073)	(0.000)	(0.005)
Efficiency	0.003	0.021**	−0.135***	−0.016*	−0.047**	0.148***
	(0.369)	(0.048)	(0.000)	(0.076)	(0.023)	(0.003)
HHI IB*	0.036**	0.100**	−0.219***	0.026	0.084	0.157
	(0.013)	(0.014)	(0.003)	(0.443)	(0.285)	(0.202)
Efficiency IB*	0.019**	0.014**	−0.128***	0.023	0.023	−0.081
	(0.015)	(0.018)	(0.001)	(0.216)	(0.574)	(0.222)
Institution	0.002**	0.007**	−0.008	0.072	0.155	0.098
	(0.035)	(0.023)	(0.885)	(0.270)	(0.294)	(0.674)
Loans/Deposits	0.008***	0.038***	0.004	−0.002	−0.034*	0.116***
	(0.001)	(0.000)	(0.723)	(0.771)	(0.109)	(0.002)
Loans/Total assets	0.002	0.006	0.004	0.001	−0.009	−0.088**
	(0.449)	(0.427)	(0.747)	(0.867)	(0.971)	(0.034)
Non-interest income	0.038***	0.093***	0.132***	0.015	0.100	1.428***
	(0.000)	(0.000)	(0.000)	(0.739)	(0.349)	(0.000)
Size	0.001**	0.005**	−0.003	0.005	0.016***	−0.044***
	(0.016)	(0.039)	(0.396)	(0.702)	(0.000)	(0.000)
(Non-financial) Loan growth	0.005*	0.024***	0.004	0.030***	0.126***	−0.046
	(0.058)	(0.001)	(0.728)	(0.001)	(0.000)	(0.133)
Liquid assets	−0.004	0.045***	0.054***	0.015**	−0.015	−0.065*
	(0.171)	(0.000)	(0.000)	(0.027)	(0.491)	(0.063
CAR	0.007**	0.068***	−0.079**	0.008	0.034	−0.094*
	(0.044)	(0.001)	(0.036)	(0.954)	(0.279)	(0.059)
E/TA	0.001	0.009	−0.010	0.046***	0.027	0.257***
	(0.689)	(0.357)	(0.589)	(0.000)	(0.273)	(0.000)

(*continued*)

Table 6.

Profitability measures	Panel A: Pre-COVID-19 ROA Model (1)	ROE Model (2)	C/I Model (3)	Panel B: COVID-19 ROA Model (4)	ROE Model (5)	C/I Model (6)
NPL/GL	−0.008	−0.036**	0.171***	−0.040**	−0.089**	0.085
	(0.131)	(0.025)	(0.000)	(0.026)	(0.028)	(0.182)
GDP growth	−0.039**	−0.086*	0.082	−0.008	−0.042	0.025
	(0.013)	(0.052)	(0.307)	(0.847)	(0.673)	(0.879)
Inflation	0.017	0.005	−0.067	−0.008	−0.020	0.003
	(0.194)	(0.876)	(0.318)	(0.622)	(0.615)	(0.961)
Domestic	0.005	0.009	0.007	−0.001	−0.078	0.075
	(0.516)	(0.694)	(0.860)	(0.965)	(0.367)	(0.585)
Islamic	−0.030***	−0.020**	0.227***	−0.029	−0.012	0.017
	(0.000)	(0.037)	(0.000)	(0.136)	(0.701)	(0.723)
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	4,121	4,121	4,121	885	885	885
R-squared (Overall)	0.0638	0.1126	0.1830	0.2268	0.4422	0.4499
Wald test (IBs vs CBs)						
H0: IB + Efficiency*IB = 0	−0.0106**	−0.0058***	0.0989***	−0.0065	0.0362	0.1450
(*p-value*)	(0.0045)	(0.0009)	(0.0000)	(0.5556)	(0.1450)	(0.1021)

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank profitability during the periods of 2006–2019 (pre-crisis) and 2020 – 2021 (crisis), while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Return on Assets (ROA) and Return on Equity (ROE) as measures of bank profitability and for the level of cost effectiveness – Cost-to-Income ratio (C/I). Bank efficiency is measured by the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-Index (HHI). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables

Source(s): Table created by authors

Table 7.
Panel regressions of bank stability (2006–2019 and 2020–2021)

Risk measures	Panel A: Pre-COVID-19 Z-Score Model (1)	MLPS Model (2)	FSI Model (3)	Panel B: COVID-19 Z-Score Model (4)	MLPS Model (5)	FSI Model (6)
Constant	0.708*	−7.043***	0.151***	1.914*	−9.587**	0.016*
	(0.077)	(0.000)	(0.000)	(0.072)	(0.033)	(0.055)
HHI	0.440*	4.875***	−0.011*	0.721**	7.622***	−0.053
	(0.100)	(0.004)	(0.082)	(0.046)	(0.004)	(0.306)
Efficiency	0.205*	4.001***	−0.024**	−0.046	−0.116	0.021
	(0.089)	(0.000)	(0.010)	(0.835)	(0.901)	(0.248)
HHI IB*	0.728	8.573***	0.011	0.099	−3.934	0.025
	(0.109)	(0.001)	(0.741)	(0.905)	(0.260)	(0.714)
Efficiency IB*	0.022	4.043***	0.007	0.795**	3.569**	−0.003
	(0.527)	(0.005)	(0.716)	(0.045)	(0.048)	(0.934)
Institution	0.021	0.316	0.002	0.670	4.826	0.049
	(0.527)	(0.115)	(0.426)	(0.666)	(0.462)	(0.705)
Loans/Deposits	0.475***	8.540***	−0.305***	0.920***	−1.191	–
	(0.000)	(0.000)	(0.000)	(0.000)	(0.205)	
Loans/Total assets	0.173**	2.114***	0.008	−0.230	14.434***	−0.243***
	(0.050)	(0.000)	(0.743)	(0.410)	(0.000)	(0.000)
Non-interest income	0.047	−0.933	0.029***	−1.236	−12.668***	0.628***
	(0.694)	(0.188)	(0.002)	(0.272)	(0.008)	(0.001)
Size	−0.044	0.388**	0.005	0.090**	1.013***	−0.004*
	(0.125)	(0.020)	(0.691)	(0.012)	(0.000)	(0.090)
(Non-financial) Loan growth	−0.407***	1.402***	−0.003	−0.481**	0.785	−0.035**
	(0.000)	(0.004)	(0.585)	(0.020)	(0.370)	(0.042)
Liquid assets	0.415***	−2.135***	0.173***	−0.001	0.839	0.190***
	(0.003)	(0.000)	(0.000)	(0.995)	(0.394)	(0.000)
CAR	2.063***	11.998***	−0.021	1.263***	5.012***	0.011
	(0.000)	(0.000)	(0.240)	(0.000)	(0.000)	(0.677)
E/TA	−0.170	1.218**	0.002	−0.112	−0.659	–
	(0.148)	(0.075)	(0.776)	(0.672)	(0.547)	

(*continued*)

Table 7.

Risk measures	Panel A: Pre-COVID-19 Z-Score Model (1)	Panel A: Pre-COVID-19 MLPS Model (2)	Panel A: Pre-COVID-19 FSI Model (3)	Panel B: COVID-19 Z-Score Model (4)	Panel B: COVID-19 MLPS Model (5)	Panel B: COVID-19 FSI Model (6)
NPL/GL	−0.086	–	0.079***	−0.443	–	0.089**
	(0.636)		(0.000)	(0.302)		(0.013)
GDP growth	0.030	−2.337	−0.074**	1.136	5.556	−0.082
	(0.951)	(0.416)	(0.047)	(0.288)	(0.218)	(0.361)
Inflation	1.682***	4.626*	0.013	−0.011	0.112	0.004
	(0.000)	(0.054)	(0.666)	(0.979)	(0.951)	(0.893)
Domestic	0.419	−0.377	0.005	−0.799	1.879	−0.018
	(0.134)	(0.816)	(0.790)	(0.385)	(0.628)	(0.812)
Islamic	0.410*	4.736***	−0.019*	−0.182	−0.381	−0.013
	(0.078)	(0.000)	(0.088)	(0.588)	(0.789)	(0.648)
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	4,121	4,121	4,121	885	885	885
R-squared (Overall)	0.0924	0.2351	0.6044	0.3053	0.6034	0.5151
Wald test (IBs vs CBs)						
H0: IB + Efficiency*IB = 0	0.4337***	−0.6932*	−0.0124	0.6128**	3.1879**	−0.0162
(*p-value*)	(0.0002)	(0.0989)	(0.1686)	(0.0189)	(0.0038)	(0.2511)

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank profitability during the periods of 2006–2019 (pre-crisis) and 2020–2021 (crisis), while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Z-Score, Multi-Level Performance Index (MLPS) and Financial Stability Indicator (FSI) as measured of bank risk and stability. Bank efficiency is measured by the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-Index (HHI). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables

Source(s): Table created by authors

Capitalization measures	Panel A: Pre-COVID-19 E/TA Model (1)	CAR Model (2)	TCR Model (3)	Panel B: COVID-19 E/TA Model (4)	CAR Model (5)	TCR Model (6)
Constant	1.624***	0.117***	0.219***	1.245***	−0.124	−0.129
	(0.000)	(0.000)	(0.000)	(0.001)	(0.241)	(0.429)
HHI	−0.088**	−0.050*	0.013**	−0.176**	−0.000	0.400***
	(0.021)	(0.010)	(0.034)	(0.014)	(0.999)	(0.000)
Efficiency	−0.011	−0.005	0.009	−0.069***	−0.007	0.048**
	(0.486)	(0.470)	(0.399)	(0.007)	(0.728)	(0.041)
HHI IB*	−0.086	−0.064**	−0.070*	−0.062	−0.001	0.131
	(0.153)	(0.033)	(0.107)	(0.516)	(0.989)	(0.306)
Efficiency IB*	−0.016	0.045***	0.051**	−0.017	0.005	0.010
	(0.611)	(0.006)	(0.028)	(0.732)	(0.902)	(0.876)
Institution	−0.014***	−0.001	0.003	0.561***	0.166**	0.104
	(0.001)	(0.428)	(0.261)	(0.002)	(0.048)	(0.659)
Loans/Deposits	0.049***	0.074***	0.090***	−0.042*	−0.032*	0.025*
	(0.000)	(0.000)	(0.000)	(0.102)	(0.058)	(0.060)
Loans/Total assets	−0.086***	0.010*	0.016*	−0.057*	0.112***	0.108**
	(0.000)	(0.068)	(0.051)	(0.071)	(0.000)	(0.012)
Non-interest income	−0.019	−0.022***	−0.015*	0.870***	−0.436***	−0.553***
	(0.218)	(0.048)	(0.090)	(0.000)	(0.000)	(0.001)
Size	−0.149***	0.006	0.003	0.027***	0.003	0.003
	(0.000)	(0.675)	(0.169)	(0.000)	(0.340)	(0.517)
(Non-financial) Loan growth	−0.054***	0.014***	0.020**	−0.062***	−0.035*	−0.090***
	(0.000)	(0.008)	(0.012)	(0.009)	(0.092)	(0.005)
Liquid assets	0.019	0.047***	0.046***	−0.050*	0.085***	0.171***
	(0.121)	(0.000)	(0.000)	(0.063)	(0.000)	(0.000)
LogZ	−0.002	0.009***	0.014***	−0.008**	0.012***	−0.002*
	(0.183)	(0.000)	(0.000)	(0.034)	(0.000)	(0.097)
NPL/GL	−0.049**	−0.006	0.025**	−0.167***	0.065	0.031**
	(0.039)	(0.564)	(0.043)	(0.001)	(0.123)	(0.030)
GDP growth	0.001	−0.046	−0.057	−0.124	−0.063	−0.009
	(0.998)	(0.157)	(0.223)	(0.330)	(0.553)	(0.954)
Inflation	0.041	−0.009	−0.073	−0.109**	−0.003	0.002
	(0.454)	(0.730)	(0.064)	(0.028)	(0.932)	(0.972)
Domestic	0.145***	0.011	−0.015	−0.032	−0.098	−0.078
	(0.000)	(0.525)	(0.565)	(0.764)	(0.286)	(0.583)
Islamic	0.046	−0.004	−0.010	0.023	0.012	−0.003
	(0.134)	(0.784)	(0.650)	(0.544)	(0.716)	(0.947)
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	4,121	4,121	4,121	885	885	885
R-squared (Overall)	0.0359	0.2465	0.1643	0.1992	0.2615	0.3718
Wald test (IBs vs CBs)						
H0: IB + Efficiency*IB = 0	0.0298*	0.0409***	0.0415***	0.0059	0.0179	0.0074
(*p-value*)	(0.0501)	(0.0000)	(0.0002)	(0.8459)	(0.4978)	(0.8555)

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank profitability during the periods of 2006–2019 (pre-crisis) and 2020 – 2021 (crisis), while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Equity to Total Assets (E/TA), Capital Adequacy Ratio (CAR), and Total Capital Requirements (TCR) as measures of bank capitalization. Bank efficiency is measured by the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-Index (HHI). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables

Source(s): Table created by authors

Table 8. Panel regressions of bank capitalization (2006–2019 and 2020–2021)

on bank performance in both periods. However, none of them influenced the short-term financial stability (FSI) of MENA banks during the crisis. These findings are consistent with the results reported for pandemic outbreaks in other developing countries (e.g. Miklaszewska *et al.*, 2021 for the CENE region). Further analysis incorporating an IB dummy variable indicates that the efficiency effect during the pandemic is stronger for Islamic banking institutions regarding their financial stability. One possible reason is that IBs are considered "more stable and capable of absorbing the effects of crises due to Sharia's principles that prohibit them from dealing with various risky financial instruments" (Abdulla and Ebrahim, 2022, p. 241). Similarly, efficient banks that are Islamic are anticipated to exhibit better financial performance (measured by the MLPS indicator) during the pandemic . The validity of these results was confirmed using the Wald test (see the bottom lines in Table 7).

Finally, we investigate the role of market concentration and efficiency in shaping banks' capital positions before and during the COVID-19 pandemic (Table 8). Our analysis indicates that during the pandemic period (2020–2021), concentration and efficiency negatively influenced banks' leverage (equity to total assets), while these effects were positively associated with banks' total capital requirements. In other words, any increase in concentration and/or efficiency levels due to COVID-19 will require a corresponding increase in banks' total capitalization level. Moreover, these effects were not significantly different between the alternative banking systems (Islamic and conventional) that co-exist in the MENA region. This finding aligns with our hypothesis (H4b). To check the validity of our results, we tested the null hypothesis that the coefficient of (IB + Efficiency × IB) = 0, using the Wald test. The results indicate that we cannot reject the hull hypothesis for the crisis period (see the bottom lines of Table 8 for the last three models).

5. Robustness checks and alternative specifications

Several tests are conducted to verify the robustness of the results. *First*, to deal with possible endogeneity in our model, we estimate the Generalized Method of Moments (GMM) estimator developed by Arellano and Bond (1991) and Arellano and Bover (1995). Following prior research, we use the one-step GMM estimator because "the two-step method could lead to erroneous conclusions, especially in the case of heteroscedasticity of the random component" (Miklaszewska *et al.*, 2021, p. 12). The validity of the instruments is tested using the Hansen test of over-identifying restrictions, whereas the AR(1) and AR(2) tests detect first- and second-order autocorrelations in the first differences [12]. The outcomes from the GMM regressions are reported in Tables 9 and 10 and indicate the absence of endogeneity and allow us to control for persistence. In line with our previous findings, we observed a negative but insignificant influence of market concentration on bank profitability (see Models 1 and 2 in Table 9). However, the efficiency effect was strongly significant, and much less pronounced during the pandemic. GMM tests also confirm earlier findings of a significant concentration/efficiency effect on bank stability (Z-score) and overall performance (MLPS) (see Models 1 and 2 in Table 10). Our primary conclusions remained unchanged.

Second, we used several alternative measures of bank profitability. Following previous studies, we employ net interest margin (NIM) as another proxy for bank profitability and growth. The results reported in Appendix 3 (Table A4) confirm the Tan *et al.*'s (2017) findings that "cost efficiency [13] is shown to have a significant and negative impact on bank profitability (ROA), but positive impact on ROE and NIM" (p. 12). Next, instead of taking the average of the individual efficiency scores (CRS, VRS, and SCALE), we re-estimated Eq. (1) and Eq. (2), using each efficiency measure individually. The results (not reported here to conserve space) remained the same qualitatively. The findings of the alternative tests strengthen the conclusion that concentration and efficiency matter to the banking market stability in the MENA region. Finally, we repeat our analysis using an alternative proxy for

Performance measures	ROA Model (1)	ROE Model (2)	C/I Model (3)
Constant	−0.178	0.197	−0.388
	(0.521)	(0.749)	(0.698)
COVID-19	−0.111**	−0.447*	0.884***
	(0.026)	(0.057)	(0.004)
HHI	−0.106	−0.269	0.168
	(0.221)	(0.127)	(0.497)
HHI COVID-19*	−0.190	−0.040	0.107
	(0.236)	(0.895)	(0.811)
Efficiency	0.093**	0.234***	−0.460***
	(0.018)	(0.006)	(0.000)
Efficiency COVID-19*	−0.025*	−0.238**	0.374**
	(0.074)	(0.024)	(0.038)
Institution	−0.014	−0.018	0.031
	(0.159)	(0.413)	(0.317)
Loans/Deposits	−0.151*	−0.138*	1.506***
	(0.099)	(0.087)	(0.001)
Loans/Total assets	0.023	0.044	−0.358**
	(0.486)	(0.549)	(0.027)
Non-interest income	0.944***	2.372***	−0.361*
	(0.000)	(0.000)	(0.056)
Size	−0.005	−0.027	0.154***
	(0.634)	(0.225)	(0.000)
(Non-financial) Loan growth	0.002	0.064	−0.400***
	(0.949)	(0.497)	(0.004)
Liquid assets	0.009	0.757**	0.225
	(0.996)	(0.043)	(0.658)
CAR	−0.119	−0.615	−0.784
	(0.545)	(0.218)	(0.283)
E/TA	−0.011	−0.033	0.314
	(0.837)	(0.795)	(0.196)
NPL/GL	−0.833**	−0.652**	2.812***
	(0.015)	(0.048)	(0.000)
GDP growth	0.179	0.213	1.113
	(0.462)	(0.688)	(0.177)
Inflation	−0.042	0.409	−0.773
	(0.810)	(0.281)	(0.148)
Domestic credits	0.131**	0.222*	−0.555**
	(0.018)	(0.089)	(0.024)
Lag_1(Profitability)	0.768***	1.024***	1.135***
	(0.005)	(0.000)	(0.000)
Islamic	−0.035	−0.003	0.100
	(0.492)	(0.998)	(0.718)
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Number of observations	4,279	4,279	4,279
p-value for AR (1) test	0.0007	0.0000	0.0000
p-value for AR (2) test	0.5005	0.2708	0.2134
Sargan-Hansen test of overidentification	47.578	55.913	27.051
(p-value)	(0.1616)	(0.3301)	(0.8851)

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank performance using the one-step system GMM estimator, during the period 2006–2021, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Return on Assets (ROA) and Return on Equity (ROE) as measures of bank profitability, and for the level of cost effectiveness – Cost-to-Income ratio (C/I). Bank efficiency is measured by the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-Index (HHI). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables
Source(s): Table created by authors

Table 9.
Panel regressions (GMM estimator) of bank profitability (All Banks, 2006–2021)

Risk measures	Z-Score Model (1)	MLPS Model (2)	FSI Model (3)
Constant	7.332	−24.171	0.187
	(0.685)	(0.689)	(0.602)
COVID-19	−1.445*	−9.410**	−0.097*
	(0.089)	(0.022)	(0.084)
HHI	2.205	4.606**	−0.116**
	(0.606)	(0.021)	(0.022)
HHI COVID-19*	−0.854	−10.730**	0.307*
	(0.947)	(0.029)	(0.096)
Efficiency	5.029*	12.078**	−0.048
	(0.069)	(0.019)	(0.293)
Efficiency COVID-19*	−6.110**	−6.428**	0.034
	(0.042)	(0.048)	(0.729)
Institution	1.311**	0.814	−0.012
	(0.032)	0.661)	(0.275)
Loans/Deposits	3.384	3.321**	–
	(0.642)	(0.048)	
Loans/Total assets	1.758	5.194	−0.064
	(0.500)	(0.645)	(0.129)
Non-interest income	3.255*	8.778**	−0.353**
	(0.081)	(0.031)	(0.042)
Size	−1.455*	−2.065**	−0.032**
	(0.096)	(0.048)	(0.012)
(Non-financial) Loan growth	2.459	8.013	0.016
	(0.485)	(0.461)	(0.699)
Liquid assets	−5.583	−3.334*	1.405***
	(0.700)	(0.061)	(0.000)
CAR	32.420**	22.287	−0.304**
	(0.027)	(0.627)	(0.018)
E/TA	3.404	−0.019	–
	(0.373)	(0.998)	
NPL/GL	−4.929	–	0.651**
	(0.820)		(0.033)
GDP growth	−19.915	−56.180	0.611**
	(0.350)	(0.151)	(0.045)
Inflation	17.982	−1.905	0.008
	(0.123)	(0.934)	(0.973)
Domestic credits	9.841**	17.889	−0.043
	(0.045)	(0.152)	(0.625)
Lag_1(Stability)	0.823*	1.287 ***	0.732***
	(0.086)	(0.000)	(0.000)
Islamic	5.294	13.673	−0.161*
	(0.627)	(0.198)	(0.060)
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Number of observations	4,279	4,279	4,279
p-value for AR (1) test	0.0094	0.0002	0.0000
p-value for AR (2) test	0.3814	0.8638	0.3398
Sargan-Hansen test of overidentification	9.3545	32.153	58.5035
(p-value)	(0.6913)	(0.6731)	(0.3836)

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank performance using the one-step system GMM estimator, during the period 2006–2021, while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Z-Score, Multi-Level Performance Index (MLPS) and Financial Stability Indicator (FSI) as measures of bank risk and stability. Bank efficiency is measured by the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-Index (HHI). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables

Source(s): Table created by authors

Table 10. Panel regressions (GMM estimator) of bank stability (All banks, 2006–2021)

banking sector concentration, namely, the share of the top three banks in the total assets of a country's banking sector (CR3). We re-estimate our models for different measures of bank performance (ROA, ROE, and C/I)) and report the results in Appendix 4 (Table A5). In support of our first hypothesis (H1a), the analysis reveals a positive association between market concentration, efficiency and bank profitability. Moreover, these effects are less pronounced during the pandemic.

6. Conclusions

Our analysis indicates that there is a gap in the empirical research regarding the specific impact of market concentration and efficiency on bank performance. This study is unique in that it examines how these two factors affect bank profitability and risk in the MENA region. Specifically, we aim to understand the role of market concentration and efficiency in explaining bank performance and stability during the COVID-19 pandemic. This study is the first to analyze banking sector stability in the MENA region, using both individual and risk-adjusted aggregated performance measures.

The main outcome of our analysis is that efficiency is positively associated with bank profitability. Contrary to our expectations, market concentration has a negative (and insignificant) effect on bank performance. Given that the banking sector in MENA countries is moderately concentrated (González *et al.*, 2017), increased competition in less competitive markets provides strong incentives for banks in the MENA region to enhance their efficiency level. Concurrently, the increased concentration caused by the COVID-19 pandemic may have harmful effect on the financial development of the banking sector in this region. This finding is consistent with the results of Hamadi and Awdeh (2020), who argue that "concentration *per se* is not harmful to financial development. Nevertheless, concentration combined with bank market power may deteriorate the development of MENA financial systems" (p. 1). If this is the case, our findings will offer valuable guidance for policymakers and regulators in formulating policies that prevent further consolidation of the banking sector in response to the recent global (COVID-19) crisis. Simultaneously, the positive impact of efficiency on bank profitability creates compelling incentives for bank managers to improve their performance by increasing operational efficiency, without requiring additional monitoring or regulation by banking authorities.

Previous studies have reported that increased efficiency positively influences banks' financial stability and credit risk reduction (Isnurhadi *et al.*, 2021; Mateev *et al.*, 2022b). This study contributes to the empirical literature on bank stability in times of crisis by undertaking a novel approach that employs both individual and aggregate performance indicators of banks' financial strength. In addition to the default risk indicator (Z-score), we use "aggregate stability and risk-adjusted performance measures" (Miklaszewska *et al.*, 2021, p. 10) to assess the overall performance and stability of banks in the MENA region. The results indicate that market concentration and efficiency positively influence bank stability. However, these effects weakened during the pandemic. We also contribute to the analysis of the main determinants of banks' capital position. Our results support the notion that market concentration and efficiency are strongly associated with banks' capital ratios. Our research indicates that any increase in concentration and/or efficiency caused by the COVID-19 pandemic requires a corresponding increase in regulatory capital. This aligns with the need for banks to build a sufficient capital conservation buffer to absorb increased risk during the pandemic.

Previous studies focusing on the performance and financial stability of banks within a dual banking system (i.e. Islamic and conventional) have reported that the COVID-19 pandemic has negatively affected the financial performance of both types of banks. Moreover, prior research has identified a significant differential impact on Islamic banking

systems (see, e.g. Abdelsalam *et al.*, 2022; Elnahass *et al.*, 2021; Mateev *et al.*, 2022b). We contribute to this strand of empirical literature by investigating whether the positive impact of market concentration and efficiency is more pronounced if banking institutions follow Sharia's business model. Our main finding is that the potential benefits of bank consolidation caused by the recent global crisis mainly accrued to Islamic banking institutions. This is largely attributed to their operations within highly regulated environments guided by Sharia's principles. However, further increases in operational efficiency do not necessarily improve bank performance. This effect depends on the bank's business model. For instance, better profitability and stability are associated with improved efficiency only if the banking institutions are Islamic.

A future extension of this study will focus on comparing the role of competition and efficiency in determining the financial stability of different banking systems (Islamic and conventional) that co-exist in the MENA region. Therefore, further investigation of the COVID-19 effects on bank profitability and risk requires an extended period of the pandemic crisis, including 2022.

7. Implications of the study

This study offers valuable insights to bank managers, policymakers, and regulators. *First*, bank managers should prioritize strategies aimed at enhancing bank efficiency, as they are positively associated with bank performance. Moreover, efficient banks are more resilient to financial crises than other banks. *Second*, our findings regarding the positive effect of concentration on bank stability inform regulatory authorities and decision-makers to adopt policies that prevent further concentration (especially in the Islamic banking sector) without considering the potential negative effects on competition, consumers, and systemic risk. *Third*, our research indicates that while concentrated banks in the MENA region are more profitable and stable, this effect depends on the business model followed by banks. This necessitates that bank managers adopt effective risk diversification strategies to sustain stability in accordance with their business models. *Fourth*, our findings inform policymakers and regulators in the MENA region to initiate policies that assign a more decisive and significant role to IBs in the post-COVID-19 recovery phase. *Finally*, regarding the dominant role of the traditional business model, bank managers are advised to prioritize their strategies aimed at increasing non-interest revenue sources as part of their income diversification approoaches during the pandemic. These recommendations provide useful guidelines for policymakers and regulators in countries where Islamic and conventional banking systems co-exist and compete, based on different business models and risk management practices.

Notes

1. Using a sample of 23 French banks over the period of 2010–2018, Saâdaoui and Ben Salah (2023) confirmed "that the financial performance of banks depends primarily on the financial stability of the bank, in particular, on capital adequacy and on the management of liquidity risk" (p. 621).
2. Under this hypothesis, "bank competition will lower the interest income for banks and therefore, banks' profits will erode, which will lead to increased probability of default or bankruptcy, and consequently, the overall disruption of the financial system" (González *et al.*, 2017, p. 1). A study by Bakhouche (2024) on the Tunisian banking sector over the 2005–2020 period revealed "that competition reduces stability, supporting the competition-fragility thesis with an insignificant efficiency channel" (p.1).
3. There are two reasons to include Malta in our dataset. First, BankFocus Database, which we downloaded data from, includes Malta in the MENA region dataset, see https://bankfocus.bvdinfo.com/. Second, as of January 2021, the World Bank website groups the same set of 21 countries/territories as MENA: Algeria; Bahrain; Djibouti; Egypt, Arab Rep.; Iran, Islamic Rep.; Iraq; Israel;

Jordan; Kuwait; Lebanon; Libya; Malta; Morocco; Oman; Qatar; Saudi Arabia; Syrian Arab Republic; Tunisia; United Arab Emirates; West Bank and Gaza; Yemen, Rep., see: https://data.worldbank.org/country/ZQ. Also, to be sure that the inclusion of Malta in the list of MENA countries used in this study does not alter the validity of our results, we run the baseline regression model without Malta (see Appendix 5, Table A6). The size and the magnitude of the estimated coefficients do not change. Therefore, our main findings remain the same.

4. Bank performance is measured by return on assets (ROA), return on equity (ROE), and cost-to-income (C/I) ratio, while bank capitalization stability - by distance to default (Z-score), capital adequacy ratio (CAR), and total capital ratio (TCR).

5. Specifically, "the multilevel performance score (MLPS) is a risk-adjusted, aggregated performance indicator developed by Miklaszewska and Kil (2016), based on three efficiency ratios and two stability indicators. FSI, like MLPS, is a comprehensive financial stability indicator based on the five performance areas developed by Iwanicz-Drozdowska *et al.* (2017)" (Miklaszewska *et al.*, 2021, p. 10).

6. It is well known fact that "DEA can be either input- or output-orientated. Under constant returns to scale both input and output-oriented DEA models produce the same efficiency scores, while under variable returns to scale, the efficiency scores in two models may be different" (Mirzaei *et al.*, 2022, p. 21).

7. The literature elucidates that "two main types of DEA models are constant returns-to-scale (CRS) or CCR model and a variable returns-to-scale (VRS) or BCC model" (Mirzaei *et al.*, 2022, p. 21).

8. Sahyouni *et al.* (2021) investigated the banks' liquidity creation in the MENA countries and more specifically, "the relationship between bank soundness and liquidity creation by using the ratios of the CAMEL rating system" (p. 86). The findings indicated that there is a negative correlation between the CAMEL rating system, used as a measure of a bank's soundness, and its capacity for liquidity creation.

9. To confirm these findings, we run additional tests with net interest margin (NIM) as profitability measure (see Appendix 4). The results reported in Table A5 indicate a strong positive association between efficiency and profitability when measured by NIM.

10. To better understand the reasons for these results, we calculated FSI for each country in the sample and found that the FSI values were not homogeneous across the sample (see Table A3). For some countries, the values are positive and higher in the 2020–2021 period than in the preceding years (e.g. the Syrian Arab Republic and Yemen), indicating a strong and stable financial position of banks in these countries. For others (e.g. Iran and Tunisia), we found evidence of substantial credit risk related to the NPLs portfolio (both before and during the pandemic) that translates in negative values of FSI index. Furthermore, when we run the analysis separately for different types of banks, the index values for FSI show slightly negative values for IBs but positive for CBs. It means that the IBs are characterized by a poorer short-term stability as measured by the index.

11. The results of our Wald tests show that IBs with the same level of efficiency as their conventional counterparts underperform the peers during normal market conditions. Specifically, the Wald test indicates a negative performance efficiency of 0.5–1.0 basis points per year (see the bottom line of Table 6). Moreover, IBs have higher cost inefficiency level during the same (pre-crisis) period. In contrast, there are no significant performance differences between Islamic and conventional banks during the crisis period, independent on their efficiency level. These results show that business model of IBs is valuable only if it is associated with improved efficiency. We run the Walt test also for concentration variable and test the null hypothesis that (IB + HH-index*IB = 0). The results are available upon request.

12. Because bank-specific characteristics are expected to be endogenous, we perform a Hausman (endogeneity) test and find that bank-specific variables are endogenous. Following Yeddou and Pourroy (2020) approach "we instrument them with their one-year lagged values. We test the validity of our instruments using the Sargan-Hansen statistic for over-identification test" (p. 21).

13. Cost efficiency is derived using stochastic frontier approach (SFA) while in our study we employ the non-parametric Data Envelopment Analysis (DEA).

References

Abdelsalam, O., Elnahass, M., Ahmed, H. and Williams, J. (2022), "Asset securitizations and bank stability: evidence from different banking systems", *Global Finance Journal*, Vol. 51 February 2022, 100551, doi: 10.1016/j.gfj.2020.100551.

Abdulla, Y. and Ebrahim, Y. (2022), "Effect of COVID-19 on the performance of Islamic and conventional GCC banks", *Review of Financial Economics*, Vol. 40 No. 3, pp. 239-258, doi: 10.1002/rfe.1151.

Agustini, M. and Viverita, V. (2012), "Factors influencing the profitability of listed Indonesian commercial banks before and during the financial crisis", *Indonesian Capital Market Review*, Vol. 4 No. 1, pp. 29-20, doi: 10.21002/icmr.v4i1.3666.

Alabbad, A. and Schertler, A. (2022), "COVID-19 and bank performance in dual-banking countries: an empirical analysis", *Journal of Business Economics*, Vol. 92 No. 9, pp. 1511-1557, doi: 10.1007/s11573-022-01093-w.

Ali, K., Akhtar, M.F. and Ahmed, H.Z. (2011), "Bank-specific and macroeconomic indicators of profitability - empirical evidence from the commercial banks of Pakistan", *International Journal of Business and Social Science*, Vol. 2 No. 6, pp. 235-242.

Aliani, K., Al-kayed, L. and Boujlil, R. (2022), "COVID-19 effect on Islamic vs conventional banks stock prices: case of GCC countries", *Journal of Economic Asymmetries*, Vol. 26, e00263, doi: 10.1016/j.jeca.2022.e00263, November 2022.

Andries, A. and Ursu, S. (2016), "Financial crisis and bank efficiency: an empirical study of European banks", *Economic Research-Ekonomska Istrazivanija*, Vol. 29 No. 1, pp. 485-497, doi: 10.1080/1331677x.2016.1175725.

Anginer, D., Demirguc-Kunt, A. and Zhu, M. (2014), "How does competition affect bank systemic risk?", *Journal of Financial Intermediation*, Vol. 23 No. 1, pp. 1-26, doi: 10.1016/j.jfi.2013.11.001.

Arellano, M. and Bond, S. (1991), "Some tests of specification for panel data: monte Carlo evidence and an application to employment equations", *Review of Economic Studies*, Vol. 58 No. 2, pp. 277-297, doi: 10.2307/2297968.

Arellano, M. and Bover, O. (1995), "Another look at the instrumental variable estimation of error-components models", *Journal of Econometrics*, Vol. 68 No. 1, pp. 29-51, doi: 10.1016/0304-4076(94)01642-d.

Aslam, E., Haron, R. and Ahmad, S. (2020), "A comparative analysis of the performance of Islamic and conventional banks: does corporate governance matter?", *International Journal of Business Excellence*, Vol. 22 No. 3, pp. 553-568, doi: 10.1504/ijbex.2021.115371.

Assaf, A., Berger, A., Roman, R. and Tsionas, M. (2019), "Does efficiency help banks survive and thrive during financial crises?", *Journal of Banking and Finance*, Vol. 106, pp. 445-470, doi: 10.1016/j.jbankfin.2019.07.013.

Bakhouche, A. (2024), "Competition, stability and the efficiency channel in the Tunisian banking system", *Accounting, Auditing, and Performance Evaluation*, Vol. 20 Nos 1-2, pp. 121-154, doi: 10.1504/ijaape.2024.10061069.

Barua, B. and Barua, S. (2021), "COVID-19 implications for banks: evidence from an emerging economy", *SN Business and Economics*, Vol. 1 No. 19, pp. 1-28, doi: 10.1007/s43546-020-00013-w.

Beltratti, A. and Stulz, R.M. (2012), "The credit crisis around the globe: why did some banks perform better?", *Journal of Financial Economics*, Vol. 105 No. 1, pp. 1-17, doi: 10.1016/j.jfineco.2011.12.005.

Berger, A.N. (1995), "The profit-structure relationship in banking: test of market-power and efficient-structure hypotheses", *Journal of Money, Credit and Banking*, Vol. 27 No. 2, pp. 404-431, doi: 10.2307/2077876.

Berger, A.N. and Bouwman, C.H.S. (2013), "How does capital affect bank performance during financial crises", *Journal of Financial Economics*, Vol. 109 No. 1, pp. 146-176, doi: 10.1016/j.jfineco.2013.02.008.

Berger, A.N. and Mester, L.J. (1997), "Inside the black box: what explains differences in the efficiencies of financial institutions?", *Journal of Banking and Finance*, Vol. 21 No. 7, pp. 895-947, doi: 10.1016/s0378-4266(97)00010-1.

Bitar, M., Saad, W. and Benlemlih, M. (2016), "Bank risk and performance in the MENA region: the importance of capital requirements", *Economic Systems*, Vol. 40 No. 3, pp. 398-421, doi: 10.1016/j.ecosys.2015.12.001.

Borri, N. and di Giorgio, G. (2021), "Systemic risk and the COVID challenge in the European banking sector", *Journal of Banking and Finance*, Vol. 6 February 2021, 106073, doi: 10.1016/j.jbankfin.2021.106073.

Bourke, P. (1989), "Concentration and other determinants of bank profitability in Europe, North America and Australia", *Journal of Banking and Finance*, Vol. 13 No. 1, pp. 65-79, doi: 10.1016/0378-4266(89)90020-4.

Boyd, J.H. and De Nicolo, G. (2005), "The theory of bank risk-taking and competition revisited", *Journal of Finance*, Vol. 60 No. 3, pp. 1329-1343, doi: 10.1111/j.1540-6261.2005.00763.x.

Boyd, J.H., De Nicolò, G. and Jalal, A.M. (2006), "Bank risk-taking and competition revisited: New theory and new evidence", IMF Working Paper No. 06/297, international Monetary Fund, Washington DC, available at: https://www.imf.org/external/pubs/ft/wp/2006/wp06297.pdf

Carletti, E., Claessens, S., Fatás, A. and Vives, X. (2020), *The Bank Business Model in the Post-Covid-19 World*, Centre for Economic Policy Research. CEPR Press, London, available at: https://www.iese.edu/media/research/pdfs/ST-0549-E.pdf

Chaffai, M. and Hassan, M.K. (2019), "Technology gap and managerial efficiency: a comparison between Islamic and conventional banks in MENA", *Journal of Productivity Analysis*, Vol. 51 No. 1, pp. 39-53, doi: 10.1007/s11123-019-00544-x.

Charnes, A., Cooper, W.W. and Rhodes, E. (1978), "Measuring the efficiency of decision-making units", *European Journal of Operational Research*, Vol. 2 No. 6, pp. 429-444, doi: 10.1016/0377-2217(78)90138-8.

Colak, G. and Öztekin, O. (2021), "The impact of COVID-19 pandemic on bank lending around the world", *Journal of Banking and Finance*, Vol. 133 December 2021, 106207, doi: 10.1016/j.jbankfin.2021.106207.

Cristian, E., Leonarsan, W. and Kim, S.S. (2020), "The impacts of competition, efficiency, and risk towards bank's performance in Indonesia", *Jurnal Keuangan Dan Perbankan*, Vol. 24 No. 4, pp. 407-419, doi: 10.26905/jkdp.v24i4.4903.

Deloitte Insights (2020), "COVID-19 potential implications for the banking and capital market sector", Deloitte Center for Financial Services, available at: https://www2.deloitte.com/content/dam/insights/us/articles/6693_covid-19-banking/DI_COVID-19-banking.pdf

Demsetz, H. (1973), "Industry structure, market rivalry and public policy", *Journal of Law and Economics*, Vol. 16, pp. 1-10, doi: 10.1086/466752.

Elnahass, M., Trinh, V.Q. and Li, T. (2021), "Global banking stability in the shadow of COVID-19 outbreak", *Journal of International Financial Markets, Institutions and Money*, Vol. 72 May 2021, 101322, doi: 10.1016/j.intfin.2021.101322.

Elnahass, M., Salama, A. and Trinh, V.Q. (2022), "Firm valuations and board compensation: evidence from alternative banking models", *Global Finance Journal 2022*, Vol. 51, 100553, doi: 10.1016/j.gfj.2020.100553.

Feyen, E., Gispert, T., Kliatskova, T. and Mare, D. (2021), "Financial sector policy response to COVID-19 in emerging markets and developing economies", *Journal of Banking and Finance*, Vol. 133 December 2021, 106184, doi: 10.1016/j.jbankfin.2021.106184.

Flamini, V., McDonald, C. and Schumacher, L. (2009), "The determinants of commercial bank profitability in Sub-Saharan Africa", IMF Working Paper WP/09/15, International Monetary Fund, Washington, Washington DC.

Ghanem, A. (2017), "The impact of Basel II on the banking strategies in the Middle East and North African (MENA) region", *Journal of Banking Regulation*, Vol. 18 No. 1, pp. 48-60.

Goldberga, L.G. and Rai, A. (1996), "The structure-performance relationship for European banking", *Journal of Banking and Finance*, Vol. 20 No. 4, pp. 745-771, doi: 10.1016/0378-4266(95)00021-6.

González, L.O., Razia, A., Búa, M.V. and Sestayo, R.L. (2017), "Competition, concentration and risk-taking in Banking sector of MENA countries", *Research in International Business and Finance*, Vol. 42 December 2017, pp. 591-604, doi: 10.1016/j.ribaf.2017.07.004.

Hafez, H.M.M. (2018), "Examining the relationship between efficiency and capital adequacy ratio: islamic versus conventional banks: empirical evidence on Egyptian banks", *Accounting and Finance Research*, Vol. 7 No. 2, pp. 232-247, doi: 10.5430/afr.v7n2p232.

Hamadi, H. and Awdeh, A. (2020), "Banking concentration and financial development in the MENA region", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 13 No. 4, pp. 675-689, doi: 10.1108/imefm-03-2019-0097.

Hamid, N., Ramli, N.A. and Hussin, S.A.S. (2017), "Efficiency measurement of the banking sector in the presence of non-performing loans", *AIP Conference Proceedings*, Vol. 1795, 020001, doi: 10.1063/1.4972145.

Hamza, H. and Kachtouli, S. (2014), "Competitive conditions and market power of Islamic and conventional commercial banks", *Journal of Islamic Accounting and Business Research*, Vol. 5 No. 1, pp. 29-46, doi: 10.1108/jiabr-05-2012-0030.

Hassan, M.K., Rabbani, M.R. and Ali, M.A. (2020), "Challenges for the Islamic Finance and banking in post COVID era and the role of Fintech", *Journal of Economic Cooperation and Development*, Vol. 43 No. 3, pp. 93-116.

Isik, I. and Hassan, M.K. (2002), "Technical, scale and allocative efficiencies of Turkish banking industry", *Journal of Banking and Finance*, Vol. 26 No. 4, pp. 719-766, doi: 10.1016/s0378-4266(01)00167-4.

Isnurhadi, I., Adam, M., Sulastri, S., Andriana, I. and Muizzuddin, M. (2021), "Bank capital, efficiency, and risk: evidence from Islamic banks", *Journal of Asian Finance, Economics and Business*, Vol. 8 No. 1, pp. 841-850.

Iwanicz-Drozdowska, M., Smaga, P. and Witkowski, B. (2017), "Role of foreign capital in stability of banking sectors in CESEE countries", *Czech Journal of Economics and Finance*, Vol. 6, pp. 492-511.

Kapan, T. and Minoiu, C. (2021), "Liquidity insurance vs credit provision: evidence from the COVID-19 crisis", Mimeo, available at: https://ssrn.com/abstract=3773328 (accessed 30 September 2021).

Kaufmann, D., Kraay, A. and Mastruzzi, M. (2008), "Governance matters VII: Aggregate and individual governance indicators, 1996-2007", Unpublished working paper. World Bank, The World Bank, Washington, DC.

Kozak, S. (2020), "Are larger banks more efficient in the Central Eastern European countries?", *Annales Universitatis Mariae Curie-Skłodowska, sectio H – Oeconomia*, Vol. 54 No. 2, pp. 31-40, doi: 10.17951/h.2020.54.2.31-40.

Kozak, S. (2021), "The impact of COVID-19 on bank equity and performance: the case of Central Eastern South European countries", *Sustainability*, Vol. 13 No. 19, 11036, doi: 10.3390/su131911036.

Kozak, S. and Wierzbowska, A. (2021), "Banking market concentration and bank efficiency. Evidence from Southern, Eastern and Central Europe", *Southeast European Journal of Economics and Business*, Vol. 16 No. 1, pp. 38-52, doi: 10.2478/jeb-2021-0004.

Leon, F. (2014), "Measuring competition in banking: a critical review of methods", Serie Etudes et documents du CERDI, available at: https://shs.hal.science/halshs-01015794/document

Mason, E. (1939), "Price and production policies of large-scale enterprise", *The American Economic Review*, Vol. 29 No. 1, pp. 61-74.

Mateev, M. and Bachvarov, P. (2021), "Regulation, ownership and bank performance in the MENA region: evidence from Islamic and conventional banks", *Emerging Markets Review*, Vol. 47 June 2021, 100789, doi: 10.1016/j.ememar.2020.100789.

Mateev, M., Moudud-Ul-Huq, S. and Nasr, T. (2021), "Capital regulation and market competition in the MENA region: policy implications for banking sector stability during COVID-19 pandemic", *Global Business Review*, p. 097215092110644, available at: https://doi.org/10.1177/0972150921106444 (accessed 23 December 2021).

Mateev, M., Moudud-Ul-Huq, S., Sahyouni, A. and Tariq, M. (2022a), "Capital regulation, competition and risk-taking: policy implications for banking sector stability in the MENA region", *Research in International Business and Finance*, Vol. 60 April 2022, 101579, doi: 10.1016/j.ribaf.2021.101579.

Mateev, M., Sahyouni, A. and Al-Masaeid, T. (2022b), "Bank performance before and during the COVID-19 crisis: does efficiency play a role?", *Review of Managerial Science*, Vol. 18 No. 1, pp. 29-82, available at: http://dx.doi.org/10.1007/s11846-022-00611-y (accessed 24 December 2022).

Mateev, M., Tariq, M.U. and Sahyouni, A. (2023), "Efficiency, market concentration and the impact of COVID-19 pandemic: evidence from the MENA region", *PlosOne*, Vol. 18 No. 5, e0285403, doi: 10.1371/journal.pone.0285403.

Miklaszewska, E. and Kil, K. (2016), "The impact of 2007-9 crisis on the assessment of bank performance: the evidence from CEE-11 countries", *Transformations in Business and Economics*, No. 2A, pp. 459-479.

Miklaszewska, E., Kil, K. and Idzik, M. (2021), "How the COVID-19 pandemic affects bank risks and returns: evidence from EU members in Central, Eastern, and Northern Europe", *Risks*, Vol. 9 No. 10, p. 180, doi: 10.3390/risks9100180.

Mirzaei, A., Saad, M. and Emrouznejad, A. (2022), "Bank stock performance during the COVID-19 crisis: does efficiency explain why Islamic banks fared relatively better?", *Annals of Operations Research*, 17 March 2022, pp. 1-39, doi: 10.1007/s10479-022-04600-y.

Molyneux, P. and Thornton, J. (1992), "Determinants of European bank profitability: a note", *Journal of Banking and Finance*, Vol. 16 No. 6, pp. 1173-1178, doi: 10.1016/0378-4266(92)90065-8.

Naceur, S.B. and Omran, M. (2011), "The effect of bank regulations, competition, and financial reforms on banks' performance", *Emerging Markets Review*, Vol. 12, p. 120.

Otero, L., Razia, A., Cunill, O.M. and Mulet-Forteza, C. (2020), "What determines efficiency in MENA banks?", *Journal of Business Research*, Vol. 112, pp. 331-341, doi: 10.1016/j.jbusres.2019.11.002, May 2020.

Pasiouras, F. (2008), "International evidence on the impact of regulations and supervision on banks' technical efficiency: an application of two-stage data envelopment analysis", *Review of Quantitative Finance and Accounting*, Vol. 30 No. 2, pp. 187-223, doi: 10.1007/s11156-007-0046-7.

Peltzman, S. (1977), "The gains and losses from industrial concentration", *Journal of Law and Economics*, Vol. 20 No. 2, pp. 229-263, doi: 10.1086/466902.

Saâdaoui, A. and Ben Salah, O. (2023), "The moderating effect of financial stability on the CSR and bank performance", *EuroMed Journal of Business*, Vol. 18 No. 4, pp. 621-642, doi: 10.1108/emjb-10-2021-0163.

Sahyouni, A., Zaid, M.A.A. and Adib, M. (2021), "Bank soundness and liquidity creation", *EuroMed Journal of Business*, Vol. 16 No. 1, pp. 86-107, doi: 10.1108/emjb-04-2019-0061.

Sarsour, S. and Daoud, Y. (2015), "The efficiency of the banking system in Occupied Palestinian Territory (OPT) 2000-2009", *Review of Middle East Economics and Finance*, Vol. 11 No. 1, pp. 55-77, doi: 10.1515/rmeef-2014-0005.

Schaeck, K., Cihák, M. and Wolfe, S. (2006), "Are more competitive banking systems more stable?", IMF Working Paper No. 06/143, International Monetary Fund, D.C, Washington D.C., available at: https://www.imf.org/external/pubs/ft/wp/2006/wp06143.pdf

Sun, P.H., Mohamad, S. and Ariff, M. (2017), "Determinants driving bank performance: a comparison of two types of banks in the OIC", *Pacific Basin Finance Journal*, Vol. 42, pp. 193-203, doi: 10.1016/j.pacfin.2016.02.007.

Syed, M.H., Khan, S., Rabbani, M.R. and Thalassinos, Y.E. (2020), "An artificial intelligence and NLP based Islamic FinTech model combining zakat and Qardh-Al-Hasan for countering the adverse impact of COVID 19 on SMEs and individuals", *International. Journal of Economics and Business Administration*, Vol. 8 No. 2, pp. 351-364.

Tan, Y.A. (2016), "The impacts of risk and competition on bank profitability in China", *Journal of International Financial Markets, Institutions and Money*, Vol. 40, pp. 85-110, doi: 10.1016/j.intfin.2015.09.003.

Tan, Y.A., Floros, C. and Anchor, J.R. (2017), "The profitability of Chinese banks: impacts of risk, competition, and efficiency", *February 2017 Review of Accounting and Finance*, Vol. 16 No. 1, pp. 86-105, doi: 10.1108/raf-05-2015-0072.

Tetsushi, H., Yoshiro, T. and Hirofumi, U. (2014), "Firm growth and efficiency in the banking industry: a new test of the efficient structure hypothesis", *Journal of Banking and Finance*, Vol. 40 March 2014, pp. 143-153, doi: 10.1016/j.jbankfin.2013.11.031.

The World Bank Development Indicators (2006-2021), "World development indicators", available at: http://data.worldbank.org/indicator/NY.GDP.MKTP.CD (accessed 15 March 2022).

The World Bank Worldwide Governance Indicators (2006-2021), "Interactive data access", available at: http://info.worldbank.org/governance/wgi/index.aspx#reports (accessed 15 March 2022).

Trinh, V.Q., Cao, N.D. and Elnahass, M. (2022), "Financial stability: a 'vaccine' for tail risk of the global banking sector in the shadow of the pandemic", *European Journal of Finance*, Vol. 29 No. 7, pp. 726-753, available at: https://doi.org/10.1080/1351847X.2022.2081091 (accessed 30 May 2022).

Viphindrartin, S., Wilantari, R.N. and Bawono, S. (2022), "The comparison of the Islamic and conventional bank performance before and during COVID-19 pandemic in Indonesia", *Manajemen dan Bisnis*, Vol. 21 No. 1, pp. 76-84, doi: 10.24123/jmb.v21i1.574.

Xie, H., Chang, H.-L., Hafeez, M. and Chafic Saliba, C. (2021), "COVID-19 post-implications for sustainable banking sector performance: evidence from emerging Asian economies", *Economic Research-Ekonomska Istraživanja*, Vol. 35 No. 1, pp. 4801-4816, doi: 10.1080/1331677x.2021.2018619.

Yeddou, N. and Pourroy, M. (2020), "Bank liquidity creation: does ownership structure matter?", *Quarterly Review of Economics and Finance*, Vol. 78, pp. 116-131, doi: 10.1016/j.qref.2020.01.003, November 2020.

Corresponding author
Miroslav Mateev can be contacted at: m.mateev@adsm.ac.ae

Appendix 1
Dependent and explanatory variables

Table A1.
Variables definition and sources

Variable	Explanation	Data source
Stability measures		
Distance to default (Z-score)	Z-score is the distance to default calculated as a bank's ROA plus the capital-to-asset ratio divided by the standard deviation of ROA over the period of five years	Authors' calculations based on Bankscope/Orbis; Mateev *et al.* (2021)
Multi-level performance index (MLPI)	Multi-level performance score composed of three efficiency ratios (ROE, C/I, and loans to asset ratio) and two stability indicators (Z-score and NPL level). Interpreted relatively to the whole analyzed group	Authors' calculations based on Bankscope/Orbis; Miklaszewska *et al.* (2021)
Financial stability indicator (FSI)	Financial stability indicator Composed of five performance indicators, representing profitability, capital adequacy, asset quality, and two liquidity measures	Authors' calculations based on Bankscope/Orbis; Miklaszewska *et al.* (2021)
Profitability measures		
Return on assets (ROA)	Net profit to the average total assets of a bank	Authors' calculations based on Bankscope/Orbis
Return on assets (ROE)	Net profit to the average total equity of a bank	Authors' calculations based on Bankscope/Orbis
Cost to income ratio (C/I)	Cost efficiency: operating cost to operating income of a bank	Authors' calculations based on Bankscope/Orbis
Efficiency measures		
DEA average efficiency score (ES)	Average of the efficiency scores of three different efficiency estimation models (CRS, VRS, and SCALE) using DEA approach	Authors' calculations based on Bankscope/Orbis
Market concentration		
HH-index	Herfindahl-Hirschman index (HHI) is a measure of market concentration calculated as the sum of the squared market shares for each bank in a country	Authors' calculations based on Bankscope/Orbis
Concentration ratio (CR3)	The share of the largest three banks in the total assets of a country's total banking industry	Authors' calculations based on Bankscope/Orbis
Bank-level characteristics		
Loans/Deposits	Loans to customers divided by deposits from customers	Authors' calculations based on Bankscope/Orbis

(*continued*)

Table A1.

Variable	Explanation	Data source
Loans/Assets	Loans divided by total assets	Authors' calculations based on Bankscope/ Orbis
Non-interest income	The share of operating income that is not due to interest income to total assets of a bank	Authors' calculations based on Bankscope/ Orbis
Size	Natural logarithm of total assets of a bank	Authors' calculations based on Bankscope/ Orbis
Non-financial loan growth	Rate of growth of non-financial loans (annual % change)	Authors' calculations based on Bankscope/ Orbis
Liquid assets	Liquid assets divided by total assets of a bank	Authors' calculations based on Bankscope/ Orbis
Capital adequacy ratio	CAR is calculated by dividing a bank's capital by its risk-weighted assets. The capital used to calculate the capital adequacy ratio is divided into two tiers (Tier 1 and Tier 2)	Authors' calculations based on Bankscope/ Orbis)
Total capital ratio (TCR)	The ratio of a bank's total capital to its RWA. Total capital includes both Tier 1 and Tier 2 capital	Authors' calculations based on Bankscope/ Orbis)
Equity/Total assets	Leverage: the ratio of equity to total assets of a bank	Authors' calculations based on Bankscope/ Orbis
Credit risk measures		
Non-performing loans	Bank non-performing loans divided by gross loans	Authors' calculations based on Bankscope/ Orbis
Regulation and institution		
Institution	The index of institution is the average of six indicators: 1) voice and accountability, (2) political stability and absence of violence, (3) government effectiveness, (4) regulatory quality, (5) rule of law, and (6) control of corruption	The World Bank Worldwide Governance Indicators (2006–2021), Kaufmann *et al.* (2008)
Macroeconomic variables		
GDP growth	Annual percentage growth rate of GDP (constant 2005 U.S. dollars), proxy for market size	The World Bank Development Indicators (2006–2021)
Inflation	Inflation is measured by the consumer price index, in percent	The World Bank Development Indicators (2006–2021)
Domestic credit to private sector as % of GDP	Financial intermediation: domestic credit to private sector as % of GDP	The World Bank Development Indicators (2006–2021)

Source(s): Table created by Authors

Appendix 2
Average performance ratios per country

Country	ROA 2006–2019	ROA 2020–2021	ROE 2006–2019	ROE 2020–2021	C/IR 2006–2019	C/IR 2020–2021	TCR 2006–2019	TCR 2020–2021	CAR 2006–2019	CAR 2020–2021	RWA_GR 2006–2019	RWA_GR 2020–2021
AE	1.32%	0.52%	9.28%	−1.58%	49.33%	56.64%	19.26%	21.25%	17.25%	19.79%	11.61%	−2.08%
BH	0.54%	−0.64%	4.27%	−7.80%	66.46%	77.54%	25.51%	42.39%	22.88%	36.36%	12.22%	1.66%
DZ	1.78%	1.81%	12.46%	9.71%	40.78%	37.54%	28.99%	24.31%	14.01%	–	17.27%	−18.13%
EG	1.44%	1.72%	15.17%	9.54%	59.85%	53.99%	15.97%	20.28%	13.11%	18.52%	12.03%	9.16%
IL	0.53%	0.51%	8.13%	9.52%	68.80%	61.18%	13.67%	14.67%	9.42%	11.79%	3.83%	10.77%
IQ	1.45%	0.51%	4.19%	2.07%	59.23%	87.82%	63.35%	91.34%	82.58%	89.65%	0.91%	25.37%
IR	−0.18%	−0.51%	16.18%	31.31%	80.72%	79.50%	13.87%	2.67%	0.44%	1.54%	−1.55%	38.52%
JO	1.08%	−0.08%	9.04%	4.50%	53.43%	71.69%	17.93%	17.55%	17.08%	16.75%	6.91%	3.98%
KW	0.50%	2.25%	−1.08%	3.87%	64.15%	69.73%	19.63%	19.44%	17.84%	17.13%	20.42%	5.05%
LB	0.79%	−1.48%	10.90%	−17.58%	57.91%	72.85%	14.12%	15.16%	12.99%	14.21%	8.38%	−9.61%
LY	0.47%	0.74%	4.18%	10.95%	61.91%	58.50%	72.44%	121%	109.67%	–	12.87%	−6.50%
MA	0.96%	0.56%	9.85%	6.48%	48.55%	51.03%	15.34%	18.06%	12.91%	13.92%	32.36%	12.42%
OM	0.59%	1.47%	6.80%	4.96%	60.27%	63.22%	21.60%	24.44%	19.57%	20.03%	15.28%	4.56%
PS	1.12%	1.01%	9.43%	5.83%	73.33%	68.63%	17.48%	17.47%	18.28%	15.58%	6.26%	−3.45%
QA	1.71%	0.80%	11.96%	6.89%	42.72%	50.19%	19.39%	19.05%	18.41%	17.43%	8.38%	6.86%
SA	2.13%	3.35%	12.98%	9.52%	42.37%	50.09%	19.48%	21.41%	16.93%	17.28%	5.97%	10.95%
SY	2.51%	15.83%	8.71%	59.40%	57.36%	11.88%	26.90%	38.61%	25.43%	37.61%	6.24%	73.75%
TN	0.91%	0.76%	10.09%	−2.25%	58.18%	65.92%	19.88%	14.71%	12.77%	23.11%	–	9.62%
YE	0.97%	2.26%	10.29%	17.28%	61.10%	58.20%	37.35%	33.09%	41.10%	–	2.68%	23.76%
Av. MENA	1.10%	1.37%	9.38%	5.70%	58.05%	60.32%	21.38%	29.37%	17.56%	22.13%	10.12%	10.35%

Source(s): Table created by authors

Table A2.
The average performance ratios for the MENA banking sectors; major indicators: ROA, ROE, C/I, CAR, TCR, and risk-weight asset growth (RWA_GR)

Country	FSI		Z score		MLPS	
	2006–2019	2020–2021	2006–2019	2020–2021	2006–2019	2020–2021
AE	−0.04	0.00	16.30	19.48	3.16	3.99
BH	0.04	0.02	12.81	16.73	−3.39	0.15
DZ	−0.08	−0.07	8.62	4.26	4.96	−0.82
EG	0.08	0.07	11.74	15.72	−0.40	5.71
IL	−0.09	−0.06	17.36	42.81	2.45	8.75
IQ	0.08	0.11	44.77	69.95	−1.77	−2.28
IR	−0.09	−0.11	11.33	1.93	2.59	−2.52
JO	0.02	0.01	15.18	31.22	0.00	4.85
KW	0.06	0.09	10.36	15.61	−3.56	0.16
LB	0.08	0.10	18.72	6.45	−1.60	−6.13
LY	0.11	0.05	5.65	1.44	−5.28	−6.71
MA	−0.07	−0.05	11.69	39.98	4.61	7.24
MT	0.03	–	8.00	–	−1.16	–
OM	−0.02	0.00	12.36	22.28	3.06	4.85
PS	0.01	−0.01	14.83	80.62	−0.75	3.41
QA	−0.02	−0.02	17.60	23.20	6.85	7.64
SA	−0.02	0.01	13.47	23.05	6.20	7.87
SY	0.10	0.20	17.10	3.43	−4.09	8.32
TN	−0.17	−0.16	11.19	16.09	1.87	6.07
YE	0.16	0.19	10.78	1.00	−7.39	−5.60
Av. MENA	*0.01*	*0.02*	*14.49*	*22.91*	*0.32*	*2.37*

Source(s): Table created by authors

Table A3. The average results for MENA banks: stability and aggregate performance indicators per country

Appendix 3
Alternative spécification model (NIM)

Performance measures	ROA Model (1)	ROE Model (2)	NIM Model (3)
Constant	−0.006	0.001	−0.001
	(0.934)	(0.924)	(0.961)
COVID-19	−0.022***	−0.049***	0.001**
	(0.000)	(0.000)	(0.030)
HHI	−0.003	−0.032	−0.006
	(0.670)	(0.145)	(0.125)
HHI COVID-19*	−0.003	−0.009	0.006
	(0.813)	(0.803)	(0.364)
Efficiency	0.004**	0.011*	0.003*
	(0.044)	(0.061)	(0.080)
Efficiency COVID-19*	−0.023***	−0.074***	−0.003**
	(0.000)	(0.000)	(0.038)
Institution	0.001	0.006	0.005
	(0.284)	(0.812)	(0.352)
Loans/Deposits	0.005**	0.036***	0.015***
	(0.027)	(0.000)	(0.000)
Loans/Total assets	−0.000	0.004	0.006***
	(0.995)	(0.511)	(0.000)
Non-interest income	0.040***	0.100***	−0.024***
	(0.000)	(0.000)	(0.000)
Size	0.004	0.002**	0.004*
	(0.366)	(0.049)	(0.074)
(Non-financial) Loan growth	0.007***	0.031***	0.001
	(0.000)	(0.000)	(0.160)
Liquid assets	−0.002	0.045***	−0.001
	(0.422)	(0.000)	(0.354)
CAR	−0.003	0.071***	0.010***
	(0.637)	(0.000)	(0.003)
E/TA	0.004*	0.003	0.000
	(0.104)	(0.696)	(0.963)
NPL/GL	−0.015***	−0.027*	0.008***
	(0.009)	(0.075)	(0.008)
GDP growth	−0.022*	−0.075**	−0.016**
	(0.102)	(0.048)	(0.027)
Inflation	−0.010	−0.015	−0.002
	(0.191)	(0.468)	(0.544)
Domestic credits	−0.005	0.011	−0.000
	(0.942)	(0.599)	(0.997)
Islamic	−0.007***	−0.008**	−0.001
	(0.000)	(0.014)	(0.958)
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Number of observations	5,006	5,006	5,006
R-squared (Overall)	0.0660	0.1339	0.1443

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank performance during the period 2006–2021 while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Return on Assets (ROA), Return on Equity (ROE) and the net interest margin (NIM) as measures of bank profitability. Bank efficiency is measured as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the HH-index (HHI). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables

Source(s): Table created by authors

Table A4. Panel regressions of bank performance with NIM (All banks, 2006–2021)

Appendix 4
Alternative concentration measure (CR3)

Risk measures	ROA Model (1)	ROE Model (2)	C/I Model (3)
Constant	0.002	0.008	0.521***
	(0.751)	(0.721)	(0.000)
COVID-19	−0.005**	−0.029*	0.080**
	(0.021)	(0.080)	(0.037)
CR3	0.003	0.015	−0.163***
	(0.641)	(0.398)	(0.000)
CR3 COVID-19*	−0.005	−0.034	0.244***
	(0.630)	(0.235)	(0.000)
Efficiency	0.004*	0.011*	−0.174***
	(0.058)	(0.065)	(0.000)
*Efficiency * COVID-19*	−0.025***	−0.077***	0.029*
	(0.000)	(0.000)	(0.087)
Institution	−0.009	0.001	0.002
	(0.358)	(0.804)	(0.639)
Loans/Deposits	0.006***	0.035***	−0.033***
	(0.006)	(0.001)	(0.005)
Loans/Total assets	−0.001	0.005	0.025*
	(0.666)	(0.450)	(0.051)
Non-interest income	0.040***	0.100***	−0.153***
	(0.000)	(0.000)	(0.000)
Size	0.003	0.002*	0.019***
	(0.502)	(0.085)	(0.000)
(Non-financial) Loan growth	0.008***	0.032***	−0.076***
	(0.000)	(0.000)	(0.000)
Liquid assets	−0.001	0.045***	0.077***
	(0.520)	(0.000)	(0.000)
CAR	−0.002	0.074***	−0.096***
	(0.724)	(0.000)	(0.002)
E/TA	0.006**	0.003	−0.049***
	(0.031)	(0.632)	(0.000)
NPL/GL	−0.015***	−0.027*	0.085***
	(0.006)	(0.078)	(0.002)
GDP growth	−0.024*	−0.078**	−0.166**
	(0.090)	(0.040)	(0.015)
Inflation	−0.013*	−0.017	−0.087**
	(0.091)	(0.405)	(0.021)
Domestic	−0.003	0.009	0.031
	(0.681)	(0.665)	(0.406)
Islamic	−0.007***	−0.008*	0.068***
	(0.000)	(0.100)	(0.000)
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Number of observations	5,006	5,006	5,006
R-squared (Overall)	0.0647	0.1336	0.1736

Note(s): The panel data regressions estimate the relation between bank concentration, efficiency, and bank performance during the period 2006–2021 while controlling for important bank-level and macroeconomic characteristics. The sample includes 575 banks in 20 countries in the MENA region. We use Return on Assets (ROA), Return on Equity (ROE) and the net interest margin (NIM) as measures of bank profitability. Bank efficiency is measured as the average of the three DEA efficiency scores (CRS, VRS and SCAL). Market concentration is proxied by the share of the three largest banks in a country's banking industry total assets (CR3). Country-level characteristics were computed as of year *t*-1. All the regressions control for year- and country-fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes bank-level characteristics, institutions, and macroeconomic variables

Source(s): Table created by authors

Table A5. Panel regressions of bank profitability (All banks, (2006–2021)

Appendix 5
Additional tests excluding Malta

Performance measures	ROA Model (1)	ROE Model (2)	C/I Model (3)
Constant	-0.009	-0.004	0.611***
	(0.165)	(0.815)	(0.000)
COVID-19	-0.020***	-0.045***	0.028**
	(0.000)	(0.004)	(0.014)
HHI	-0.003	-0.031	0.221***
	(0.707)	(0.145)	(0.000)
HHI COVID-19*	-0.003	-0.010	0.176***
	(0.785)	(0.786)	(0.008)
Efficiency	0.001**	0.006**	-0.172***
	(0.023)	(0.045)	(0.000)
Efficiency COVID-19*	-0.021***	-0.070***	-0.024*
	(0.002)	(0.000)	(0.075)
Institution	0.001	0.005	0.002
	(0.293)	(0.838)	(0.561)
Loans/Deposits	0.006***	0.038***	-0.028**
	(0.006)	(0.000)	(0.016)
Loans/Total assets	0.000	0.006	0.022*
	(0.747)	(0.408)	(0.088)
Non-interest income	0.040***	0.100***	0.150***
	(0.000)	(0.000)	(0.000)
Size	0.003*	0.002*	0.021***
	(0.072)	(0.067)	(0.000)
(Non-financial) Loan growth	0.008***	0.032***	-0.081***
	(0.000)	(0.000)	(0.000)
Liquid assets	-0.002	0.044***	0.074***
	(0.471)	(0.000)	(0.000)
CAR	-0.003	0.070***	-0.099***
	(0.554)	(0.000)	(0.002)
E/TA	0.004	0.002	0.049***
	(0.142)	(0.740)	(0.001)
NPL/GL	-0.016***	-0.025*	0.083***
	(0.004)	(0.108)	(0.003)
GDP growth	-0.023*	-0.077**	-0.167**
	(0.099)	(0.044)	(0.015)
Inflation	-0.010	-0.016	-0.079**
	(0.176)	(0.451)	(0.038)
Domestic credits	-0.001	-0.011	0.040
	(0.919)	(0.599)	(0.298)
Islamic	-0.007***	-0.008*	0.068**
	(0.000)	(0.104)	(0.013)
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Number of observations	4909	4909	4909
R-squared (Overall)	0.0701	0.1361	0.1755

Note(s): The panel data regressions estimate the relationship between bank concentration, efficiency, and bank performance from 2006 to 2021, while controlling for important bank levels and macroeconomic characteristics. The sample includes 575 banks in 19 countries (Malta is excluded) in the MENA region. To measure bank profitability, we use Return on Assets (ROA) and Return on Equity (ROE). The cost-effectiveness level is measured by the cost-to-income (C/I) ratio. Bank efficiency is proxied by the average of the three DEA efficiency scores (CRS, VRS, and SCAL). Market concentration is measured using the HH-Index (HHI). Country-level characteristics were computed as of year *t−1*. All regressions control for year and country fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Appendix 1 describes the institutional quality, bank-level characteristics, and macroeconomic variables

Source(s): Table created by authors

Table A6. Panel regressions of bank profitability excluding Malta (All banks, 2006–2021).